Payments for Ecosystem Services in Washington State: Understanding Stakeholder Values and Potential Coalitions in the Nisqually Watershed Services Transaction Pilot Project

by

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A Thesis
Submitted in partial fulfillment
of the requirements for the degree
Master of Environmental Studies
The Evergreen State College
June 2014

This Thesis for the Master of Environmental Studies Degree

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ABSTRACT

Understanding Stakeholder Values and Potential Coalitions in the Nisqually Watershed Services Transaction Pilot Project

Charissa M. Waters

Payments for Ecosystem Services (PES) are used as a conservation tool to protect ecosystem services and human well-being and to incorporate ecosystems into economic and political decision-making. Ecosystem services provide a multitude of economic, social, and ecological benefits. Ecosystem management crosses jurisdictional boundaries and requires collaboration and buy-in from a variety of government agencies, non-profit and non-governmental organizations, and stakeholder groups. This study uses in-depth interviews and surveys to examine stakeholder values and critical factors involved in the Nisqually Watershed Services Transaction pilot project. Observations and analysis of stakeholders in this PES pilot project in Washington State are used to determine if potential stakeholder coalitions are forming around similar values and beliefs, patterns of support or resistance, and perceptions of key stakeholders. Qualitative and quantitative methods of data collection and analysis were used to reveal potential coalitions, patterns in beliefs, and common perceptions of the Nisqually pilot project. The analysis also identified specific areas of agreement or divergence in respondent's beliefs regarding the causes of, and potential solutions to, issues facing PES programs in the Nisqually Watershed. These findings will assist in the development of PES programs in Washington State by helping ecosystem managers and decision-makers increase awareness of stakeholder values and preferences, reveal potential coalitions, and integrate this knowledge of stakeholder perceptions into planning, communication, and outreach strategies.

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Acknowledgments

This thesis would not have been possible without all the people who contributed their time and valuable input to this project. A very big thank you to those who took the time to discuss the Nisqually pilot project with me and for everyone that completed my survey, I couldn't have done it without you. Specifically, I would like to thank Craig Partridge for his invaluable insight, advice, and feedback. Many thanks to my professor and reader, Kevin Francis, for advising me throughout this process and providing me clear and detailed feedback.

I am eternally grateful to Sophie and John Bilezikian who financially supported my graduate career through the Sara Anne Bilezikian Fellowship, which they founded in loving memory of their daughter. Sara's legacy for the balance of human rights and a safe environment will remain with me in my endeavors towards the equitable and sustainable management of ecosystems and natural resources.

Thanks to my family and friends for their love, support, and patience throughout this process, and to my cat for countless hours of warming my lap as I sat at my desk. Words cannot fully express my gratitude to all of you.

Chapter 1: Introduction

The biosphere and diversity of ecosystems therein are all the dynamic outcome of biological processes. These life processes on Earth are in turn dependent on the structure, function, and dynamic composition of ecosystems within the biosphere. Air, water and nutrient cycling, the composition of soil and the atmosphere, and other processes that support life, are in return replenished and altered by life. The human species has buffered the experience of living in immediate connection to the environment through technological and cultural means, which lessen the impact the environment has on human life styles (Millennium Ecosystem Assessment, 2003). Despite the illusions of disconnection, humans and the human constructions (e. g., social and economic systems) that fuel this perceived separation remain fully dependent on the services ecosystems provide. Perhaps one of the largest and well-known demonstrations of human dependence on (and ignorance of) ecosystem structure and function was in the Biosphere II experiments in 1991. The extensively funded project attempted to create a self-sustaining environment, and failed to produce ecosystems that provided the services essential for sustained biodiversity and the consistency of elements crucial for human life (Salzman, 2006).

This experiment underscored the need for increased scientific information and understanding of ecosystem dynamics and processes. The concept of an ecosystem as a unit of study was first introduced by Arthur Tansley in 1935 and later grew out of the initial workings on the *Fundamentals of Ecology* by Eugene Odum in 1953. The ecosystem concept has since assimilated into new areas of research and ecosystem-based management practices that view the environment as the entirety of complex biological

and physical interactions functioning in a dynamic system. Beyond discovering new information on the intricate connections within ecosystems, it is also necessary to communicate their status and value to the general public and policy-makers. Clearly communicating new scientific information is needed to inform environmental management practices that buffer the impacts humans have on ecosystems and to in turn enhance and maintain the services ecosystems provide for human well-being.

In an ideal world, information from natural and social scientists, empirical observations on the health of ecosystems, and reports on the benefits humans are receiving from ecosystems would be utilized directly by policy and decision makers for optimal management of the ecosystems upon which all life on Earth depends. This management process would be continuously updated and adaptive to accommodate the continuous influx of new information and scientific findings. Clearly, this is not always the case and our world is far from ideal, which is why the need for science-based and participatory decision making and adaptive management of ecosystems has been widely recognized throughout the literature. Several approaches including the widely accepted method of Ecosystem Based Management (EBM) have been proposed (Christensen et al., 1996) to improve natural resource management practices.

The concept of Ecosystem Services (ES) compliments the well-established method of Ecosystem Based Management that takes a landscape level and interdisciplinary approach to land management. EBM looks at various factors involved in a certain place such as the ecological, social, economic, and institutional interactions that impact ecosystem structure, function, and processes. Communication can be difficult across this wide range of disciplines, which is why the concept of Ecosystem Services

(ES) can provide a common language and framework that facilitates dialogue and understanding across diverse groups with differing beliefs, interests, and ideas for managing ecosystems (Granek et al., 2010). Environmental policy decision-making and EBM inherently requires making trade-offs between ecosystem services and benefits to different groups, which can result in disagreements and debates that tend to slow the management process. Utilizing the framework of ES provides a common foundation for negotiations, includes ecological and socioeconomic complexity, and makes clear the connections between management choices, the provision of ecosystem services, and the expected impacts on different groups and human well-being.

World leaders and environmental policy-makers are increasingly realizing that valuing the worth of ecosystem services highlights their importance to human well-being and facilitates their incorporation into economic and political systems to decrease ecosystem degradation and improve conservation efforts (Braat & de Groot, 2012; Gómez-Baggethun, de Groot, Lomas, & Montes, 2010; TEEB, 2010; Thiaw & Munang, 2012). The concept of ecosystem services not only provides a common language for scientist and decision-makers, but also increases more general political support for conservation. Presently, ecosystem services are being incorporated into economic and political decision-making through promotion of market-based conservation methods such as Payments for Ecosystem Services (PES) programs. Methods to estimate the economic value of ecosystem services has been increasing along with efforts to put them on the policy agenda (Costanza et al., 1997; Fisher, Turner, & Morling, 2009). Since the release of the Millennium Ecosystem Assessment (MEA) in 2003, the political attention and literature on ecosystem services has grown rapidly (Fisher et al., 2009).

Overview of Thesis

Ecosystem services have multifaceted connections with social, economic, and political systems and are marked by a variety of definitions, concepts, and theoretical frameworks. These components and theories have evolved over time and adapted to the empirical knowledge developed through applications of the ES concept that were designed to influence environmental policy and increase conservation. There are important lessons that can be drawn from efforts that utilize payments or compensation to provide incentives for the increased protection and stewardship of ES. Many critical factors are involved in these market-based incentive methods, including scientific knowledge, institutional mechanisms, stakeholder participation and collaboration, as well as stakeholder beliefs and values. Stakeholder involvement, preferences, and influences are critical to the development and implementation of ecosystem-based management. While efforts have been made to gain a better understanding of the role of stakeholder and public perceptions and participation in the management of ecosystems and ES, there is still much work that needs to be done.

Through mixed methods research that utilizes in-depth interviews and survey questionnaires, this thesis contributes to this dialogue and informs decision-making by examining perceptions and values of a pilot Payments for Ecosystem Services (PES) project in Washington State. A public policy framework, the Advocacy Coalition Framework (ACF) is used to analyze stakeholder beliefs and values and to identify potential coalitions that may influence policy change for the Nisqually Watershed Services Transaction pilot project. This information could be used by managers to identify similar beliefs and issues around which stakeholders may find common ground

and form coalitions. Using an interdisciplinary lens of environmental studies and ecosystem-based management, combined with a public policy framework to examine stakeholder beliefs and perceptions in this pilot project, I present a unique and valuable addition to the existing literature. This research also addresses environmental policy and planning needs by asking questions pertaining to preferences for ecosystem management, potential solutions to environmental problems, and beliefs about where management authority should reside and the best policy tools for conservation.

This thesis addresses a gap in the literature with regard to stakeholder preferences and values for PES programs in Washington State and applies a public policy framework to the analysis of stakeholder beliefs that has the potential to contribute to the advancement of PES development and implementation. The findings of this case study identify areas of divergence among stakeholder groups with regards to the cause and severity of environmental problems facing ES in the Nisqually Watershed, which may indicate areas for further education, communication, and consensus-building. Divergence among stakeholder groups with regards to preferences for management and policy tools demonstrate greater differences in preferences and potential areas of conflict that may need to be addressed to encourage and maintain a collaborative approach for the management of ecosystems and PES programs. This information on stakeholders is an important consideration for managers, and understanding different beliefs, values, and preferences may also help to develop more effective communication and outreach strategies that in turn would increase the effectiveness of PES programs.

Chapter 2: Literature Review

Studying PES programs requires an understanding of ecological economics, basic terminology, and theoretical frameworks. This literature review explores the peer-reviewed literature encompassing the primary concepts, definitions, and frameworks for PES, as well as several prominent empirical studies and critical factors contributing to the success of PES programs. The objective of this literature review is to understand the evolution of the concepts of ecosystem services, limitations of ecosystem service valuation, the most effective frameworks for PES, and primary lessons from applications of PES programs in order to identify opportunities to advance PES development and decision-making in Washington State.

Definitions of Ecosystem Services

Due to the complex factors involved in the relationship between ecosystems and human well-being it is critical for decision makers and managers to have common definitions and theoretical foundations for the management of ecosystem services. There have been a variety of proposed definitions for Ecosystem Services (Braat & de Groot, 2012; Fisher et al., 2009; Ojea, Martin-Ortega, & Chiabai, 2012; Shelley, 2011; Turner, Morse-Jones, & Fisher, 2010), most of which are presented as alternatives and refinements to the commonly cited definition by the Millennium Ecosystem Assessment (MEA). The MEA definition states that, "Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual,

recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth" (MEA, 2003, p, 3). The MEA separates ecosystem services into these general categories (provisioning, regulating, cultural, and supporting) for ease of understanding and classification.

The MEA places human well-being central in its framework for the assessment of ecosystems. However, it recognizes the significant importance of biodiversity as the source of many ecosystem services and critical to ecosystem functions. The MEA also acknowledges that ecosystems have intrinsic value beyond the services that they provide. This intrinsic value can make it difficult for scientists and managers' attempting the valuation of ecosystem services because it is dependent on people's perceptions of what is important in the ecosystem. Decisions for ecosystem management are largely affected by the socio-political and economic context of the place and what people value in the environment. Understanding ecosystem services involves a landscape scale look at how they are generated, regulated, and provided. For ecosystem managers it is not only a question of what effect a land use change may have (i.e. how cutting a forest affects water filtration, flood regulation and nutrient retention) but more specifically to what degree a certain amount of (marginal) change impacts specific services like water quality.

Although the MEA definition is widely accepted and applied to ecosystem management, several limitations have been highlighted and alternatives proposed in the ensuing literature. Fisher et al. (2009) introduced a definition for classifying ecosystem services (ES) that is flexible and appropriate for their various biophysical characteristics as well as the socio-political context of a specific place. The authors claimed that the MEA scheme is inappropriate and could lead to double valuing because some services

can fall under multiple classifications such as water purification and clean drinking water, which is both regulating and provisioning. Granted, the MEA does acknowledge that there is overlap with the functional categories of ecosystem services they use. Fisher et al. (2009) recommended using intermediate, final services, and benefits for classification, and argued that it is more appropriate for application in a particular policy context. The authors defined ES as "the aspect of ecosystems utilized (actively or passively) to produce human well-being." (2009, p. 645).

The definition by Fisher et al. (2009) is similar to that presented by The Economics of Ecosystems and Biodiversity (TEEB) study in 2010 that stated, "Ecosystem Services are the direct and indirect contributions of ecosystems to human well-being." Both these definitions also parallel one of the earliest popular definitions by Costanza et al. (1997) that describes ES as, "the benefits human populations derive, directly or indirectly, from ecosystem functions" (p. 253). It is apparent that all of these definitions share many similarities, and each of them highlight various outputs/benefits of ecosystems, the complexity of ES as the product of ecosystem structure, function, and processes as well as various benefits for human populations. They also emphasize that ES research is an on-going and inherently experimental field that requires adaptability and clear communication for the public and generators of environmental policy.

Perceived issues with the application of the Millennium Ecosystem Assessment have been addressed by several authors that presented specific alternative definitions and classification systems to improve the use of the concept of ecosystem services in real-world situations (Joshua Farley & Costanza, 2010; Ojea et al., 2012; Polishchuk & Rauschmayer, 2012). Ojea et al. (2012) critically examined the problems that have been

brought up with applying the MEA's definition of ecosystem services for economic valuation. They discussed several issues they found with the MEA classification system in these studies such as service overlapping (or double valuing) and ambiguity. The MEA definition is perceived as ambiguous because it does not distinguish between ecosystem functions and services provided, which makes the classification of a specific ecosystem service difficult to determine. Ojea et al. (2012) applied an alternative classification system based on outputs (benefits) and compared it to the MEA classification system in several studies. The authors found conflicts in these studies between the definition of the service and the corresponding MEA classification. They claimed that the output-based system was more definitive and practical when applying ES valuation in the field. They also call for more research into the definitions and classifications used for specific ecosystem services and to use a flexible framework for valuation that is appropriate for the context in which it is being applied. Alternatives definitions and classification systems introduced some practical application issues with the rather vague MEA definition and stressed the need to be context specific when valuing ES for management purposes.

However, economic valuation and management of ecosystem services is challenging due to the fact that most services provided by ecosystems are common goods or public goods. Both of these concepts are similar in that it is difficult to exclude use of the resource, like many fish stocks and large bodies of water. The difference is that the use of a common good limits its use by others (it is rivalrous), whereas a public good is non-rivalrous and non-excludable such as with fresh air. The example that is often cited for common good resource issues is from the theory of the Tragedy of the Commons by

Garrett Hardin (1968). The tragedy of the commons dilemma depicts the grazing of a shared pasture being over exploited by individuals acting rationally and in their own self-interest, without regard for the long-term sustainability of the resource. There are many real-world examples of this commons dilemma, such as the devastation of salmon runs on the Columbia River from damming, which benefitted a few at the expense of many. Elinor Ostrom addressed this dilemma in her 1990 book, *Governing the Commons* that looked at the problem of collectively managing shared resources. Ostrom used the term common pool resources and recommended the formation of cooperative institutions to solve the problem rather than centralized governance structures or privatization of the resources.

Other similar common pool resource problems in modern society include that with forests, fresh water, and non-renewable resources like coal that have positive and negative externalities. People tend to benefit from common and public goods whether they pay for the service or not. This can be seen as a positive externality, in which there are external benefits to individuals from certain practices. For instance, if a common good such as the water filtration provided by a forested watershed is protected by laws and regulations, there are more benefits from the conservation of this resource than merely to those paying for it. The flip-side of this coin is negative externalities, which appear when there are costs paid by individuals that did not choose to incur them. A simple example of this is with air or water pollution caused by industrial activities in which society and the general populace, not the responsible party, incurs health risks and clean-up costs.

When an ecosystem is degraded to the point that it can no longer provide critical services (e.g. crash of fish populations) and negative external effects such as pollution of air and water are costs taken up by the public then it often becomes necessary for an authority such as a governmental entity to manage the common resource and solve collective action problems. Sometimes there are property rights that limit the use of a common pool resource like a forest, or land-use can be restricted on specific parcels such as with zoning laws. However, these regulations are often difficult and costly to enforce. It is also possible for the public beneficiaries of a common resource to form collaborative groups that cooperate on behalf of the whole community for mutual benefits, such as with watershed partnerships. The management of ecosystems relies on institutional mechanisms (legal and policy tools) that are meant to "internalize" the external costs of the use of ecosystem services. An example of this would be requiring a polluter to pay for the restoration of an ecosystem that was degraded as a result of their activities, or to mitigate the impacts of proposed activities, thus bringing the environmental costs back to the responsible party.

There are many different approaches and management strategies for altering public actions and addressing collective action issues. A prominent interdisciplinary author on environmental law and policy, James Salzman (2006) highlights social and economic factors that influence environmental problems and refers to the political strategies for management of public goods as the "Five P's" (p. 138): payment, property rights, persuasion, prescription and penalty. They can also be divided into regulations that include economic penalties for non-compliance, or incentives that usually take the form of financial rewards for desired behavior. Incentives tend to rely on persuasion, payment,

and education of landowners and the goal is for self-regulation. The payment incentive approach is common in the United States and has been traditionally implemented by government agencies at the expense of public budgets (Salzman, 2006), which is an attempt to internalize externalities and bring the cost of conserving and enhancing ecosystem services back to the society that benefits.

Theories and Concepts of Payments for Ecosystem Services

It makes intuitive sense that providing non-monetary or economic incentives for the stewardship and enhanced provision of ecosystem services is often favored by the general public over regulation and penalties for non-compliance. The concept of economic incentives for environmental conservation has been around for a long time; however it has more recently been combined with the concept of ecosystem services into what is generally known as Payments for Ecosystem Services (PES). One of the commonly cited definitions by Wunder (2006) defined Payments for Ecosystem Services as "(1) a voluntary transaction in which (2) a well-defined environmental service (ES), or a land use likely to secure that service, (3) is being "bought" by at least one ES buyer (4) from at least one ES provider (5) if, and only if, the ES provider secures ES provision, i.e.. conditionality" (p. 2). Wunder acknowledged the importance of terminology used for defining economic incentive programs, which helps large groups and communities to focus the goal of a PES program for a specific desired outcome.

It is important to keep in mind that PES is one of many conservation tools and that in most cases it is utilized to boost conservation approaches by securing additional

funding, and aiding in the alleviation of both environmental degradation and poverty in communities with few economic alternatives to natural resource extraction or land-use changes (Ferraro & Kiss, 2002; Pagiola, Bishop, & Landell-Mills, 2002; Wunder, 2006). Wunder has been an advocate of PES schemes by arguing that they can be beneficial to both the environment and local communities while also acknowledging that they are not a panacea, but that they are a promising conservation tool that will need patience and experimentation to develop further.

Despite its common use, alternative terminology has been proposed to address perceived limitations of Wunder's (2006) definition, specifically the issue of measuring additional conservation provided by PES programs. Sommerville, Jones, & Milner-Gulland (2009) proposed a definition that refines Wunder's to allow for a wider range of incentive-based mechanisms and increased applicability to unique situations. Sommerville et al. defined PES as "approaches that aim to (1) transfer positive incentives to environmental service providers that are (2) conditional on the provision of the service. Where successful implementation is based on a consideration of (1) additionality and (2) varying institutional contexts" (2009, p. 2).

In Payments for Ecosystem Services (PES) programs, additionality is important because it is the amount of additional conservation outcomes (i.e. benefits) that occurred in relation to the expected outcomes without incentives (Sommerville et al., 2009). Additionality is important for monitoring PES programs because it can be used to assess the success of a specific program relative to the social and ecological goals. However, additional benefits from PES can be very difficult to measure and requires deciding on metrics to be used such as percent forest cover and establishing baselines prior to

application of the program, as well as continued monitoring throughout implementation. Due to the limitations of scientific information and issues with measuring ES, additionality is not often used as a concrete criterion for evaluation, but it does need to be considered when planning a PES program in order to establish how the impacts and effectiveness will be assessed. Institutional context is also emphasized when applying PES, which elaborates on Wunder's discussion of identifying the service providers, beneficiaries, and appropriate type of incentive used for a particular context. This highlights the importance of different contextual aspects of PES programs and the need to be flexible when defining criteria of PES programs in order to increase the applicability to various complex social and ecological situations.

Evolution of PES Theory and Practice

The concept of Ecosystem Services (ES) has grown since it first appeared in the late 1970s and 1980s. Describing ecosystems in the light of human benefits and well-being was initially an attempt to increase public interest in conservation and show human dependence on ecosystems by building a bridge between social and natural sciences. The concept of ES explored the complex relationships between social, political, economic, and ecological systems in an effort to shed light on the impacts of environmental degradation and species extinction (Braat & de Groot, 2012; Ehrlich & Ehrlich, 1982). ES developed as a pragmatic tool for conservationists to communicate the value of ecosystem functions. Using the same language and emphasis on human benefits that dominated political and economic systems, the ES concept was utilized to catalyze short

term policy action to more effectively address the mounting calamity of environmental degradation and biodiversity loss (Daily et al., 2009; Gómez-Baggethun et al., 2010).

One of the earliest and well known examples of Payments for Ecosystem Services (PES) in the U.S. comes from New York City in the 1990s when water suppliers chose to invest in natural capital and provide clean water through watershed management rather than building an expensive filtration plant (Salzman, 2006). The Millennium Ecosystem Assessment (2003) emphasized the connection between humans and ecosystems and that the entirety of a society's capital (manufactured, human, social and natural) determines its wealth and well-being. With the growing demand on ecosystem services it has become imperative to assess the state of ecosystems and to invest in increasing their resiliency and productive capacity.

The PES approach is aimed at integrating the importance of ecosystem conservation into economic and social systems through the valuation of ecosystem services. The ground breaking estimation of the total economic value of global ecosystem services by Costanza et al. (1997) sparked an increase in the use of monetary valuation in science and policy making. The extensive study on the state and importance of ecosystem services for human well-being by the United Nations Environmental Programme published by the MEA in 2003, included a more complex definition and classification system and emphasized the significance of ES to society. This socio-economic framing of environmental issues was advanced by The Economics of Ecosystems and Biodiversity (TEEB) study published in 2010 that called for more research and empirical studies to link economics and ecology. These milestones demonstrate the rise of the ES concept and

mark its continuing increase in prominence for political agendas worldwide (Braat & de Groot, 2012; Gómez-Baggethun et al., 2010).

The growth in interest and design of various economic incentive schemes increased political support for conservation, but also increased concern over the commodification of ecosystem services. In many cases a purely market-based approach may not be appropriate for tackling complicated environmental problems in real-world situations (Gómez-Baggethun et al., 2010; Muradian, Corbera, Pascual, Kosoy, & May, 2010; van Noordwijk et al., 2012). Approaches continue to evolve because of the experimental nature of valuing ecosystem services, the on-going study of the ecology of ES, and the various contexts and social factors that influence land-use decisions. Most ecosystem valuation methods have suggested refining PES to make specific programs more appropriate for certain sociocultural settings.

The on-going development of PES systems has not only been marked by a variety of proposed definitions and terminology but also by evolving conceptual frameworks for improved application in various situations (Fisher et al., 2008; Muradian et al., 2010; Sommerville et al., 2009). The refined definitions and more flexible framework discussed previously demonstrated a reoccurring theme, the increasing acknowledgment of the need for context-specific PES programs. Muradian et al. (2010) also introduced a framework that considers the many complexities involved in PES and focused on issues with different institutional and political contexts. The goal of this framework was to create a comprehensive picture and real-world theoretical basis of PES that is more practical to apply in a variety of context. The authors emphasized that there is a variety of PES arrangements that all need appropriate definitions, classification systems, and local

institutional frameworks. In their conceptualization of PES the authors stressed the public goods nature of ecosystems as well as the challenge of attaining public action and cooperation.

In response to these management issues, PES focuses on altering collective and individual behavior with the use of positive incentives in order to reduce environmental degradation and over-exploitation of natural resources. These incentives can take the form of direct payments or non-monetary compensations for the provision of ecosystem services, which highlights the diversity of forms that PES schemes can take in application. Muradian et al. (2010) group the types of PES programs based on three main criteria. 1) How important a monetary incentive is for changing behavior and altering land uses (just one of many driver such as cultural and social factors). 2) How direct the transfer is (amount of coordination and intermediaries). 3) How much the ES is commoditized and clearly tradable on a market. For example, carbon sequestration is more easily valued and traded on an existing market than ES that are not as well backed by science and measurements are primarily based on shared beliefs of the relationship between certain land-uses and ecosystem service provision, such as the use of forest cover as a general proxy for measuring and monitoring ES in Costa Rica. This PES framework by Muradian et al. (2010) incorporates the diversity and complexity of incentive programs. Evolving PES frameworks and alternative approaches highlight the issue with trying to distinguish between "PES-like" programs and more "genuine" market based PES programs. These authors suggest that it is more practical to allow PES to have flexibility with a theoretical definition that is broader than the purely economic market-based framework in order to increase applicability to a diversity of complex, real-world

situations, and to integrate PES into environmental policy tools in a specific context. In other words, a flexible theoretical framework and context-specific approach is essential to the integration of PES into environmental policy and the successful implementation of these vital programs.

There is an increasing recognition and consensus among world leaders and scientists of the importance of incorporating ecosystem services into policy and decision making (TEEB, 2010; Thiaw & Munang, 2012). The United Nations Conference on Sustainability that convened in Rio de Janeiro in 2012 (Rio+20) showed that there exists an overall perspective among world environmental leaders that development approaches are outdated and need to be fundamentally redefined. This conference emphasized the need for policies that reinforce the concept of sustainable management of ecosystem services and biodiversity with consideration to the specific socio-ecological context in order to change public behaviors and recognize ES value in economic systems. Thiaw and Munang (2012) claimed that Rio+20 shows that the global community recognizes that a primary driver of environmental degradation is an economic failure to take into account the value of natural capital. These authors argued that it is essential to incorporate environmental values into government institutions and decision making in order to expedite change. They also resolved that local communities, businesses, and other organizations need to assimilate these ES concepts into policy and decision-making on multiple levels, which could be dependent on the participation and support of the general public.

The type of policy tool used should depend on the multi-faceted context and characteristics: politically, socially, and ecologically as well as the particular

classification of the ES (i.e. provisioning or regulating, good or service). Kemkes, Farley, & Koliba (2010) explained that the nature of the policy tool and whether it has high levels of "coerciveness", as well as other dimensions of its classification, determines its amount of public support, effectiveness, efficiency, and political feasibility. For example, a policy tool that is more "coercive" relies on rules and regulations and is often appropriate to use to get industries or businesses to change their behavior or environmental impacts, but it may not be appropriate to change the behavior of individual private landowners and to get the support of the general public. Environmental policy strategies need to consider property rights, the targeted audience, and use appropriate payment types for the context and the specific ES being valued. The authors emphasized that the low level of coerciveness of public outreach and education can give it higher levels of political support, but that information alone may not be enough to alter behavior. However, when public outreach and education are combined with incentives, or some sort of payment scheme (which are also highly politically feasible due to the lower levels of coerciveness) the effectiveness of the program can be increased. This is why PES is considered an effective policy tool to encourage private landowners to conserve and protect ecosystem services (Kemkes et al., 2010).

Limitations and Valuation Methods

Using an economic framework for valuing ecosystems can be useful in decision making, but the limitations of such a tool must be recognized by managers implementing PES programs. Obstacles and limitations are recognized by many authors, including the

process of economic valuation, the risk of over-commodification, and the over-simplification of the complex and non-linear nature of ecosystem services (Chee, 2004; De Groot et al., 2012; Fisher et al., 2008; Kallis, Gómez-Baggethun, & Zografos, 2013; Nicolás Kosoy & Corbera, 2010; Norgaard, 2010). Norgaard (2010) brought up a common argument that, in theory, the concept of ecosystem services has helped humans realize their dependence on nature and facilitated the inclusion of the value of ES in decision-making. However, there remains concern that valuing ES is not a sufficient solution for the complexity of issues that we face in social and natural systems. De Groot et al. (2012) recently estimated the global economic value of ES but warned that most of the value is in non-tradable public benefits and that better accounting for public goods and services is needed for better decision making and ecosystem management.

To address concerns of commodification, there is a critical distinction that needs to be made between monetary valuation and commodification. It is useful to quantify the value of ES to aid in decision making. However, this should not be used for the commodification and privatization of ES; instead it can add to both the knowledge basis of environmental policy decisions and conservation strategies. Valuing ES can make positive and negative externalities of ecosystems more tangible in order to internalize and account for at least a portion of their true importance (Daniels, Bagstad, Esposito, Moulaert, & Manuel Rodriguez, 2010; Muñoz-Piña, Guevara, Torres, & Braña, 2008). Norgaard (2010) revealed that the concept of ES, having grown quickly into a scientific and policy model (especially for developing countries), may have outgrown itself and actually be harmful by continuing the over commodification and simplification of complex natural systems. He pointed out an interesting irony with using ES to attain a

sustainable economy when the majority of economic institutions do not support sustainability. This emphasizes the importance of policies that support economic and environmental sustainability. Ecosystem service markets and PES programs are inextricably influenced and limited by the present institutional and political settings.

The role of PES in policy stems from the need to include common pool resources and public benefits of ES in the decision-making process for improved conservation and sustainability (MEA, 2005; Fisher et al., 2008), which can be difficult given the inherent uncertainties, incomplete scientific information, and difficulties of measuring ES. Fisher et al. (2008) pointed out the importance of marginal analysis when valuing ES for policy and economic decisions in order to quantify what the value of an ecosystem service is based on the willingness to pay for an additional unit of that good, or to prevent losing it. The basic concept of marginality in economic valuation can be difficult to apply for complex ecological systems where it may not be apparent how much the change in a certain unit of ES will affect the quantity or quality of goods provided. Other drivers of natural resource based political conflicts include scarcity, differing beliefs and values, scientific disagreement (and uncertainty), and policy frames (the definitions and narratives used). Generally, the value of a resource will increase as it gets scarcer. However, if there is not a scientific consensus on the quantification of an ecosystem service (what should be measured and what metrics or measurement proxies to use) it will be difficult to measure its scarcity and assess its value. Furthermore, consistent terminology and definitions are necessary to frame and communicate issues to the public.

Quantification of Ecosystem Services

Assigning a value to ecosystem services has many challenges beyond scientific uncertainty. The difficulty of economic valuation for ES lies in the term value. There are many different aspects to valuing ecosystems including ecological, sociocultural, and intrinsic values that are much more difficult to measure than economic value. Different social and cultural settings will encourage different worldviews and social norms for the value of ecosystems. It is important to consider the many different aspects of valuing ES and to use standard definitions and methods during assessment as well as the subsequent communication to stakeholders and decision-makers.

The primary methods of economic valuation take a top-down and utilitarian (anthropocentric) approach that often underestimates ecological complexity and values of ecosystems beyond a direct or indirect use for humans. For example, the approach known as production function (PF), attempts to estimate the influence of an ecosystem service on the production of a good (i.e. drinking water). In this case, cause-effect relationships are analyzed between a change in the service and the output of the good (i.e. forest cover and water quality). However, there is not enough scientific understanding and data on cause-effect relationships between ecosystem functions and the goods and services produced for markets (Chee, 2004; Daily et al., 2000). There is also irony in this method in that it relies on the demand for the marketed service, which influences the value assigned to that ecosystem service from markets that do not traditionally put much value on such public goods in the first place (Norgaard, 2000). Another approach that is widely used for the utilitarian valuation of ecosystems is called Total Economic Value (TEV). There are two main types of values within the TEV framework, use values and non-use values. The

values that are directly or indirectly used by people for production or consumption of goods are use-values, whereas the ones not currently being used or those being conserved are considered non-use or existence values. The ecological, sociocultural, and intrinsic values of ecosystems are generally not explicitly considered in the utilitarian approach.

A common utilitarian approach to ES valuation, which is not as reliant on market behavior or available scientific information, assesses the buyer's (beneficiaries) willingness to pay (WTP) and the sellers (ES providers) willingness to accept (WTA) compensation for changing activities or land management practices that impact the ES. This can be accomplished through surveys and interviews that ask direct questions regarding how much an individual is willing to pay for a particular benefit. An obvious limitation to this method is the potentially biased subjectivity of the information from the surveys. Also, technical issues with the survey design include the information and definitions that are provided of the ES to be valued, the framing of the questions, and prior knowledge and opinions of respondents, which can all influence the results (Chee, 2004).

In contrast, contingent valuation (CV) is a method that is much more applicable to a diversity of ES in various contexts and includes non-utilitarian (i.e. sociocultural and intrinsic) values discussed with other value considerations in a collaborative manner. Unlike the previous more top-down methods, CV elicits stakeholder input and embraces a participatory process in a bottom-up approach. This valuation technique continues to evolve and grow from the idea that issues of public goods and valuation of ES should be addressed with public involvement and collaboration across diverse groups of stakeholders (MEA, 2003). The goal of this group is to come up with a valuation for the

ES in question and is a result of similar surveys and interviews as in the WTP/WTA method, although it is a group effort based on consensus rather than simply individual preferences. Because of the complexity both socially and ecologically inherent in PES programs, it is critical to encourage collaboration in the overall decision making process and promote dialogue, adaptive learning, analysis of risk, and negotiations for the common good. This type of participatory approach fosters public understanding, fairness, informed decisions, and greater validity for policies. A participatory approach can be more effective in the long-run, especially when informed by models of ecological processes and scenario planning for predicting future outcomes in the face of scientific uncertainty (Chee, 2004).

Through this review of ecosystem services literature related to theory, concepts, and applications, a need has been identified for more theoretical and conceptual work. More importantly, the literature calls for empirical studies on Payments for Ecosystem Services program development, implementation, and evaluation in a specific context to better inform policy decisions. Environmental policy and management decisions need to have a sound scientific basis, but they also must consider societal values and penchants.

Common themes from the literature highlight certain factors to consider and include in development and management of PES, including stakeholder interests and beliefs regarding a specific issue, as well as strategies for broader outreach and altering public behavior (Fisher et al., 2008). It is also important to consider spatial scale when developing programs, for many ecosystem services an entire landscape (i.e. watershed) or regional scale is often most appropriate in order to understand the diversity of cultural, economic, ecological, and institutional factors that make up the entirety of the problem

area context. However, management on this scale can be difficult because it expands beyond traditional management and jurisdictional boundaries. The complexity of different aspects that underwrite landscape or regional level planning, ecosystem-based management, and PES programs begs for simplification and breaking a specific problem down into the primary contributing factors.

Critical Factors

This literature review has identified many key factors involved in the design and implementation of Payments for Ecosystem Services programs. The aspects critical to understanding and valuing ES, developing PES programs, and implementing them in a particular context are highlighted here. These general categories of critical factors include available scientific knowledge, institutional and market mechanisms, perceptions and values of people involved, as well as the inclusion of these elements in a collaborative process. Both scientific information and institutional settings have been discussed previously and are important considerations for the development of PES programs. These factors are reviewed briefly here; while the role of stakeholders is explored further to illuminate the critical influences of human perceptions and values as well as motivations for participation. In this context, stakeholders are considered the active participants, individuals, organizations, and other entities that have a stake in the outcome of a specific problem area or program.

Scientific Knowledge

Our knowledge of the ecology of Ecosystem Services (ES) is very limited and we need more research on the crucial aspects of ES such as the relationships between ES provision, ecosystem structure and functions, and ecological community dynamics (Kremen & Cowling, 2005). Valuing ecosystem service for land use decisions needs a sound scientific basis and understanding of the complex relationships involved in the delivery of ecosystem services. This scientific information is vital, but it may be imperative for some critical issues to act in the face of scientific uncertainty and use the best available knowledge for management decisions. It is also necessary to classify the targeted ES for valuation purposes and to establish a standard definition and classification of ES (MEA, 2003; Ojea et al., 2012; Ghazoul et al., 2009; Shelley, 2011; Fisher et al., 2009; Farley, 2012; Turner et al., 2010). Several alternatives to the MEA classification system were presented in the literature review, which highlighted the need to increase its applicability to a specific context. In addition, Costanza (2008) reasoned that the Millennium Ecosystem Assessment framework is vague because it needs to be an overarching framework in order to be used in a diversity of contexts and for various ES being targeted. He argued not for the MEA system in particular, but for a pluralism of classification systems for different purposes rather than trying to create a single system that overlooks the complex and site specific nature of ecosystem services.

Institutional and Market Mechanisms

Significant relationships have been found between institutional design and performance of PES programs worldwide (Brouwer, Tesfaye, & Pauw, 2011). The nature of the policy tools being used by certain institutions to induce a desired behavioral change (i.e. coercive vs. persuasive) largely determines the programs that are favored and supported. Prominent ecological economics authors have highlighted the importance of adapting traditional economic, institutional, and market mechanisms to ecosystems in a comprehensive, context appropriate approach to recognize and account for the true value of ES (Farley & Costanza, 2010). In contrast, adapting ecosystem services to traditional economic markets that have inherent failures in valuing such public goods and common pool resources has been argued to be inappropriate and potentially disastrous (Muradian et al., 2010; Fisher et al., 2008; TEEB, 2010; Thiaw and Munang, 2012). Thus, the underlying goal of ecological economics is to adapt market and institutional mechanisms to fit ecological systems to be more sustainable for the long-term. For those involved in developing PES programs and the essential supporting institutional and market mechanisms, it is important to clearly communicate many details of the project to a variety of audiences. The primary aspects to communicate and clarify include theoretical and conceptual foundations (standardized definitions) as well as classification and valuation methods being employed in a specific institutional, social, and ecological context.

Stakeholder Participation and Collaboration

The communication of different concepts and theories of PES is central to both the development of institutional mechanisms, the valuation of ES, and the perceptions of stakeholders to foster common understanding and collaboration in diverse groups (Brouwer et al., 2011; Chee, 2004; Josh Farley et al., 2010; Joshua Farley & Costanza, 2010). The complexity, interdisciplinarity, and uncertainties of PES program design and implementation necessitate clear and open dialogue and collaboration that encourages stakeholder participation and feedback throughout the entire process in an adaptive management approach(Chee, 2004; R. S. de Groot, Alkemade, Braat, Hein, & Willemen, 2010; Prager, Reed, & Scott, 2012). Communication and collaboration play a crucial role in the development of ES transactions. PES programs involve the coordination of many different organizations and stakeholders including private land owners, government agencies, non-governmental agencies (NGO's), and non-profits.

Because the management of ecosystem services often requires a landscape level approach that crosses human conceived boundaries it must involve cooperation between land owners, natural resource managers, and other stakeholders. Landscape level planning can be challenging and it is important to use an appropriate spatial scale for the targeted ES (Prager et al., 2012; Wunscher, Engel, & Wunder, 2008). Encouraging participation and collaboration throughout planning and implementation can be costly and time consuming but is an integral part of ES management. Partnership groups such as watershed collaborative organizations can help to lower the costs and increase the dissemination of knowledge, social learning, and program monitoring and adaptation (Prager et al., 2012).

The collaborative approach with PES programs highlights the question of what factors influence participation of stakeholders and landowners. The traditional economic approach focuses on financial incentives and assumes that to get a landowner to participate they must be provided with payments that are equal to or greater (including transaction costs) than land use alternatives such as converting forests to agriculture. Transaction and negotiation costs also need to be taken into account when designing PES programs and are affected by institutional and market mechanisms, which can be reduced with a greater degree of stakeholder participation and partnerships (Gong, Bull, & Baylis, 2010; Pagiola, Arcenas, & Platais, 2005). Given the interrelatedness of social and political relationships and program costs it is important to build trust, collaboration, and social capital to increase program efficiency. The traditional approach emphasizes the socio-economic status of the landowner, which has been identified as being one of the key determinants of participation in PES programs (Arriagada, Sills, Pattanayak, & Ferraro, 2009).

However, other motivations for participation have been identified in the literature. In a review of a large amount of PES case studies from an institutional and social perspective, Vatn (2010) pointed out that PES programs as a market solution to environmental degradation, in practice do not necessarily adhere to traditional economics. The authors attribute this primarily to the nature of ES as a common-pool resource, which are often managed and regulated by public agencies, not standard markets. Furthermore, critical factors in PES programs are interconnected, including institutional mechanisms such as governance structure with stakeholder perceptions and motivations for participation. Institutions tend to act as a rationality context for citizens and nurture

certain values, which by changing the framing of an issue or the perspective that applies can effectively change the understanding of the situation and the subsequent action taken.

The motivational aspects of PES program participation are not very well studied. Vatn (2010) explored key aspects of motivational factors, including motivations of intermediaries, perception of stakeholders, and other motivations that influence natural resource use. Intermediaries and non-governmental organizations (NGOs) often play important roles in PES programs because of the amount of information that needs to be exchanged between buyers and providers of ES. A lack of information has been attributed to one of the reasons that providers choose not to participate (Arriagada et al., 2009) and service buyers also need information on the use of payments and the quality of services provided. NGOs and other intermediaries can provide this necessary information. However, it is important to understand their motivations for involvement and monitor their actions and the messaging, outreach strategies, and information being conveyed to stakeholders and the general public.

Stakeholder Beliefs and Values

Perceptions of PES and key concepts can be a significant challenge to program development and implementation. In particular, the distinction between payments and compensation (or rewards) is important to make due to the power of terminology to change the focus of these programs and their future direction (Shelley, 2011). Payment incentives emphasize individual gain and provide motivation to deliver a certain amount of a good/service purely for the economic benefit. On the other hand, compensation

emphasizes rewards for good stewardship practices and reimbursement for the costs of enhancing and maintaining ES. Stewardship makes it clear that the landowners are not the producers of ecosystem services, they are the caretakers of the ecosystem and different actions or management practices affect the quality and quantity of ES. There may be certain individual choices contributing to the quality of specific ES that can be rewarded with compensation. The term beneficiary may also be preferred over buyer because those that are benefitting are not necessarily the direct buyer, in practice there are often intermediary agencies. The perception of compensation as reciprocation for good stewardship and buyers as beneficiaries has more potential to influence behavioral changes through the combination of both monetary and social incentives. The terminology used and the social benefit framing of an issue can improve stakeholder relationships and community collaboration, which also tends to lead to more accountability (Nicolás Kosoy & Corbera, 2010; Shelley, 2011; Vatn, 2010).

In light of the impact of motivations, social perceptions, and values it becomes clear that community relationships and cooperation between ES beneficiaries and providers can greatly influence PES programs. This also draws attention to other motivational factors such as pre-existing social values that affect participation. It has been shown in a case study exploring motivations for participation in a PES program in Mexico, that those involved were already prone to pro-conservation values, whereas those that did not participate were not (Nicolas Kosoy, Corbera, & Brown, 2008). This raises serious concerns and questions. How affective are the payments at changing behavior? How do the values of landowners and stakeholders in a particular context affect participation and outcomes?

Furthermore, these questions emphasize the practical concern regarding the impacts of the concept of monetary payments for ES on landowner perspectives and behavior. When individual gain is emphasized where a pro-conservation value already exists payments have the potential to backfire (Kosoy and Corbera, 2010) because payments may encourage self-interest and an over-commodification of ecosystems where there wasn't this viewpoint to begin with. To counteract this, it helps to recognize the common good gains that people tend to support, without being paid to do so, and use payments as a reward for providers that go above and beyond regulations in their efforts to be good stewards. This approach also provides incentive for buyers that wish to increase good public relations. These concerns demonstrate the complexity of PES and the potential it has to influence behavior and vice versa, for perspectives and behaviors to influence PES programs. These points emphasize how critical it is to use appropriate conceptual frameworks, suitable messaging, and collaborative, bottom-up approaches for the application of PES in specific sociocultural, political, and institutional settings.

Lessons from the Application of Payments for Ecosystem Services

Critical factors have arisen as common themes throughout the literature and are evidenced through PES programs that have been implemented around the globe. Case studies of PES programs worldwide identify main themes and lessons, including issues with spatial targeting for payment effectiveness (Daniels et al., 2010; Muñoz-Piña et al., 2008), motivations for participation (Arriagada, Ferraro, Sills, Pattanayak, & Cordero-Sancho, 2012; Asquith, Vargas, & Wunder, 2008; Morse et al., 2009; Rosa, Kandel, &

Dimas, 2003), effects of stakeholder values (Vignola, McDaniels, & Scholz, 2012; Pagiola, 2008), outreach and education (Asquith et al., 2008; Ferranto et al., 2012), and using appropriate policy tools and classification of ES for valuation (Birol, Karousakis, & Koundouri, 2006; Brauman, Daily, Duarte, & Mooney, 2007; Costanza, 2008), as well as the need to be adaptive, flexible, and context-specific when designing, implementing, and evaluating programs (Daniels, Bagstad, Esposito, Moulaert, & Manuel Rodriguez, 2010; Jack, Kousky, & Sims, 2008; Pagiola et al., 2005; Roumasset & Wada, 2013; Wendland et al., 2010; Wunder, 2006; Wunder et al., 2008).

One of the most well-known and long-lived of PES program is the Pagos por Servicios Ambientales (PSA) or Payments for Environmental Services in Costa Rica. The ongoing PES program in Costa Rica recognizes four ecosystem services for payments: carbon sequestration, water services, biodiversity, and aesthetic beauty. Costa Rica's PES program was a cumulative result of over a decade of conservation efforts. It was implemented by the government in 1997 as a component of the 1996 Forestry Law, which also prohibited land-use change in primary forests and regulated timber harvest. This combination of institutional mechanisms (laws and regulations) and economic incentives for conservation have been widely considered successful and many countries have looked to Costa Rica as an example when developing PES programs of their own (Pagiola, 2008).

However, the case studies from Costa Rica show many areas that need improvement and critical factors to consider in PES programs. The primary reoccurring suggestions for consideration are the variables that affect participation and land-use decisions, including communication, perceptions and values of participants, socio-

economic drivers, and suitability of a site for alternative uses (Arriagada et al., 2012, 2009; Asquith et al., 2008; Morse et al., 2009; Pagiola et al., 2005; Pagiola, 2008; Rosa et al., 2003; Vignola et al., 2012). Another main recommendation from these case studies is to use a comprehensive landscape level scale that considers the context in which the program is developed and to implement and monitor with an adaptive management style approach (Asquith et al., 2008; Daniels et al., 2010; Pagiola, 2008; Wunder et al., 2008). Due to the vast amount of research and literature on ecosystem services and PES programs, this is not an exhaustive literature review. However, the primary considerations and critical factors for PES programs identified in this literature review develop the foundation and focus of the following case study on a pilot PES project in Washington State.

Context for Payments for Ecosystem Services in Washington State

The institutional mechanisms that led to the development of pilot Payments for Ecosystem Services (PES) projects in Washington State resulted from legislation enacted in 2010. The Engrossed Substitute House Bill (ESHB) 2541 called for proposals from the Washington State Department of Natural Resources (WSDNR) on how to encourage conservation for private forest landowners through incentive programs focusing on ecosystem services. In 2012 the Commissioner of Public Lands recommended PES demonstration projects to test the feasibility of economic incentives for watershed services. There was widespread support expressed for these demonstration projects and a vast amount of collaboration for their development and implementation in the Nisqually

Watershed (WSDNR, 2013). There were two watersheds chosen, the Snohomish and the Nisqually; this case study focuses on the Nisqually watershed pilot project.

There were many organizations that partnered with WSDNR on this pilot project including the Nisqually River Council, Nisqually Land Trust, Northwest Natural Resources Group, Swedeen Consultants, Earth Economics and the City of Olympia Public Works. The demonstration project officially ended in 2013 and at that time had accomplished its primary exploratory goal of providing information through research and lessons learned from direct experience to inform the development of future PES projects. However, conversations between partners and key stakeholders continue as they consider opportunities for finalizing a watershed services transaction in the Nisqually Watershed. Although this study was conducted after the pilot project ended, observations and analyses took place in what can be described as the middle stages of the project implementation.

The Nisqually Watershed Services Transaction pilot project focused on the goal of improving the health of forest ecosystems, by retaining forest cover and preventing forests from being degraded or lost to development, through the use of market-based policy tools and providing new sources of income for private forest landowners. These market-based tools generally provide monetary incentives to alter behavior of landowners in ways that improve the ecosystem services being provided from their land. For example, financial incentives could be provided to landowners for specific land practices that protect and enhance forest ecosystems within a watershed that has priority wildlife habitat areas.

Priority conservation areas for wildlife habitat have been identified by the Washington State Department of Fish and Wildlife (WDFW) and many have been found to be primarily on private lands (2005, 2009). A study conducted by Cassidy & Grue (2000) pointed out that focusing conservation efforts on public lands may not be efficient for many range restricted at-risk vertebrates that utilize private lands in Washington State. They defined "at-risk" species as those vulnerable to human impacts and development (p. 1061). The authors found that the percentage of private land within the habitat range of at-risk species was nearly identical to the percentage of private land in the state (56% and 55% respectively). Furthermore, they found 63 at-risk species that rely on private lands for successful recovery.

If conservation efforts are primarily focused on public lands (i.e. national parks and wildlife refuges) many populations of species that have critical habitat on private property in the Puget Sound lowlands, or that range between elevations and land-use types, will likely continue to decline (Cassidy & Grue, 2000). Socio-economic incentives can be used to increase the cooperation of private landowners and industry in order to reduce environmental impacts and protect ecosystem services. The combination of specific policy tools, regulations, and an ecosystem management style approach that incorporates PES incentive programs to increase conservation efforts on private lands could improve protection for vulnerable species and overall biodiversity. Biodiversity is closely tied to ecosystem structure and function, which makes it vital for many other ecosystem goods and services, including water filtration and clean drinking water.

The classification of specific ecosystem services (ES) for valuation was one of the first hurdles for designing the PES pilot projects. Initially WSDNR looked at carbon

trading and offsets and other ES market opportunities. Stakeholder discussions showed that watershed service and biodiversity markets have more potential now than carbon offsets. However, rising markets such as the new California "cap-and-trade" program indicate an increasing future potential for a forest carbon market for offset type programs in Washington State (WSDNR, 2013). Payments for Watershed Services (PWS) were finally decided on for the pilot projects because there is currently more potential economic demand for the services watersheds provide than for biodiversity. Furthermore, it is often the case that biodiversity is a co-benefit with the conservation of forests for watershed services provision due to the subsequent habitat protection. The development of biodiversity markets shows a promising future for combining ecosystem service protection (i.e. watershed services and biodiversity) and increasing funding for ES transactions from organizations and entities focusing on individual benefits such as drinking water or critical wildlife habitat. However, the present institutional and market settings in Washington State show the most support for the development of PWS programs because of the potential market support and current widespread public recognition of the importance of the services watersheds provide (WSDNR, 2013).

Furthermore, watersheds also have relatively easily defined geographical boarders and typically have existing collaborative organizations such as watershed partnerships that are focused on their conservation and management. In Washington State watershed planning is encouraged by the Watershed Planning Act that was enacted in 1998. This institutional mechanism stimulated a collaborative process that involved local governments and organizations whose main objectives are to address issues with water quality and quantity as well as salmon habitat and in-stream flows. Watershed planning is

completed with the consensus of local, tribal, state, and federal governmental organizations as well as the participation from other stakeholders, citizens, and non-governmental organizations (Ryan & Klug, 2005). The watershed plans are implemented by the Washington State Department of Ecology and local governments can (but are not required) to enact ordinances for actions according to the watershed plan.

The focus on collaborative watershed management in Washington State advanced with the formation of the Puget Sound Partnership (PSP) in 2007. PSP was a result of Washington State policy decisions and the findings of the "blue-ribbon" advisory panel appointed by Governor Christine Gregoire to create a Sound Health Strategic plan with the cooperation and collaboration of various stakeholders, organizations, tribal, local, state, and federal agencies (Paulson, 2007). The strategies employed by PSP are incentive based, focus on behavioral change programs, and encourage collaborative approaches to addressing environmental issues with collective action rather than relying exclusively on traditional top-down regulatory mechanisms that in the past have resulted in costly litigation and political gridlock. This kind of intergovernmental and collaborative planning is structured by legislation and policy mandates, but it is also supported and informed by cooperative planning and the inclusion of various stakeholders in a bottom-up approach that encourages innovative solutions and local buy-in. Combining these approaches and including stakeholder input and local knowledge allows for programs that are adapted to a specific context and can help the local government better address pertinent issues facing their communities, while also taking action towards meeting broader policy goals (Ryan & Klug, 2005).

Summary

The concept of ecosystem services has evolved since it was first introduced in the 1970s as a tool to communicate the value of conserving ecosystems in a common language that could be easily understood and incorporated into decision-making. The concept of valuing ecosystem services for management purposes has since grown from theory in the field of ecological economics into a practical tool for encouraging environmental conservation on private lands. The MEA definition and framework for ES classification is still widely used by managers. The general MEA categories of supporting, cultural, regulating, and provisioning services are used in the valuation of ecosystem services in the Nisqually Watershed. The focus of these kinds of applications of PES tend to be on provisioning services that are easier to measure such as clean water, but other regulating services such as flood control, and cultural services such as recreational and spiritual values are also important considerations for managers and decision-makers.

Developing Payments for Ecosystem Services programs is a complex, interdisciplinary, and collaborative process that involves various dynamic critical factors. Institutional mechanisms are the foundational basis and often the catalyst for setting up PES programs. Scientific knowledge is important for the development of PES from theory to practice. And stakeholder perceptions and beliefs surrounding ecosystem services are instrumental in the development and application of programs in a specific context. The literature calls for more empirical studies and evaluations of PES programs. This thesis informs the development and advancement of this market-based tool for

conservation through the analysis of stakeholder values and perceptions of the Nisqually Watershed Services Transaction pilot project.

These factors, central to the development of PES programs, are also fundamental to the Advocacy Coalition Framework (ACF), a model for policy analysis. Both the ACF and PES rely on scientific information to inform the process and recognize the influence of participant's beliefs and values. The identification of potential buyers (beneficiaries) and sellers (providers) is a fundamental step for the implementation of PES projects, which requires clear communication and collaboration across diverse groups of stakeholders. However, this collaboration is dependent on the differing values and beliefs of stakeholders, their perceptions of the critical factors in the project, and motivations for participation. The ACF provides a method for understanding these factors that impact collaboration and the outcomes of PES programs. This information can potentially be used to help inform the design and implementation of future PES programs. Knowledge of different stakeholder's perspectives and values can also aid in the design of communication materials and outreach strategies, which in turn can increase participation, collaboration, and effectiveness of PES programs.

Chapter 3: Research Methods

Methodology

Policy change is a highly debated and widely studied process in policy analysis. It is vital to natural resource management and environmental policy development that all the factors that enter into such changes are given due consideration and review. Theories have been developed to explain the policy processes, how interested parties interact and how public policies are developed, implemented, and revised. Through the work of political scientists that have studied political institutions and people involved in the process, it has become clear that these theories must consider the human element and the fact that people may be motivated by personal and political interests, not just to address a public issue (Schlager & Blomquist, 1996). By the late 1980s the traditional "policy cycle" model was recognized as having severe limitations and consequently alternative theories were developed (Sabatier & Jenkins-Smith, 1994). The policy cycle model cut down the policy process into distinct stages within a greater political context but it relied heavily on a simplistic model. The basic stages of the policy cycle model generally encompass the definition of the problem, followed by agenda setting, policy development, implementation, and evaluation. Although important contributions were made to political science using the policy cycle concept, its limitations were realized and alternative approaches attempted to fill in the missing pieces. The primary missing pieces that were looked at in order to get a better understanding of the policy process included the lack of attention to the social and political context of policy development, as well as the simplistic step-wise assumption about a process in which all aspects are actually at play simultaneously.

Foremost to the arguments for the development of alternative policy models was that the policy cycle lacks the critical causal driver mechanism that would explain what force pushes the process from one stage to another. Furthermore, when the policy cycle method was applied in practice the expected linear stages were often inaccurate with multiple stages occurring simultaneously within the policy system. Another primary limitation identified was the strictly top-down approach of the policy cycle method that failed to take into account the influences of many important actors in the policy process. In the context of environmental issues and policy, the strictly top-down (also known as command-and-control) approach has been shown to be inappropriate for certain problems and can result in increased conflict and litigation due to its failure to consider the perspectives and values of various stakeholders (Weible, Sabatier, & Lubell, 2004). Overall, the policy cycle method is unsuitable in most cases when the policy under question is a result of complex influencing factors, including the dynamics of various participants, belief systems, and multilayered institutional drivers of the policy process.

Alternative political theories focus on individual choices, interests, and political influence as the major driver of policy change. One of the more commonly understood political theories called the "politics of structural choice" (SC) views the development of policies as arising from the interaction of interest groups and political power struggles (Moe, 1990). This theory shares characteristics with Ostrom's "Institutional Rational Choice" (IRC) theory that highlights institutional rules and sees policy change as a result of rational actions taken by groups of individuals to address collective problems (Ostrom, 1990). Moe's Structural Choice (SC) approach also focuses on institutional rules and arrangements for the development of public policy and shares the view that changes can

result from rational efforts to overcome collective action problems. Moe does acknowledge that people can cooperate for mutually beneficial solutions, but believes that conflicts over power often influence the formation of public policies (Schlager & Blomquist, 1996). For Moe, the political process is highly bureaucratic with the drivers of policy change being organized interest groups.

The Advocacy Coalition Framework

On the other hand, the Advocacy Coalition Framework (ACF) introduced by Sabatier (1988) as an alternative to the policy cycle model was presented as a more pluralistic political theory that provides a causal driver theory and a more pragmatic method to understanding the policy process. The ACF relies on several assumptions including stakeholder beliefs as the causal driver of political behavior, the influence of diverse players, a central role of scientific information, and the policy subsystem as an appropriate scope of analysis (Weible, Sabatier, & McQueen, 2009). The ACF is more pragmatic than the policy cycle model because it has a place in the framework for both top-down and bottom-up directions of influence to explain political behavior and policy change. When applied to policy systems, the ACF theoretical view recognizes the importance of combining a regulatory command-and-control approach with a bottom-up approach that also considers stakeholder opinions and preferences during the development and implementation of policy change.

The causal drivers in the ACF method are the beliefs and values of various individuals and stakeholders from a wide range of backgrounds and organizations

working within a specific policy arena. It is around these beliefs that players in the policy process will form coalitions based on similarities as well as competitive coalitions based on differences. These coalitions will operate within a policy subsystem, which deals with a specific issue or policy being addressed. Policy subsystems are not separate from the greater political environment but they do tend to have relatively stable parameters in a certain location in regards to a particular topic, such as forest conservation or watershed management in Washington State. Moreover, the diversity of topics and geographical areas involved in the broader political environment encourages specialization within subsystems for players to be able to understand the complex topic areas and address specific issues (Weible et al., 2009). Policy subsystems can be usefully divided into three general categories: adversarial, collaborative, or unitary in which a single coalition dominates the political environment (i.e. policy monopoly). An adversarial subsystem will have at least two highly competitive coalitions that differ in their belief systems and contend for resources and influence over political outcomes. On the other hand, a collaborative subsystem is made up of coalitions that do not differ as greatly in their beliefs and are generally marked by institutions that promote communication and collaboration across coalitions.

However, not all beliefs are influenced equally. The ACF describes three levels of individual beliefs: deep core beliefs, policy core beliefs and secondary beliefs (Sabatier & Jenkins-Smith, 1994; Sabatier, 1988; Weible et al., 2009; Weible, 2007). Core beliefs are the deepest and least likely to be influenced or to change greatly. These deep core beliefs are normative beliefs, including beliefs about the role of humans in nature, science in decision making, or the value of conserving ecosystem services for future generations.

Policy core beliefs are at the mid-level and are more likely to change with new knowledge and experiences than core beliefs. Similar policy core beliefs act as the glue that groups or coalitions form around. These coalitions of like-minded groups, or individuals with similar policy core beliefs, often stay together and relatively stable over long periods of time. Policy core beliefs represent the perceptions of issues, causal drivers, and value based priorities of a coalition within a policy subsystem. For example, the relative importance of environmental conservation vs. economic development or the perceptions of the seriousness of an issue like water pollution and its believed causes would represent policy core beliefs (Sabatier & Jenkins-Smith, 1994, p. 180). Secondary beliefs are the lowest level and are specific beliefs and preferences that are the most malleable of the three levels and can change rather frequently based on new knowledge and education from various pathways, including new scientific information, or advertising and outreach strategies.

Stakeholder coalitions typically form based on similar policy core beliefs but their secondary beliefs and the degree of coordination around a specific issue also play a part in their formation and stability. An example from a study in the UK by Ricky Lawton and Murray Rudd (2013) applied the ACF to

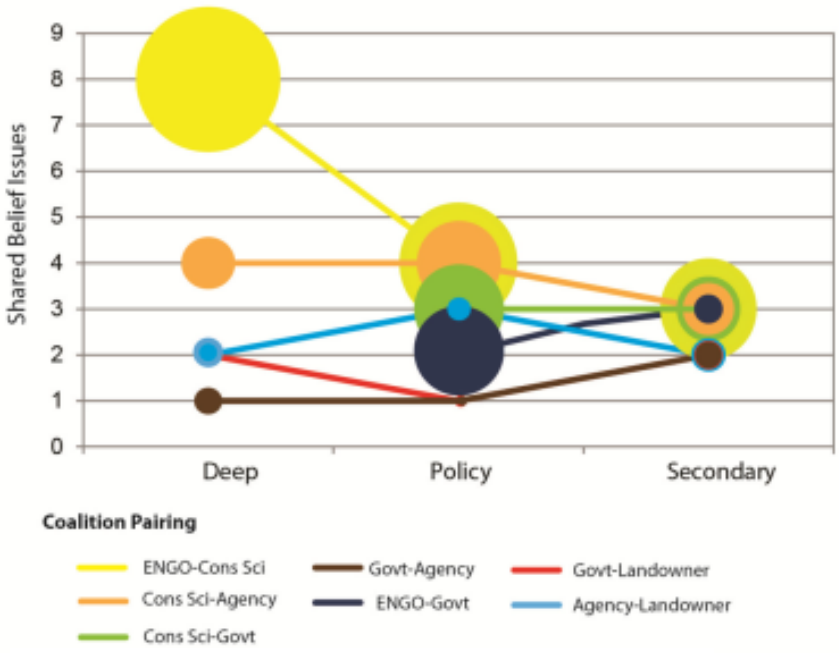

Figure 1. Each circle represents the amount of shared beliefs between paired coalitions at each belief level.

understand the values and beliefs of key players involved with the trend towards the ecosystem services approach for conservation policy. The results of this study indicated divergence at the level of deep core beliefs, especially between the conservation groups and the central government (Figure 1). Most pairs showed less agreement on issues at the deep core level, while there were more similarities in responses at the policy core level, and almost complete alignment on shared belief issues at the secondary belief level. These results would be expected by the ACF for the formation of coalitions around policy core beliefs and the more flexible secondary beliefs. Advocacy coalitions consist of various participants from governmental organizations, non-profit and private organizations, scientists and research organizations, and other individuals actively involved in furthering their shared beliefs and bringing about changes within a policy subsystem.

Coalitions that have one type of belief system typically compete with coalitions that have another

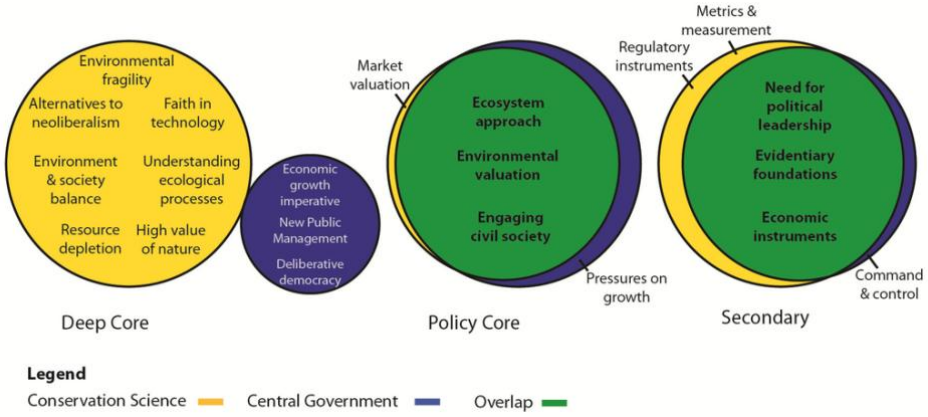

Figure 2. Agreement on beliefs between conservation and central government groups. Policy core and secondary beliefs overlap much more than beliefs at the deep core level (Lawton & Rudd, 2013).

for resources (e.g. funding for programs) and to influence decision making in a policy subsystem. However, coalitions can also collaborate based on shared beliefs to deal with specific issues and develop solutions such as environmental valuation or engaging civil

society (Figure 2). Studies have found that policy core beliefs affect stakeholder relationships, collaboration, competition, and inevitably decision making and policy change (Lubell, 2004; Weible, 2007; Weible et al., 2004).

Policy changes come from multiple directions, but the ACF highlights two primary pathways, 1) from the effects of external subsystem events and 2) a result of policy-oriented learning. Factors external to a policy subsystem, including dramatic changes to socioeconomic conditions, public opinion, and governance or institutional structures, can change core attributes of the subsystem by shifting resources or power among coalitions (Figure 3). Although factors internal to the policy subsystem, such as dramatic changes in the availability of resources or staffing of coalitions, can bring about a degree of policy change they tend to not be as influential or long-lasting as external events (Weible et al., 2009). The second primary path to policy change occurs when behavior and beliefs (usually at the policy core or secondary belief levels) are altered based on new experiences or knowledge that is pertinent to the realization or alteration of policy goals. The ACF method also operates from the viewpoint that individuals are functioning under bounded rationality, which means that

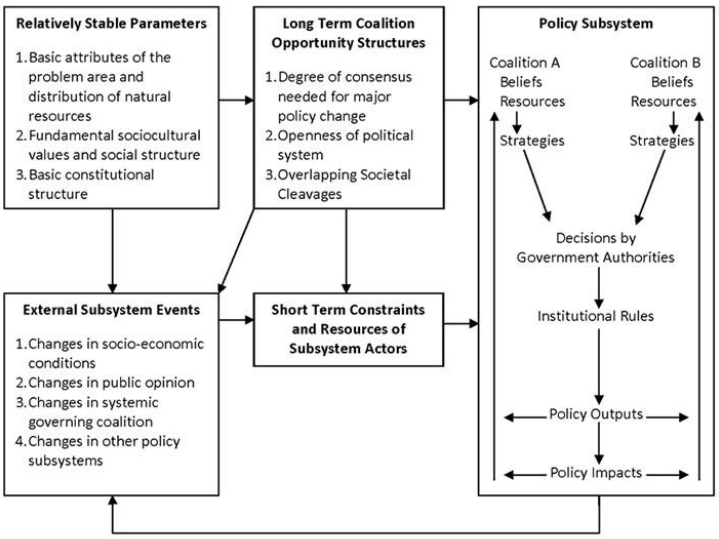

Figure 3. The ACF flow diagram shows the broader political environment with stable parameters and external events that are constrained by long term coalition structures as well as short term constraints and resources that influence change in the policy subsystem (Weible, 2007).

with a limited capacity to fully understand the world people must rely on their existing beliefs and available information to simplify and makes sense of a situation.

Available scientific and technical information can result in policy-oriented learning and influence people's beliefs and preferences for decision-making, as well as the overall policy process. New information is seen to contribute to policy-oriented learning when it has the capacity to influence certain beliefs and behaviors and result in adaptations or changes to policy objectives (Weible et al., 2009). Policy-oriented learning generally affects policy core or secondary beliefs that are more malleable than deep core beliefs and it concerns preferences for action or alliances in a specific context. If the subsystem is collaborative then ideally local and expert-based information will be integrated in an interdisciplinary and adaptive approach to problem-solving and policy change(Weible et al., 2009; Weible, 2008).

Within collaborative subsystems another pathway to policy change has been more recently recognized and occurs when there are negotiated agreements that usually emerge within consensus-based and collaborative institutions (Weible et al., 2009). However, negotiations do not always entail collaborative institutions or aforementioned policy-oriented learning when they are the result of what is known as a "hurting stalemate." A hurting stalemate occurs when there are mutually negative impacts and no better options for any of the key parties, which requires the negotiation of a solution in order to realize some sort of policy change. The negotiation pathway is easiest when there are institutional structures in place that encourage learning and collaboration across coalitions. For example, with the support of professional forums or other venues and institutional structures that provide a safe environment for everyone to collectively learn,

come to an agreement, and implement policy change. These kinds of collaborative institutions strive to mitigate conflict and integrate scientific information, local knowledge, and belief systems through partnerships focused on finding mutually agreed upon solutions (Lubell, Schneider, Scholz, & Mete, 2002; Lubell, 2004; Weible & Sabatier, 2009; Weible et al., 2004). Furthermore, the hope is that collaborative institutions can not only create benefits for the environment but for the economy as well because they are potentially less costly in the long-run due to avoided litigation or political gridlock.

Partnerships that take collective action with a more bottom-up approach to management tend to emerge in response to public resource problems that remain unresolved from a command-and control (top-down) approach and can be complimentary to regulatory agencies (Lubell et al., 2002). For example, watershed partnerships and collaborative groups tend to emerge due to increasingly severe nonpoint (dispersed) pollution problems that are difficult to solve with command-and-control policies (regulations). Furthermore, the distribution of authority and use of collaborative institutions in a subsystem that mitigates conflict to intermediate levels inevitably changes how scientific information is used. In a collaborative subsystem, instead of science being utilized as a political weapon, which often happens in adversarial subsystems, scientists are more likely to collaborate with nonscientists and contribute to learning across coalitions as well as the development of agreements and policy change or adaptation (Weible & Sabatier, 2009; Weible, 2008).

The Advocacy Coalition Framework applied to Payments for Ecosystem Services

The Advocacy Coalition Framework (ACF) model has several critical factors that contribute to an explanation of policy change. These include the influences of current institutional mechanisms, scientific knowledge, beliefs of stakeholders, and collaboration. Similar critical factors were previously discussed in the literature review as being instrumental in the development of Payment for Ecosystem Services programs. Institutional settings lay the ground work for shaping policy subsystems and framing issues to be addressed by coalitions. Legislative decisions and other institutional mechanisms can put priorities on certain issues and also suggest methods for problem solving such as forming collaborative institutions and scientific forums.

Scientific information is critical in shifting beliefs and preferences of coalitions through the process known as policy-oriented learning. The role of experts and scientific knowledge is central to legitimizing decisions about complex environmental issues (Weible, 2008). Technical information and scientific evidence can also be used politically to support a predetermined position of a coalition. On the other hand, it can be ignored when it does not align with policy core beliefs, which if taken up by a competing coalition could be used as a political weapon and possibly raise the level of conflict between groups. Through the lens of the ACF, policy can be seen as the interpretation of beliefs from competing coalitions. Information from experts is critical because it can alter the beliefs of stakeholders and result in policy changes when the new knowledge is agreed upon across coalitions. The ACF hypothesizes with empirical support that policy-oriented learning can occur across coalitions and lead to collaborative action when several critical factors are in place (Sabatier & Jenkins-Smith, 1994, p. 191). Specifically,

if there is an intermediate level of conflict (enough to have a healthy debate but not enough to end in a hurting stalemate) and an active effort for communication and sharing of knowledge such as a professional forum, then the instrumental use of technical information can result in collective learning. Ideally, the development of a mutually beneficial solution or agreed upon policy decisions that use the best available science would be the preferred outcome of this collaborative approach.

Collaborative subsystems tend to use flexible policy instruments that are voluntary in compliance and have consensus-based venues for policy-oriented learning. In the case of the Nisqually Watershed Services Transaction pilot project, the instrument is Payments for Ecosystem Services that provides an economic incentive for voluntary compliance to a conservation objective. In this example private landowners would be rewarded for certain forest practices that protect watershed services such as water quality and quantity. Learning is central to the pilot project and takes place in a professional forum and with the collaboration of a variety of stakeholders, citizens, scientists, and representatives of government agencies, NGOs and non-profit organizations. This collaborative process helps to gain a greater understanding of the dynamics of the Nisqually Watershed and to negotiate agreements for a PES transaction that is mutually beneficial. In applying the ACF to this case, the three main groups of beliefs that have the potential to become policy core beliefs and impact collaboration and decision making within a policy subsystem include the severity, causes, and potential solutions to an issue.

In the context of the Nisqually Watershed Services pilot project these can be stated as: beliefs about the severity and major types of watershed services problems, beliefs about the causes of watershed services problems, and beliefs about the potential

solutions and priorities for watershed services problems. Understanding stakeholder values and beliefs, especially on types of problems and priorities for the conservation of watershed services, are important considerations for natural resource managers and for designing communication strategies to facilitate collaboration. An important goal of this study is to also understand perspectives, critical factors, challenges, and lessons involved in the Nisqually Watershed Services model to help explain the stakeholder dynamics involved and the results of the pilot project efforts and to inform the development of similar PES programs.

Site Description and Context

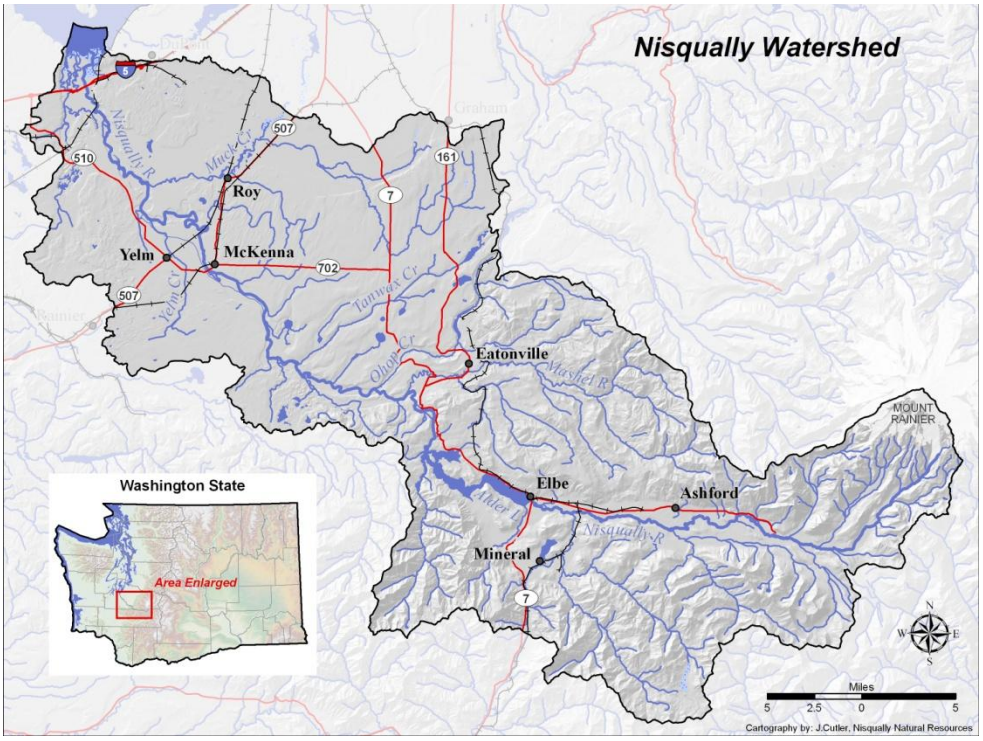

Figure 4. The Nisqually Watershed

The Nisqually Watershed is unique, and is considered to be one of the least developed and most pristine watersheds in the Puget Sound. The Nisqually River's headwaters are protected in Mount Rainier National Park and its delta resides in the Nisqually National Wildlife Refuge. However, there are many challenges that arise from human activities and decisions that affect the integrity of this vital area. The Nisqually River journeys 78 miles from glaciers on the highest mountain peak in the continental United States (at over 14,000 feet) down to its delta in the South Puget Sound (Figure 4). The Nisqually River drains about 720 square miles of land. The headwaters and tributaries flow through subalpine meadows and dense forested mountains. Down from the steep mountain gradients, the Nisqually River courses through lush river valleys, which provide habitat for a diversity of wildlife and many threatened and endangered species. The Nisqually River finally cuts across lowland valleys and prairies before it reaches the estuary.

The major human impacts to the river's natural flow are noteworthy. These include three dams, beginning with Tacoma City Light's Alder Dam with its seven mile long Alder Reservoir, followed shortly after by the LaGrande Dam, and finally the Centralia Powerhouse diversion dam. Just below the LaGrande Dam there is a large waterfall that naturally prevents fish from migrating any further upstream. Before this waterfall, the four-foot high Centralia Powerhouse diversion dam, which fish are able to bypass, diverts river water into a power canal that travels to a powerhouse to generate almost a third of Centralia's electricity (City of Centralia, Washington, 2013). Downstream from the LaGrande Dam, the Mashel River tributary meets with the main

stem of the Nisqually River where the land begins to flatten and the river meanders through numerous land-uses, farming, and residential areas in the lowland valley.

Due to the various protected areas along the lower Nisqually River, unlike many other rivers in the Puget Sound basin, it has no artificial levees and its riparian zones have remained relatively unaltered since the mid-19th century. As a result, there is a significantly higher abundance of wood jams and pools, which provide important fish habitat (Collins, Montgomery, & Haas, 2002). Over 94 species of fish are observed in the Nisqually basin and estuary, including herring, cods, sculpins, rockfish, prickle backs, gobies, and salmonids. Salmonids are likely the most abundant fish species in the Nisqually River basin, with ten species being found and most being maintained through hatchery production. The majority of hatchery releases have consisted of fall Chinook, Coho and chum salmon (Cook-Tabor, 1999). The Nisqually Tribe operates two hatcheries along the Nisqually River and most of the fish caught by tribal members are from these hatcheries, while sports fishermen are required to keep only hatchery fish and must release wild salmon to continue their journey upstream. Far upstream, the Nisqually Glacier on Mount Rainier feeds the headwaters of the river with melt water that sustains flows throughout the dry summer months.

However, the glacier has receded dramatically within the last 150 years with three cycles of retreat and advance but an overall loss of 1588 meters between 1913 and 1994, with the latest 300 meter retreat from 1970 to 2008 (Nylen, 2004; Sisson, Robinson, & Swinney, 2011). South facing glaciers like the Nisqually are most susceptible to thinning. However, the glacier has receded dramatically, which could be an indicator of climate change (Marr, 2010; Nylen, 2004). In effect, the retreat of the Nisqually Glacier

may have important implications for water flow and quantity, hydropower, wildlife habitat, sediment transport, and flooding along the Nisqually River. Beginning in April, the discharge from the Nisqually River increases while precipitation decreases, which demonstrates that the major input of freshwater into the river shifts from rain to snowmelt (Figure 5). This input shift illustrates the importance of snowpack and glacial melt water to the river during the dry months of summer. Furthermore, since the middle of the 20th century, spring snowpack volume has declined. Changes in the proportions of snowmelt and stream flow timing trends also show spring runoff peaks shifting to earlier in the year, which suggests that climate change is influencing changes in snowmelt (Marr, 2010). These effects of climate change and shifts in precipitation patterns, flow regimes, and declining snowpack are compounded by increasing population growth and demand for water resources in the Nisqually Watershed. These issues are important considerations for watershed planning and management.

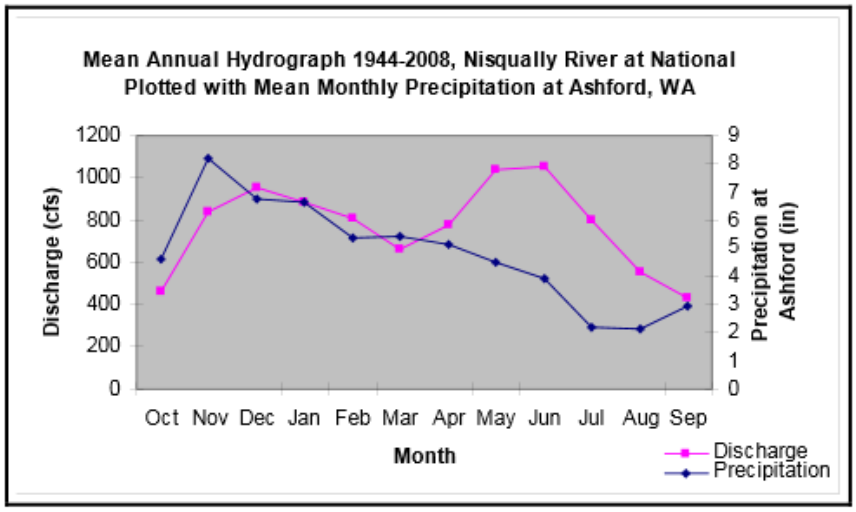

Figure 5. Mean annual hydrograph for the upper Nisqually River (Marr, 2010).

Collaborative Watershed Planning

The Nisqually River has a long history of collaborative watershed planning. Under the 1972 Washington State Shoreline Management Act, the Nisqually was recognized as a "River of Statewide Significance" because it supports many resources that humans depend upon including salmon, forest products, agricultural, and hydropower. The significance of the Nisqually River was also recognized in 1985 by the state legislature when they directed the Department of Ecology to create a watershed management plan that resulted in the Nisqually River Task Force, which grew into the oldest river council in Washington State. The Nisqually River Council is comprised of various stakeholders, citizens, private landowners, conservation organizations, local and state government officials, local industry, and the Nisqually Tribe. The Nisqually tribe has demonstrated leadership in coordination and implementation of conservation and restoration efforts in the watershed (Batker, de la Torre, Kocian, & Lovell, 2009). The Nisqually River Council collaboratively developed the Nisqually River Management Plan that was adopted by Legislature in 1987 and calls for stewardship of natural resources, education campaigns, and the coordination and implementation of various conservation and restoration projects (The Nisqually River Council, 2014). This collaborative watershed council works towards the protection and conservation of the Nisqually Watersheds plentiful resources as well as the well-being and health of the wildlife populations and human communities that make a home in the watershed.

Further statewide watershed planning grew from the Watershed Planning Act of 1998 that designated the watersheds throughout Puget Sound as Water Resources Inventory Areas (WRIAs). The watershed planning law provided funding and a method

to allow citizens (with the help of state agencies) to collaboratively asses the status of the resources in their watershed and to develop management plans, specifically focused on water quantity, supply, and use. Furthermore, The Nisqually Watershed (WRIA 11) was assessed in the Puget Sound Characterization project, which is an ongoing collaborative effort between the Dept. of Ecology, PSP, and WDFW. The primary goal of the Puget Sound Characterization project is to provide a relatively complete assessment of all the WRIAs in an ecosystem view of the Puget Sound landscape to better prioritize areas for conservation and restoration. This Puget Sound Watershed Characterization project has progressed to become a regional-scale tool to help local governments with land-use decisions and other plans to identify critical areas to protect and to advance restoration projects (Department of Ecology, 2010). Priority areas for restoration and protection in the Nisqually Watershed were identified through the Puget Sound Characterization project. An example of the results from the sediment and water quality model suggest that the highest priority areas for management of sediment transport and water quality are to the northeast and west of Eatonville, where ongoing forest and agricultural practices are resulting in environmental degradation (figure 6).

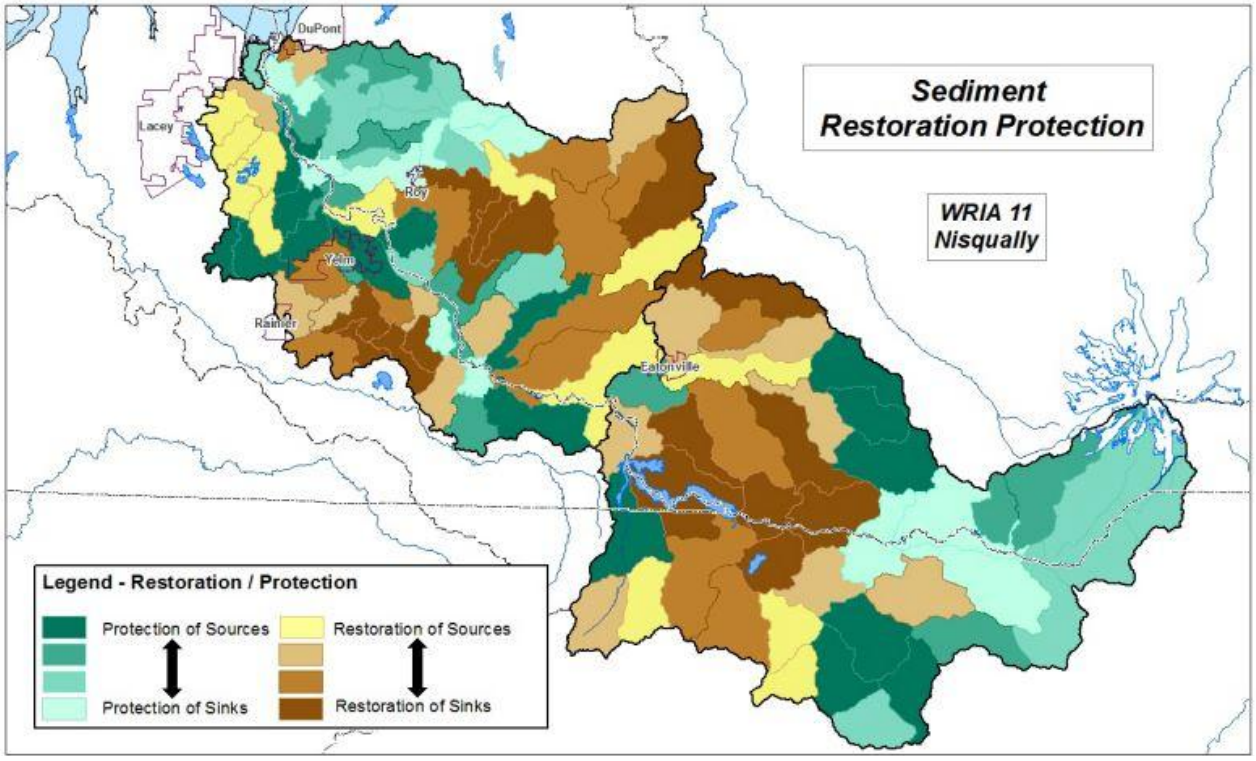

Figure 6. Results from the Puget Sound Watershed Characterization (2012) for the sediment water quality model. Eight management areas are suggested including the darkest blue being areas for protection with the greatest potential to transport sediment and lowest level of degradation and the yellow being areas for restoration with the highest potential for sediment transport and that are the most degraded. The dark brown areas indicate potential sinks as they are least likely to transport sediment (i.e. wetlands) but are suggested for restoration.

Furthermore, in 2003 the Nisqually River Council reviewed the Watershed Management Plan and revised it with an emphasis on a watershed-wide approach to ecosystem management and restoration that is more inclusive than the previous focus. Prior to this, the emphasis was primarily on riparian areas along the Nisqually River rather than the combination of ecosystems and the socioeconomic settings in the entire watershed (Batker et al., 2009).

The Nisqually River passes through numerous different land-use areas on its way to Puget Sound, including protected areas, rural communities, public and private timberlands, municipal hydropower projects, farmlands, the Nisqually Indian Reservation, and the Fort Lewis Military Reservation. There are approximately 69,000

residents in the Nisqually Watershed including new military families, long-time residents, and Nisqually tribal members. These citizens, organizations, and government agencies have been working to protect the ecological and economic aspects of the watershed in order to ensure a high quality of life for all the residents as well as maintaining the aesthetic beauty of the area and the benefits from recreation. Mount Rainier National Park alone drew in 1.3 million visitors in 2000 and contributed $30 million dollars to the local economy.

On the other end, the Nisqually National Wildlife Refuge brings in over $9 million a year from visitors and it provides critical habitat to a great diversity of migratory birds, amphibians, salmon, and many other wildlife species. The refuge also has been undergoing a large delta restoration project in close collaboration with the Nisqually Tribe and other partners to remove agricultural dikes and restore 700 acres of salt marsh habitat, utilizing over $12 million from federal grants (Batker et al., 2009). In 2002, the Brown Farm dike removal reintroduced the rhythmic motion of the tides for the first time in nearly a century. The ongoing Nisqually Delta restoration project is the largest tidal marsh restoration project in the Pacific Northwest and it is enabling the estuary to function once again as critical salmon and wildlife habitat on such a large scale that it is expected to increase ecosystem functions and services considerably ("Nisqually Delta Restoration," 2011).

Many organizations have been collaborating on the conservation of wildlife habitat and ecosystems within the Nisqually watershed for over two decades with the latest collaborative efforts focused on developing a program of Payments for Watershed Services (PWS). Organizations involved in this PWS pilot project include the Nisqually

Land Trust, Northwest Natural Resources Groups (NNRG), the Nisqually Tribe, Earth Economics, the Nisqually River Council, and the Washington State Department of Natural Resources (WSDNR), with the goal of connecting the land-uses of private landowners with the beneficiaries of the services their forested ecosystems provide in the watershed. Efforts to restore salmon populations and habitat have received national recognition, which is evidenced by an exhibit in the Smithsonian Museum in Washington D.C. that is dedicated to the work in the Nisqually Watershed. This ongoing effort to improve the quality of ecosystems in the Nisqually watershed is combined with a determination to address increasing population development pressure, improve land management on private lands, and protect watershed services. This project considers vital aspects such as the quality and quantity of the drinking water the ecosystems deliver, while at the same time landowners are provided with a viable economic alternative to land-use conversion and given compensation for retaining and protecting ecosystem services provided by a forested watershed.

The Nisqually Watershed has been assessed by Earth Economics (2009) for its estimated economic value and was found to have bountiful goods and services that offer great natural capital investment opportunities. The goods and services studied include fish, timber, flood protection, drinking water filtration, aesthetic value and recreation. The study used cutting edge economic analysis techniques and found that 12 of 23 ecosystem services identified in the Nisqually Watershed gives an estimated $287,600,000 to $4,165,990,000 in benefits to people yearly (Batker et al., 2009). The economic analysis of ecosystem services is still a new field of study and needs more primary studies to fill in valuation gaps. Earth Economics acknowledges that this

estimation likely underestimates the economic value the Nisqually Watershed actually provides.

The underestimation of the value of the Nisqually Watershed may be partially due to the fact that natural capital is different than built capital in many regards to its valuation. Natural capital tends to increase in value over time and is renewable, whereas built capital slowly crumbles and requires ongoing maintenance. Traditionally, watersheds have been underinvested in because as a whole they were not valued economically. This has led to the over degradation of watersheds and the loss of benefits and services, which subsequently damages the economy both directly and indirectly through costs associated with repairing damages and replacing natural capitol with expensive infrastructure. For example, if a watershed is developed to the point that it can no longer provide flood control services, properties and houses along the river may become flooded and damages will need to be repaired. Furthermore, costly infrastructure such as a dike system may be put in place rather than investing in the natural flood reducing ability of the watershed itself.

Economic sustainability and human well-being are inherently tied to environmental sustainability and the goods and services that healthy ecosystems provide. Investing to protect and maintain ecosystem services in the Nisqually Watershed provides benefits for people far into the future and across the watershed boundaries for the entire region. It is in close proximity to three of Washington's largest cities, Olympia, Tacoma and Seattle and contributes to the ecological health of the Puget Sound. Half of the freshwater input to South Puget Sound flows from the Nisqually Watershed, which is critical to the water quality of the southern end of Puget Sound because it does not

receive tidal flushing from the Straits of Juan de Fuca (Batker et al., 2009). Thus, investing in the natural capital and ecosystem services of the Nisqually Watershed will contribute to the overall ecological health of the Puget Sound and the well-being of many individuals and communities.

The Nisqually Watershed provides critical goods and services that are protected through collaborative management that encourages ecological and socioeconomic sustainability. One of the most critical goods provided by the Nisqually Watershed is drinking water to its residents and citizens of Olympia, Washington. Numerous aquifers in the Nisqually Watershed discharge to the Puget Sound and provide much of the watershed's groundwater. Recent studies have shown these aquifers are more directly connected to surface waters than previously thought, which raises concern for the McAllister aquifer and wellhead that provides the primary source of drinking water for the city of Olympia. The Nisqually River basin also hosts native salmon runs and several threatened and endangered species, including the Marbled Murrelet, Bald Eagle, and Spotted Owl. Farming also contributes to the economy and ecology of the Nisqually Watershed as well as forestry, which is the dominant land-use in the upper watershed with timber companies being the primary private landowners.

Increased pressure on the Nisqually Watersheds natural resources is expected from the anticipated population growth in the next 20 years, which may be confounded by the forecasted impacts of climate change and shortfalls to the water supply in the Puget Sound Basin (Batker et al., 2009). The Nisqually Watershed Plan, with the collaboration of the Department of Ecology, local governments, private stakeholders, and the Nisqually Tribe, has identified several priority issues on which management efforts

need to focus. These included population growth, land-use, and water allocation, which all need careful consideration and management to safeguard the health of ecosystems, conserve the goods and services they provide, and sustain local economies and communities.

Sampling Methods

Both qualitative and quantitative methods were used for this study. For the interviews, key players in the Nisqually Watershed Services Transaction pilot project were identified through research and recommendations from Craig Partridge, the former Policy and Government Relations Director for the Washington Department of Natural Resources. Craig Partridge was integrally involved with the conception and development of the Watershed Services Transaction pilot projects. Semi-structured, in-depth interviews were audio-recorded and conducted with members of the core team and key stakeholders that were central players in the Nisqually pilot project. Through their answers to open-ended interview questions, these key participants provided insight into the goals and development of the project as well as observations on stakeholder dynamics and critical factors involved.

Additionally, quantitative data gathered from the short survey questionnaire was used to determine perspectives and beliefs from a larger group of participants, including landowners in the watershed (sellers) and city water utility programs (buyers) that were considered for a watershed services transaction. This questionnaire was designed to identify possible coalitions based on shared beliefs and to show how these might affect

groups that are already formed based on organization affiliation or highlight areas of collaboration or competition. The survey questions and method applied the Advocacy Coalition Framework (ACF), which provides the theoretical foundation and testable hypothesis that coalitions of stakeholders will form around similar beliefs.

According to the ACF, stakeholder coalitions can impact the degree of collaboration and competition within a subsystem, or more specifically the implementation of an agreement or policy change. It would be expected that if there are coalitions with highly divergent beliefs, the level of disagreement would rise and the degree of collaboration and subsequent implementation of agreements would decrease. The objective of the survey data combined with the interview results is to gain a more comprehensive understanding of how stakeholder beliefs and potential coalitions, as well as other critical factors, may have influenced the outcomes of the Nisqually pilot project and how these beliefs may inform PES program development and implementation.

A modified snowball sampling approach was used to identify the larger group of stakeholders for the survey. Using this referral type of sampling technique, members of the core team identified other stakeholders that they were familiar with as being involved with the Nisqually Watershed Services Transaction pilot project. Surveys were also collected in-person at a Nisqually River Council meeting and from emailing an online version out to the organizations members as well as others identified by referral as being stakeholders in the pilot project. The snowball approach is a non-probability sampling technique commonly used in social studies to identify potential study subjects that may be hard to locate or that are a part of a specific subpopulation. This method to access data yields a unique and valuable type of information from the targeted informants (Noy,

2008). The interviews of key informants (stakeholders) are inextricably connected to the quality of the snowball sampling approach. The dynamic process of referrals, trust-building, and clear communication are essential to acquire the recommendations of a sufficient amount of contacts. This approach, similar to referral or respondent-driven sampling, utilizes social networks to access specific study participants that share common characteristics. In this case, the populations consisted of stakeholders and individuals from organizations with interest and involvement in the pilot project. Respondent-driven sampling has been shown to result in a good representative sample in well-connected populations (McCreesh et al., 2012), which is the case in the Nisqually pilot project with the involvement of well-known and established partnership organizations such as the Nisqually River Council.

Quantitative and Qualitative Data Analysis

The quantitative survey data set provided an overall view of stakeholder perceptions and mean responses to questions, but was primarily analyzed to identify potential stakeholder coalitions based on similar responses. An exploratory non-hierarchical method of clustering was used to search for patterns in the dataset and organize the respondents into similar groups (Aldenderfer & Blashfield, 1984) for stakeholder analysis according to the ACF. The 22 survey questions were arranged on a Likert scale (Appendix A) for quantitative analysis (1 = strongly disagree – 5 = strongly agree). First, a preliminary analysis of the survey data set was completed to understand the overall patterns (mean responses, standard deviation, and the percentage) of responses

to each question without regards to stakeholder groups. A one-way analysis of variance (ANOVA) was also performed for each question to reveal if there were any differences in the mean responses among the 6 stakeholder groups (private landowner, NGO, non-profit, local government, other, and State, Federal, or Tribal government). Given that the sample size was relatively small (49 respondents), K-means cluster analysis was used to organize the data and identify coalitions of stakeholders based on similar responses concerning their beliefs and preferences for ecosystem services in the Nisqually Watershed. Cluster analysis is exploratory and often used to find patterns in data, rather than to test a hypothesis (Lipsky & Ryan, 2011). Conclusions are not drawn directly from the results of cluster analysis; it simply finds patterns of stakeholder beliefs and suggests potential groups that can be validated using qualitative analysis and results from the interviews.

Qualitative interview data was crucial for understanding critical factors and perceptions of the pilot project as well as explaining shared values and similar responses for the potential coalitions identified through the quantitative survey analysis. Interviews of key players from leading organizations involved in the pilot project were voice recorded, transcribed, and analyzed for patterns and coded for major themes in stakeholder responses and perspectives using qualitative content and thematic analysis (Patton, 2002; Rubin & Rubin, 2012). A framework for thematic analysis was developed and each interview transcription was coded for reoccurring themes in response to each question, which were then used to sort responses into thematic groups. For example, when asked about the goals of the pilot project, the reoccurring response of protecting water quality and quantity was one of the themes coded for the question and five

interviewees were sorted into that group based on their similar responses. In this way, the in-depth interview responses were organized and quantified according to how many respondents replied with the same theme.

Chapter 4: Results

Perceptions of the Nisqually Watershed Services pilot project were identified in the interviews of twelve key stakeholders involved in the pilot project who represent different organizations. These included two representatives from the Washington State Department of Natural Resources (WSDNR), and one each from the Department of Health (DOH), Earth Economics, the Nisqually Land Trust (NLT), Nisqually River Foundation (NRF), an environmental consulting agency (Sweden Consultants), Washington Forest Protection Association (WFPA) that represents private forest landowners, Hancock Timber Resource Group (a large industrial forest landowner), the City of Olympia Public Works, Northwest Natural Resources Group (NNRG), and the Nisqually Tribe Natural Resources Department. The representatives of these organizations worked collaboratively to develop and implement the Nisqually Watershed Services pilot project and had valuable insights into the inner workings, critical factors, and challenges and lessons of the Nisqually pilot project.

Interview Results

The overall goals of the Nisqually pilot project were succinctly summarized by Craig Partridge, the former Policy and Government Relations Director, who has helped guide policy for more than three decades with WSDNR and played an instrumental role in the development and implementation of this pilot project.

> *I think the major goals are two-fold, one is maintaining the benefits themselves, which include drinking water, flood moderation and protection of fish habitat, water quality protection, and then coincident with those benefits, is the economic value to the landowners that are taking the actions that provide the benefits. They derive some economic benefits that will hopefully retain them practicing forestry or whatever land use that is producing the benefits on that land.*
>
> Craig Partridge-WSDNR

When asked an open-ended question about the main goals of the pilot project, areas of strong consensus and themes among interviewee responses included: to protect and ensure drinking water quality and quantity for generations to come, to develop new revenues of funding, to provide financial incentives to private landowners to maintain their forested lands, and to change forest practices to be more ecologically sustainable. Other benefits such as conserving forests for wildlife and endangered species habitat as well as sustaining the various values of forested ecosystems, including cultural and spiritual values to the community, were also reported as goals by five respondents. Two interviewees elaborated on the goal of providing incentives to private landowners to develop satisfactory economic opportunities for alternatives to certain forest practices, land-use change, or development (timber landowner representatives). The Nisqually Tribe representative emphasized the goal of ensuring their usual and accustomed fishing grounds and securing a long-term future for the community.

The primary objective of the Nisqually Watershed Services pilot project, and developing demonstration PES programs in Washington State, is presented as a means to protect and improve forest ecosystems on private lands through the distribution of financial incentives to landowners (WSDNR, 2013). This overall goal was reflected in the interview responses from key players involved, although different foci were chosen

by different organizations. The goal of protecting the quality and quantity of water resources was reported by five different representatives from organizations including DOH, the Nisqually Tribe Natural Resources Department, the City of Olympia, and WSDNR. The goal of developing financial incentives to change forest practices and retain forest cover on private lands was reported by seven different representatives from organizations including the NLT, NRF, Hancock, WFPA, WSDNR, NNRG, and Earth Economics. Conservation value and other values to wildlife habitat and community benefit were highlighted by five organizations the NLT, WSDNR, NNRG, and the Nisqually Tribe Natural Resources Department.

The Role of Scientific Information

When responding to an open-ended question on the role of scientific information, all of the interview participants reported that it played a crucial validating role in the pilot project. Four of the respondents (representatives from DNR, The Nisqually Land Trust, and Swedeen Consultants), emphasized the use of scientific information to validate the cause-effect relationship between forest practices and the ecosystem services (ES) being measured (i.e. water quality). The other eight respondents focused on the critical role of scientific information to validate the market-based strategies being pursued and show the scientific basis for the identification and valuation of specific ecosystem services. One interviewee gave a great example of the difficulties associated with scientific validation and measuring the additional ecosystem services and benefits provided by specific forest management practices.

> *If you have 100 foot buffer already and I wanted to put 101 foot buffer on it, I can certainly tell you how much that costs me as a landowner but you can't tell me how much that's adding benefit for fish, for water… the list of ecosystem services. The added value of increased buffers are extremely challenging to justify scientifically.*
>
> Doug Hooks-WFPA

For these reasons, the scientific component of the project was reported as being very critical and central to the pilot project effort overall. One respondent ascribed over half (60-70%) of time and resources to being invested in data collection, creating metrics for ES valuation, and economic analysis.

Eight of the interviewees also reported that there was generally not enough scientific information and that more was being sought than was available. Three respondents also reported that there were challenges with the development of new scientific information. However, two interviewees (DNR and Swedeen Consultants) expressed concern that the demand for high scientific rigor and validation of the cause-effect relationship can make a transaction impractical by raising the transaction costs and time requirements. For example, when describing the need for scientific justification and validation of the cause-effect relationship between certain forest practices and the actual ecosystem services and additional benefits being provided to those paying for them, one interviewee explained that,

> *The more the [buyers] have to be sure that those benefits in a quantitative sense are going to occur compared to if they hadn't made the payments then the more important the scientific underpinnings of the cause effect relationship is… if the*

> *stakes are high enough that the buyers have very high demand for scientific rigor it might make the transaction impractical, either because that science doesn't exist or it would be too expensive to acquire.*
>
> Craig Partridge-WSDNR

This highlights concern over the need to balance the requirements for scientific validation of the cause-effect relationship and the demand for scientific justification of the market-based methods used, which can take massive amounts of resources and time, when there is need for immediate action on a critical issue. The representative stakeholder interviewed from Earth Economics clearly articulated the need for swift and efficient action for forest conservation and ES protection to address issues now, using the best available science, rather than waiting for new scientific findings.

> *I think that we were seeking more scientific information than is available. We found that the scientific information available from USGS for example was not as conclusive as we were hoping that it would be to better justify the use of a payments for watershed services scheme. Those of us involved in promoting investments in natural infrastructure recognize the need for strong scientific information yet we can't stand by and wait for the science to catch up, otherwise we're going to be in bigger trouble down the road than we are today.*
>
> Tracy Stanton-Earth Economics

The provision and dissemination of scientific information is a complicated process that is subject to personal perceptions and interpretations. Three (NRF, NLT, and City of Olympia) interviewees reported that it needs to be handled carefully in terms of interpreting and communicating scientific findings to stakeholders, decision-makers, and regulators. Furthermore, other non-monetary and hard-to-quantify values such as cultural and spiritual values are difficult to measure and subject to individual perceptions and

values given to specific ecosystem services. These difficult to measure ecosystem services and values were stressed by two of the interviewees (Earth Economics and the City of Olympia) as being an integral component to these types of projects and complimentary to scientific data. One respondent clearly articulated the importance of different values of ecosystem services saying that,

> *There's cultural value that begins with the tribes' historical use of the area and reaches to modern times with uses such as recreation. One person might be willing to pay for this cultural value, while another would say it's priceless. The concept of value lies with individual perception… so how does a community put value on preserving an ecosystem? How non-scientific aspects, such as the concept of value, relate to or compete with other factors and the roles they play in preserving an ecosystem, are very important considerations, definitely part and parcel to the role of scientific data.*
>
> Donna Buxton-City of Olympia

The Role of Institutional Mechanisms

In response to an open-ended question about the role of institutional mechanisms, one of the main themes that was reported by seven participants (DOH, Earth Economics, DNR, NLT, WFPA, and NRF) pertained to the crucial support of DNR and the legislative direction they received to lead the pilot projects. These interviewees pointed at DNR's steady backing, resources, authority, and connections with other agencies and organizations as vital institutional components to the pilot project. The apparent role of institutional mechanisms as the critical foundation and underpinnings for the pilot project was explicitly reported by five interviewees (DNR, NNRG, City of Olympia, and DOH), which involved the initial legislative direction that led to exploring PES as a tool for forest conservation.

Furthermore, the partnerships and collaboration of committed organizations and individuals were reported by five interviewees (Hancock, DNR, Earth Economics, DOH) as being essential to the project as well as its continued forward progress. These interviewees pointed specifically to the core team that brought their own experience and resources to the table to collectively develop the project. The Nisqually Land Trust and its experience with market-based transactions and the Nisqually River Council with its diverse stakeholder participation were named as important private institutional forces in the pilot project. Five respondents (NNRG, WFPA, NRF, DNR, and Hancock) discussed the role of The University of Washington's Northwest Environmental Forum, which provided a venue for communication and facilitated learning across organizations and groups, as a crucial institutional component of the pilot project.

Regulatory mechanisms and different agencies involved in natural resources management were discussed by six interviewees (NRF, Nisqually Tribe, DNR, NNRG, Swedeen Consultants, and DOH) to be important institutional settings that have complex dynamics and relationships with creative mechanisms such as PES programs for conservation. These interviewees discussed that the pressure to find innovative solutions and tools for conservation and long-term protection stem from the Forests Practices Act and the Clean Water Act and requirements to meet water quality standards, which encourages finding creative solutions and ways to meet regulations more efficiently. Four of these respondents explicitly discussed the need for regulatory agencies to recognize and support PES programs and the development of creative mechanisms for forest conservation that exceed the regulatory requirements. Furthermore, if forest practices aren't meeting CWA standards it would result in the need to change regulations.

However, adaptive management is often difficult and time intensive. As the following interviewee articulated, the potential for changing regulations over time could also undercut that solid foundational role that institutional and regulatory mechanisms were reported as playing for this pilot project.

> *An important underpinning and foundation of any ecosystem services transaction is the regulatory baseline, and in our case, this means the Forest Practices Act and the Clean Water Act. One of the interesting things about Forest Practices is the adaptive management program, which can mean that the regulatory baseline changes over time.*
>
> Dan Stonington-NNRG

The Role of Stakeholder and Public Involvement

The Nisqually pilot project core team (six of the key stakeholder interviewees) was a partnership between several organizations including DNR, NNRG, the NRF, Sweden Consultants, and the NLT. Eight of the interviewees (Swedeen Consultants, DOH, DNR, NNRG, NRF, Hancock, Nisqually Tribe) reported that the core team and this small group of committed stakeholders has been critical to the pilot project. The core team was seen as the driver that organized other stakeholders, developed the project on the ground, and kept it going forward. The larger group of stakeholders and landowners were also reported by these eight respondents as providing vital input to contribute to the discussion and shape the development of the pilot project. The point was made by three of these participants about the unpredictable role of individuals and the influence of key staff members in organizations to sway the project objectives and outcomes, or to continue driving it forward despite obstacles that appear along the way. These stakeholders and active participants are drivers of the process and through the lens of the

ACF, the beliefs and preferences of these individuals are seen as critical influencing factors, and thus were the focus for survey questions.

However, the general public, which in this project is seen as the active citizens that influence government officials and public policy, was stated by nine participants (Nisqually Tribe, DNR, NNRG, NLT, WFPA, City of Olympia, Earth Economics, and DOH) as being either not involved at all or only remotely involved through public agencies such as DNR. There was an apparent contradiction that arose from the interview responses on the appropriate role of public involvement. Three of the respondents (Swedeen Consultants, NLT, and NRF) discoursed that it was too early to involve the public, that a successful pilot project was needed to point to as an example of how it can work before bringing the idea to the public for additional support.

On the other hand, four interviewees (Nisqually Tribe, WFPA, Earth Economics, and DNR) discussed the need for more public awareness, input, and support for the pilot project. These respondents emphasized the need for public understanding and support for these types of projects that concern public benefits, especially for the completion of an actual transaction that involves public funds. As would be the case with the City of Olympia's water utility rate payers being the buyers and beneficiaries in this proposed PES program.

> *I don't feel like we got the level of input that would have been beneficial as far as public involvement… I think that if we had more outreach, public outreach, it would have been more supported by the rate payers and then [the City of Olympia] would've felt like they needed to follow through with it.*
>
> Nahal Ghoghaie-WSDNR

Two respondents pointed out that these kinds of creative mechanisms of PES that deal with social goods and public services need strong public support and input in order to succeed. They shared the concern that, if the public is unaware and doesn't support it or doesn't see the benefits of these kinds of pilot projects, they are not likely to endure even with the support of stakeholders.

> *With these kind of creative mechanisms I think they only work if there is strong public support, there's going to be potentially changes and if the public doesn't see the benefit, then it really isn't going to go anywhere. We've got a unique body with the Nisqually River Council that as a group of stakeholders are really supportive of creative and innovative things and are really supportive of this process. I think that's really important.*
>
> David Troutt-Nisqually Tribe

However, it was pointed out by two interviewees (Earth Economics and Nisqually Tribe) that organizations were involved that represent the public, larger groups of stakeholders, private landowners, and people who live in the watershed. The Nisqually River Council for example, has a long history of innovative watershed management and restoration efforts and a large group of supportive stakeholders from a wide variety of backgrounds including representatives of government agencies, non-profit organizations, and citizens and landowners in the Nisqually Watershed. Having this support from one of the oldest watershed councils in the U.S. that has been nationally recognized for such efforts was explicitly mentioned by two interviewees (Nisqually Tribe and DNR) as being invaluable and extremely beneficial for the pilot project in getting the involvement of a larger group of stakeholders that have strong connections to the Nisqually Watershed and the communities therein.

Other Critical Factors

The main theme in responses to the question about what other factors were critical to the pilot project was reported by nine of the interviewees (NRF, Nisqually Tribe, NNRG, WFPA, NLT, Earth Economics, Swedeen Consultants, and DOH) and pertained to market demand and the availability of funding. These respondents discussed the institutional and market mechanisms that are needed to drive the demand for ES and provide funding for transactions but two interviewees (Swedeen Consultants and WFPA) pointed out that developing PES programs and creative funding mechanisms takes time and long-term commitments.

Furthermore, the application of PES is still new and four interviewees (NNRG, NRF, NLT, and Earth Economics) discussed the role of other regulatory agencies and institutional support and emphasized that PES programs still need institutions and regulatory agencies to recognize ES and drive market development. Also, three respondents (WFPA, Hancock, and NLT) emphasized that in order to get larger landowners on board, the PES mechanism for conservation need to be widely recognized and make economic sense to their investors.

Four interviewees (NNRG, Earth Economics, The Nisqually Tribe, and WFPA), also discussed the pressing need to convince watershed services beneficiaries and buyers of the value and investment opportunity of natural capitol to increase demand and develop a market for ecosystem services. For example, convincing communities and decision-makers to invest in the natural flood reduction capacity of wetlands not only provides numerous environmental and public benefits but also is less costly than letting

the wetland get developed or degraded and repairing damages to infrastructure or homes every time it floods. This pilot project is also a good example because one of the primary objectives was to increase investments in forested ecosystems and protect water filtration services of the watershed. Watershed development for residential or industrial uses results in degraded ecosystem structure, functions, and services. One of the negative consequences of watershed development would be that water utilities would have to build more expensive water quality treatment plants. There are many examples of the practical benefits of investing in natural capital and taking proactive measures to protect ecosystem services. One of the challenges identified by interviewees is to communicate those benefits of investing in natural capital to the public, decision-makers, and buyers of watershed services such as water utility companies.

Another theme that appeared in two interviewee responses (Earth Economics and Swedeen Consultants) and that was central to the concept of PES, was the need for broader recognition of environmental externalities and the development of mechanisms such as PES programs to internalize those. These interviewees discussed people's perceptions of common-pool resources and their subsequent actions affecting ecosystems and the need to change those in order to better protect the environment that we all share. Along these lines, the positive and negative environmental externalities associated with common-pool resources could be internalized in the economic system through market-based conservation methods. This relates to the basic conceptual framework of PES programs, to provide a common ground and common language for scientists, stakeholders, and environmental policy decision-makers in order to internalize these externalities that lead to degradation of common-pool resources. These interviewees

explained how the primary goal of these kinds of PES programs is to ensure that individuals or landowners that are protecting and maintaining ecosystem services continue to provide those positive externalities and public benefits associated with them. On the other hand, the objective would also be to ensure that the creators of negative externalities and environmental impacts are responsible for their actions. Either way, common-pool resources have environmental externalities that need to be internalized and accounted for in our political and economic systems in an effort to close the loop and increase the sustainability of our environment, economies, and communities.

Stakeholder Communication

Communication between stakeholders was facilitated through partnerships with organizations, regular meetings of the core team, and the NW Environmental Forum. When asked if there was a specific type of stakeholder communication that either did or should in the future promote a positive outcome for watershed services, four of the interviewees (DOH, NLT, NRF, and the City of Olympia) reported that face-to-face stakeholder meetings were important, especially early on in the process of developing the project in order to brainstorm ideas and see what works for everyone (particularly buyers and sellers).

As far as communicating the concepts and getting the idea out to a broader group of stakeholders, one-on-one communication was reported as being very beneficial by three of the interviewees (NLT, NRF, and the City of Olympia). Initial contact would often be made by email or phone and these respondents emphasized direct

communication with landowners (sellers) and buyers to explain the project, get a better understanding of their perspectives and preferences, and clear up any confusion. Two of these respondents also further discussed the usefulness of a short, one-page information sheet that could be sent following initial contact for more basic information on PWS programs, how it works and the benefits.

> *A lot of the best progress was made with that one-on-one communication, it may start with a phone call then a meeting, especially with landowners and buyers and sellers, really taking a chance to spend some time together and delve deep into it.*
>
> Justin Hall-NRF

The need for a marketing and communication campaign to communicate concepts and ideas to the general public, elected officials, and decision-makers was considered by eight (Nisqually Tribe, DNR, NNRG, the City of Olympia, WFPA, Earth Economics, and Swedeen Consultants) interviewees to be crucial for building more support for the pilot project and the future development of PES conservation mechanisms. The messaging surrounding the benefits to the long-term water supply and the public benefits of these kinds of projects was stressed by these eight respondents as an important part of a broader communication strategy to get the public and decision-makers to understand the importance of this kind of project in order to achieve conservation goals. Another interviewee (DNR) discussed the need for communication that is pragmatic and communicates the different possible outcomes including the ones that are in the public interest and that have a limited time frame to accomplish them. This suggested approach to communication would use proactive stories and examples about securing the common future in order to get people on board.

Level of Agreement

The majority of stakeholders interviewed (11 out 12) described the level of agreement on the efficacy and desirability of this kind of approach to achieving positive watershed outcomes as relatively strong overall in terms of the intent, basic concepts, and goals of the pilot project. The highest areas of agreement and support were identified as being among the core team's organizations, the Dept. of Health, and especially DNR.

> *The importance of DNR's role in the project should not be underestimated. Without the leadership of key staff, the whole project would not have moved forward. Moreover, the weight of having the State agency responsible for management of public lands-forested lands-gave additional credibility to the work of the Nisqually Watershed Services Pilot Project.*
>
> Tracy Stanton-Earth Economics

Four interviewees (Swedeen Consultants, NNRG, Hancock, and the Nisqually Tribe) also said that it was too early to tell the actual level of agreement because the pilot project is still being discussed and the specific approach is being developed further among the organizations involved. The respondent (Hancock) that did not report that the level of agreement was high in regards to the basic idea and goals mentioned that it was just too early to determine for this pilot project.

However, there was indication by five of the interviewees (DNR, NNRG, Earth Economics, Swedeen Consultants, and DOH) that agreement declined over time or went in a different direction than originally planned and these respondents pointed out minor disagreements as far as specific methods for the transaction. Areas that were described as

lower in agreement included different ideas about the funding mechanism and the attitude of regulatory agencies towards non-regulatory methods of achieving goals. The ways agreement changed were identified as being primarily surrounding a low level of understanding and communication of scientific information, specifically the results from the USGS groundwater model.

Challenges and Lessons

One of the main themes in challenges for the pilot project that eight of the interviewees discussed had to do with the scientific quantification and justification of payments for watershed services. Four of the interviewees (NRF, DNR, WFPA, and Swedeen consultants) further elaborated on the role of scientific information and the challenges to the scientific justification of PES. These specific challenges were described as issues with measuring both the value of specific ecosystem services, and the additional benefits (additionality) that result from the action taken by the landowner in exchange for the payment they receive for providing or protecting those services. Challenges with the measurement of specific ecosystem services and additionality were tied to the limitations of and demand for science and the need to act with limited time and resources.

> *One of the trickiest things is what's the service being provided? Is that sedimentation prevention? How do you measure it? If it's water temperature how do you measure it? How do you know you're having an impact? Things like that, what we're learning about science is mostly that we need more of it.*
>
> Joe Kane-NLT

Issues were reported with new scientific information that was generated, specifically with the scope and focus of the research done by USGS on the relationship between forest cover and groundwater as well as the interpretation and communication of the information they generated. Three of the interviewees (NNRG, Swedeen Consultants, and Earth Economics) discussed the new scientific information generated through the USGS groundwater model and expressed that it was frustrating due to issues with this aspect of the project, which included concerns that it didn't ask the right questions in terms of how forest soils actually affect the water quality and prevent contamination from getting to the wellhead. Instead the focus was primarily on how forest cover influences groundwater flow patterns and transportation rates through the wellhead protection area. These participants expressed concern that the study results showing that forest cover did not significantly affect the time of travel for contaminants to enter the aquifer were misinterpreted by the potential buyers and may have had a counterproductive role in realizing a transaction. One interviewee clearly articulated these concerns stating that,

> *Unfortunately, I think that the information that USGS worked hard to generate was not productive. Their work wasn't focused on quite the right question and as a result I think the results were misinterpreted.*
>
> Dan Stonington-NNRG

Challenges with institutional mechanisms and other public policy and regulatory tools were conferred by five interviewees (NRF, DNR, NNRG, NLT, and WFPA) that highlighted the need for clear legislative direction, broad recognition of payments for ecosystem services methods, and innovative thinking outside of traditional methods for conservation. Seven (Nisqually Tribe, Hancock, DNR, NNRG, Swedeen Consultants,

Earth Economics, and DOH) of the key stakeholders discussed that institutional mechanisms to support these kinds of ecosystem services transactions are not present or not developed enough and that there are challenges with current regulatory systems and operational structures. These participants discussed regulatory programs and mechanisms such as the Clean Water Act (CWA) and Forest Practices Law and regulatory agencies that need to consider how they can include ES valuation and payment mechanisms for forest conservation. Four of these respondents revealed that the current inflexible regulatory mechanisms present a challenge to PES for various reasons and discussed the complex dynamics between regulatory agencies and market-based programs. The relationship of regulatory programs and market-based programs is complicated and there could potentially be conflict when they are focusing on the same outcomes. A general example would be the relationship between the Forest Practices Law, the Clean Water Act, and market-based conservation programs all aimed at improving forest practices and water quality. One interviewee provided an example from the pilot project in which the property targeted for watershed services payments was outside of city limits and within Thurston County's authority to regulate land-uses and protect the water resources.

> *The regulatory entity that was in the picture with regard to the city of Olympia was Thurston County exercising its land-use and zoning authority, because the city of Olympia was saying we need to buy certain outcomes here that are protective of our water supply, that could be seen as a vote of no-confidence in the county's zoning to provide those outcomes.*
>
> Craig Partridge-WSDNR

Furthermore, these respondents elaborated on the current institutional structures and concerns that they are not fully supportive of these kinds of creative mechanisms. One

interviewee in particular (Nisqually Tribe Natural Resources Director) articulated the issue that current institutional mechanisms were developed without the idea of PES and trying to fit these concepts into those well-established systems can be very difficult, thus new pathways are needed through these present operational structures.

Finding creative mechanisms for funding was one of the main goals of this pilot project and eight of the stakeholders discussed the challenges of securing funding and cultivating the market demand that is needed to drive PES projects such as this. Theoretically, PES programs can potentially address inherent issues with limited revenue for conservation and restoration programs. However, concern was raised by two respondents (DOH and the Nisqually Tribe Natural Resources Director) that regulations could be a barrier for PES program implementation in small rural communities that are struggling to meet requirements and that funding mechanisms need to bring funds to more rural areas to protect ecosystem services. These respondents emphasized that it is important for institutional systems to support creative solutions for new funding mechanisms, especially ones that bring financial capital from urban areas to more rural areas that lack funding but are rich in natural capital.

Competing costs are also a challenge and were stated by two interviewees (WFPA and City of Olympia) as an important consideration as well as the assessment and perception of risk to the environment and where the money can be made to go the farthest, or where the "biggest bang for the buck" is. There is often a trade-off between priority areas of conservation and other areas that have risk and the effort and resources required to protect them as well as the interests of the community. This trade-off was clearly articulated by the representative stakeholder for the City of Olympia, who said,

> *A particularly difficult challenge was realizing the value of the opportunities to help preserve part of an ecosystem while weighing those opportunities against other needs that require limited ratepayer funds... needs that benefit citizens of a City that relies on drinking water outside City limits. How does the opportunity to invest in specific parcels weigh-in with respect to other competition for the limited revenue received from ratepayers, that's a huge challenge… It's a balancing act of what makes sense in terms of weighing the relative risks affecting all our water sources, while not diminishing the importance of McAllister being our primary water source, while also striving to be accountable for limited revenue, to our rate payers, and for competing costs with infrastructure.*
>
> Donna Buxton-City of Olympia

This concern is especially an issue with common-pool resource issues and environmental problems that are numerous and costly to address with limited public funds.

An interesting point discussed for lessons and creative solutions for the funding challenge was to combine beneficiaries (buyers) to increase funding for PES projects. For example, funds can be combined from rate payers of a city's water utilities with other funds from beneficiaries of increased forest cover in a watershed, such as salmon restoration programs. Developing partnerships and aggregating buyers to increase funding may be an important next step to advance the viability of PES programs on a larger regional or statewide scale.

The primary positive lesson emphasized by eight of the interviewed key stakeholders (Nisqually Tribe, DNR, NNRG, WFPA, Earth Economics, City of Olympia, Swedeen Consultants) was the need for clear communication and getting the messaging right around the subject of PES programs and the valuation of ecosystem services in order to raise awareness and support with the broader public, regulators, and decision-makers. These eight interviewees reported the importance of mounting a good

communication campaign to educate the community and show people the value of ecosystem services. Four interviewees highlighted the need to communicate the basic concepts of PES programs to the broader public and show people that investing in ecosystem services can provide some regulatory relief and can be less expensive than responding to a crisis after the fact. Communicating the value of natural capital, gaining citizen support, and getting buyers on board was considered a critical step for the implementation and future development of PES programs.

Survey Results

There were 49 survey participants. Respondents were categorized according to their organization affiliation for the purpose of a stakeholder analysis and for anonymity. Respondents selected their stakeholder group from the following 6 categories: Individual (landowner) (n=13), local government (n=6), Non-Governmental Organization (NGO) (n=8), conservation non-profit organization (n=4), other (n=6), and State, Federal, or Tribal agency (n=12). The stakeholders that answered "other" specified their organization and answers were from individuals that fell under more than one affiliation such as, NRF board member and Nisqually Delta Association board member, private landowner and NGO, private landowner and landscaping contractor, or that were truly in the "other" category such as, Wildlife Park or Nisqually Volunteer Stream Steward. Analysis of responses to each question in the survey was initially completed to comprehend the mean response, standard deviation, and the general make-up of responses to each question

regardless of stakeholder organizational affiliation. These overall perceptions of the survey population are shown in Table 1 and discussed in the following sections.

Table 1. Mean responses across stakeholder groups to scaled research questions. (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Part I: Attitudes towards watershed services in the Nisqually Watershed

Column1	Mean	Standard Deviation	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
It is important to conserve watershed services for future generations	4.77	0.66	83.33%	14.58%	0.00%	0.00%	2.08%
It is important to spend money and use public funds to conserve watershed services	4.55	0.82	67.34%	24.48%	2.04%	2.04%	2.04%
The quality of watershed services from the Nisqually watershed is high	4.22	0.82	40.81%	44.89%	12.24%	0.00%	2.04%

Part II: Perceptions of the severity and causes of problems for watershed services

Column1	Mean	Standard Deviation	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Pollution is a severe environmental problem for watershed services	3.90	1.05	30.61%	42.85%	16.32%	6.12%	4.08%
Increased impervious surfaces (e. g. pavement) is a severe environmental problem for watershed services	4.29	0.91	51.02%	32.65%	12.24%	2.04%	2.04%
Fewer forested areas is a severe environmental problem for watershed services	4.18	0.99	42.86%	57.14%	4.08%	4.08%	4.08%
The accumulation of many individual actions (such as the use of lawn chemicals or littering) is a major cause of environmental problems for watershed services	4.24	0.85	42.86%	44.90%	8.16%	2.04%	2.04%
Land use decisions of private land owners are a major cause of environmental problems for watershed services	3.77	1.08	25.00%	45.83%	14.58%	10.42%	4.17%
Natural resource management practices on public lands are a major cause of environmental problems for watershed services	3.06	1.14	8.16%	30.61%	32.65%	16.33%	12.24%
Natural resource management on private lands (e.g. logging and related erosion and sediment deposition) are a major cause of environmental problems for watershed services	3.69	1.25	28.57%	38.78%	16.33%	6.12%	10.20%
Farming practices and related nutrient inputs are a major cause of environmental problems for watershed services	3.79	0.98	21.28%	48.94%	21.28%	4.26%	4.26%
Human development (e. g. deforestation and conversion to housing) is a major cause of environmental problems for watershed services	4.41	0.89	57.14%	34.69%	2.04%	4.08%	2.04%

Part III: Potential Solutions for watershed services in the Nisqually Watershed

Column1	Mean	Standard Deviation	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Stronger enforcement of existing regulations and/or stricter regulations are good ways to improve the environmental quality of watershed services	3.76	1.11	24.49%	46.94%	14.29%	8.16%	6.12%
Increased public land ownership (i.e. government agencies) is a good way to improve the environmental quality of watershed services	3.44	1.07	14.58%	39.58%	25.00%	16.67%	4.17%
Government guidance of land and natural resource use on private property through land rights and/or zoning is a good way to improve the environmental quality of watershed services	3.53	1.06	10.20%	57.14%	16.33%	8.16%	8.16%
Providing financial incentives to private landowners for sustainable resource management and stewardship practices is a good way to improve the environmental quality of watershed services	4.38	0.71	51.06%	36.17%	12.77%	0.00%	0.00%

Part IV: Relative Importance and preferences for watershed services

Column1	Mean	Standard Deviation	Least Important	2	3	4	Most Important
Quality and quantity of water resources provided by watersheds	4.55	82.91%	2.13%	2.13%	2.13%	25.53%	68.09%
Traditional industry of logging in forested watersheds	3.19	113.52%	8.51%	17.02%	34.04%	27.66%	12.77%
Traditional industry of fishing in watersheds	3.76	111.92%	4.35%	10.87%	17.39%	39.13%	28.26%
Traditional industry of farming in watersheds	3.43	109.83%	6.38%	12.77%	27.66%	38.30%	14.89%
Places for public recreational activities in watersheds	3.81	92.40%	2.13%	8.51%	12.77%	55.32%	19.15%
Wildlife habitat and biological diversity in watersheds	4.45	92.80%	4.26%	0.00%	4.26%	29.79%	61.70%

Attitudes Toward Nisqually Watershed Services

The first questions asked in the survey pertained to attitudes towards watershed services in the Nisqually Watershed. The questions were designed to better understand stakeholder beliefs at the deep core and policy core levels, including whether or not it is important to conserve watershed services for future generations, to spend money and use public funds to conserve watershed services, and opinions on the quality and watershed services in the Nisqually Watershed. Most survey respondents (97.91%) agreed (responded with a 4 or 5) that it is important to conserve watershed services for future generations. Survey respondents also mostly agreed (91.82%) that it is important to spend money to conserve watershed services and only 4.08% disagreed (responded with a 1 or 2). Survey respondents primarily agreed (85.7%) that the quality of watershed services from the Nisqually Watershed is high, and 12.24% responded neutral to the question.

Analysis of mean responses among stakeholder groups using one-way ANOVA for each question and the Tukey-Kramer method, also known as Tukey's Honest Significant Difference (HSD) test, found no significant difference in mean responses between stakeholder groups with regards to their attitudes towards watershed services. This indicates that there was general agreement among all stakeholder groups on the importance of conserving watershed services for future generations, the importance of spending money to conserve watershed services, and that the quality of watershed services is high in the Nisqually Watershed.

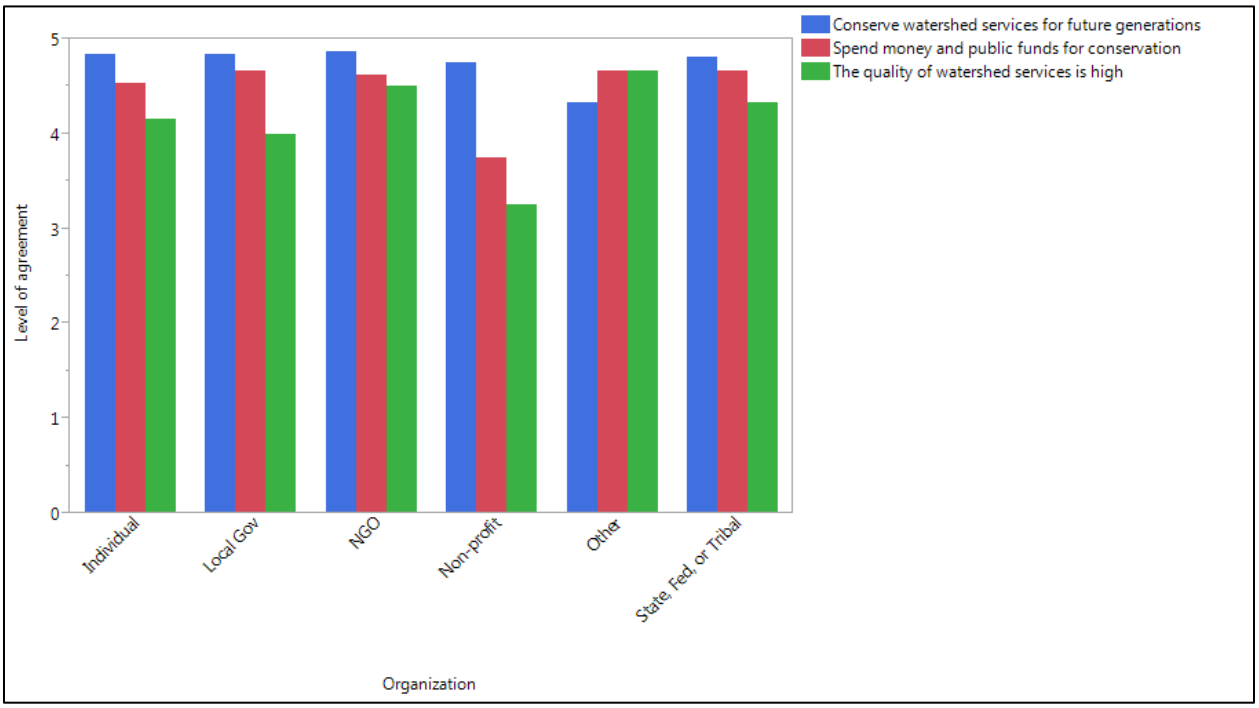

Figure 7. Mean responses across stakeholder organizations about attitudes toward watershed services in the Nisqually Watershed

Severity and Causes of Environmental Problems for Watershed Services

Research has identified a number of factors that can contribute to environmental problems for watershed services in the Nisqually Watershed, including pollution, increased impervious surfaces, fewer forested areas, individual actions, land-use decisions, natural resource management, farming practices, and human development. Most respondents agreed (73.46%) that pollution is a severe environmental problem, while 16.32% were neutral and 10.2% disagreed. Increased impervious surfaces were largely agreed upon as a severe environmental problem (83.67%) but 12.24% of respondents answered neutral. Respondents mostly agreed (87.76%) that fewer forested areas are a severe problem. The accumulation of many individual actions (such as the use of lawn chemicals or littering) were agreed upon as a severe environmental problem (87.76%). 70.83% of respondents agreed that land-use decisions of private landowners are a severe environmental problem, 14.58% were neutral, and 14.58% disagreed.

For the question about natural resource management practices on public lands, 38.78% of respondents agreed it was a major cause of environmental problems for watershed services, 28.57% disagreed, and 32.65% answered neutral. With regards to natural resource management practices on private lands (such as logging and related erosion), 67.35% of respondents agreed it was a major cause of problems, 16.33% disagreed, and 16.33% answered neutral. Respondents mostly agreed (70.21%) that farming and related nutrient inputs were a major cause of environmental problems but 21.28% answered neutral. Human development was agreed upon the most out of all the questions regarding severity and causes of environmental problems for watershed services, with 91.84% of respondents that agreed it was a major cause.

Analysis of mean responses among stakeholder groups using one-way ANOVA for each question and Tukey's HSD test found no significant differences for any of the questions pertaining to the severity and major causes of environmental problems for watershed services. However, there were notable differences between mean responses of organizations with regards to specific questions about the causes of problems for watershed services (Figure 8). Most notably, the mean responses to the question about natural resource management on private lands ranged from 3 (local gov) to 4.25 (State, Fed, or Tribal agencies), although this was not considered a statistically significant difference ($F = 1.51$, $p = 0.21$). The mean responses to the question about land-use decisions of private landowners ranged from 3.17 (local gov) to 4.34 (State, Fed, or Tribal agencies), although this was not considered significant ($F = 1.35$, $p = 0.26$). Mean responses to the question about many individual actions ranged from 3.5 (non-profits) to 4.58 (State, Fed, or Tribal agencies), although this was not considered significant ($F = 1.3$, $p = 0.28$). The mean responses to the question about increased impervious surfaces ranged from 3.75 (non-profits) to 4.67 (State, Fed, or Tribal agencies), although this was not considered significant ($F = 1.41$, $p = 0.24$). This indicates that there is general agreement, but a relatively large range in levels of agreement, among stakeholder groups on the severity and causes of environmental problems for watershed services in the Nisqually Watershed.

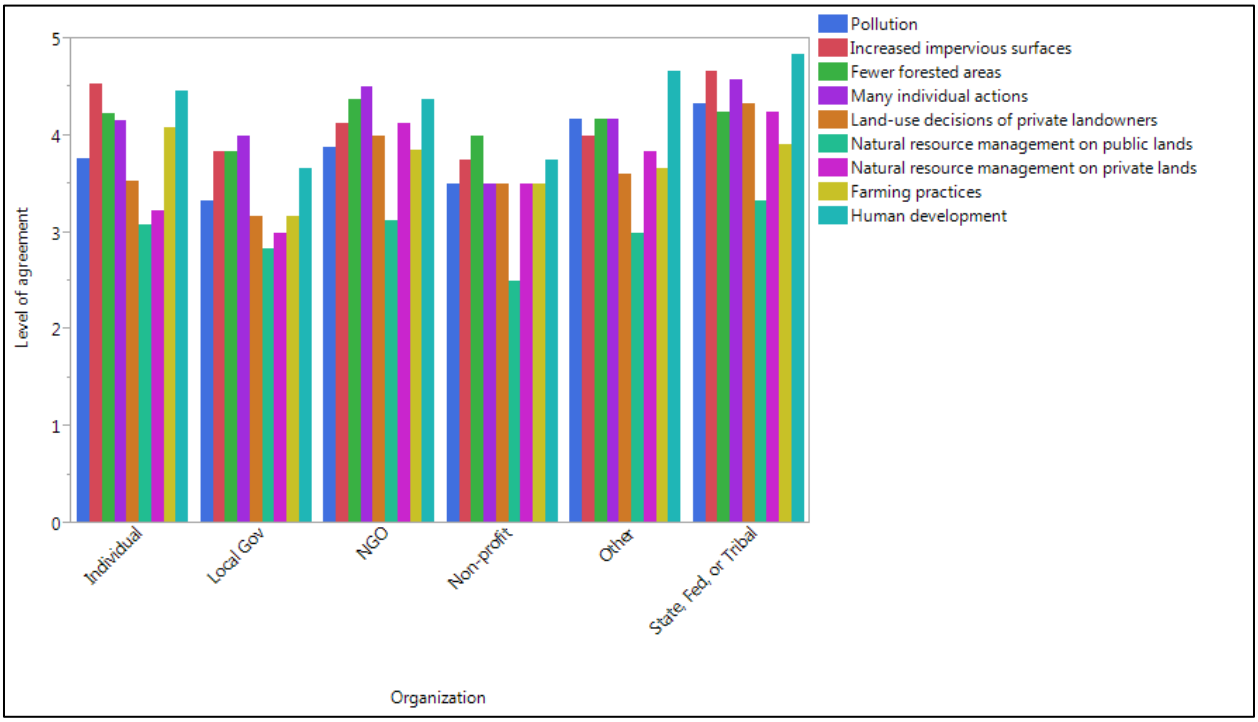

Figure 8. Mean responses across stakeholder groups about causes and severity of problems for watershed services in the Nisqually Watershed

Potential Solutions for Watershed Services in the Nisqually Watershed

Research has identified potential solutions for natural resource management issues (such as the protection of watershed services), including stronger enforcement of existing regulations and/or stricter regulations, increased public landownership (i.e. national parks or ownership by government agencies), government guidance of land and natural resource use on private property through land rights and zoning, and providing financial incentives to private landowners for activities such as sustainable resource management or stewardship practices. Most respondents agree (71.43%) that stronger enforcement of existing regulations and/or stricter regulations are good ways to improve

the environmental quality of watershed services. Just over half (54.17%) of respondents agreed that increased public landownership was a good way to improve watershed services, a quarter of the respondents answered neutral, and 20.83% disagreed. Survey respondents had 67.35% agreement that government guidance of land and natural resource-use on private property is a good way to improve watershed services, 16.33% disagreed, and another 16.33% answered neutral. A large majority of the survey respondents agreed (87.23%) that providing financial incentives to private landowners was a good way to improve watershed services, 12.77% answered neutral, and no one disagreed.

Analysis of mean responses across stakeholder groups using one-way ANOVA for each question and Tukey's HSD test found no significant differences among stakeholder groups. However, there are certain notable differences among mean responses to these questions regarding potential solutions. Responses to these questions demonstrated a relatively large range in mean responses among stakeholder groups (Figure 9). The mean responses among groups to the question about stronger enforcement and/or stricter regulations ranged from 3.31 (individuals) to 4.17 (other), although this was not considered a statistically significant difference ($F = 0.75$, $p = 0.59$). For the last question pertaining to financial incentives as a good way to improve watershed services, mean responses indicated that local governments had the lowest level of agreement (mean=4) and conservation non-profit organizations had the highest level of agreement (mean=5), although this was not considered significant ($F = 1.71$, $p = 0.15$). These results indicate that there is general agreement, but a relatively wide range in levels of

agreement, among stakeholder groups on potential solutions to environmental problems facing the Nisqually Watershed.

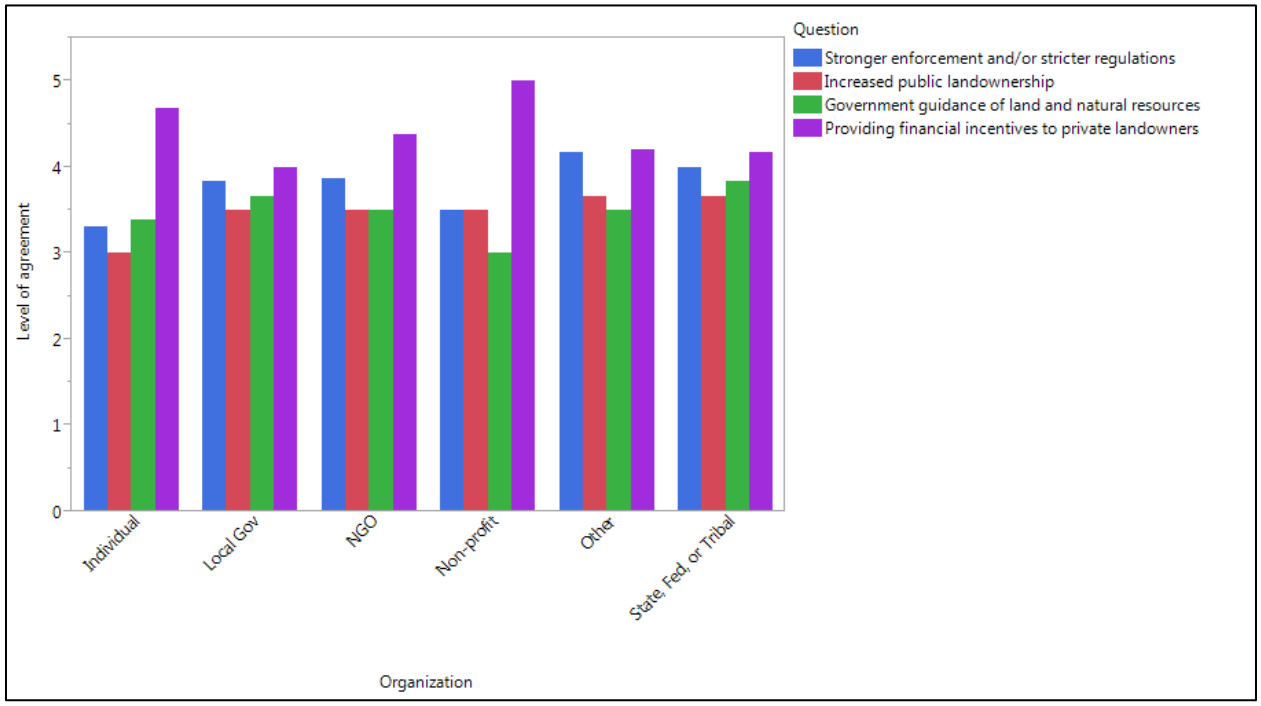

Figure 9. Mean responses across stakeholder organizations to questions about potential solutions to problems for watershed services in the Nisqually Watershed

Relative Importance and Preferences for Watershed Services

Stakeholder preferences and values for specific watershed goods and services are important considerations for ecosystem managers. Part IV of the survey asked respondents to rank watershed goods and services according to the relative level of importance of each for protection in the Nisqually Watershed (1 = least important – 5 = most important). The watershed goods and services ranked were: quality and quantity of water resources provided by watersheds, logging in forested watersheds, fishing in forested watersheds, farming in forested watersheds, places for public recreation, and

wildlife habitat and biological diversity in watersheds. Most of the respondents (93.62%) agreed that maintaining the quality and quantity of watershed resources was most important (answered 4 or 5). Only 40.43% of the respondents replied that logging was important and 25.53% replied that it was least important (answered 1 or 2). 67.39% of respondents thought that fishing was important and 15.22% responded that it was least important. Just over half (53.19%) of respondents thought farming was important and 19.15% said it was least important. Nearly three quarters (74.47%) of all respondents replied that places for public recreation was most important and only 10.64% thought it was least important. The respondents largely (91.49%) believed that wildlife habitat and biological diversity were among the most important watershed services to protect.

Analysis of mean responses across stakeholder groups using one-way ANOVA for each question and Tukey's HSD test indicated that there was a significant difference among mean responses for the question pertaining to the importance of wildlife habitat and biological diversity ($F=2.56$, $p=0.04$). Significant differences were reported between State, Federal, or Tribal agencies (mean=5) and conservation non-profit organizations (mean=3.5). There were not statistically significant differences between the mean responses of the other stakeholder groups, which fell between the range of 4 (local governments) and 4.67 (other). This indicates that there are relatively large differences in the perspectives among stakeholder groups (particularly State, Federal, or Tribal agencies and conservation non-profit organizations) for the importance of protecting and maintaining wildlife habitat and biological diversity as an ecosystem service in the Nisqually Watershed.

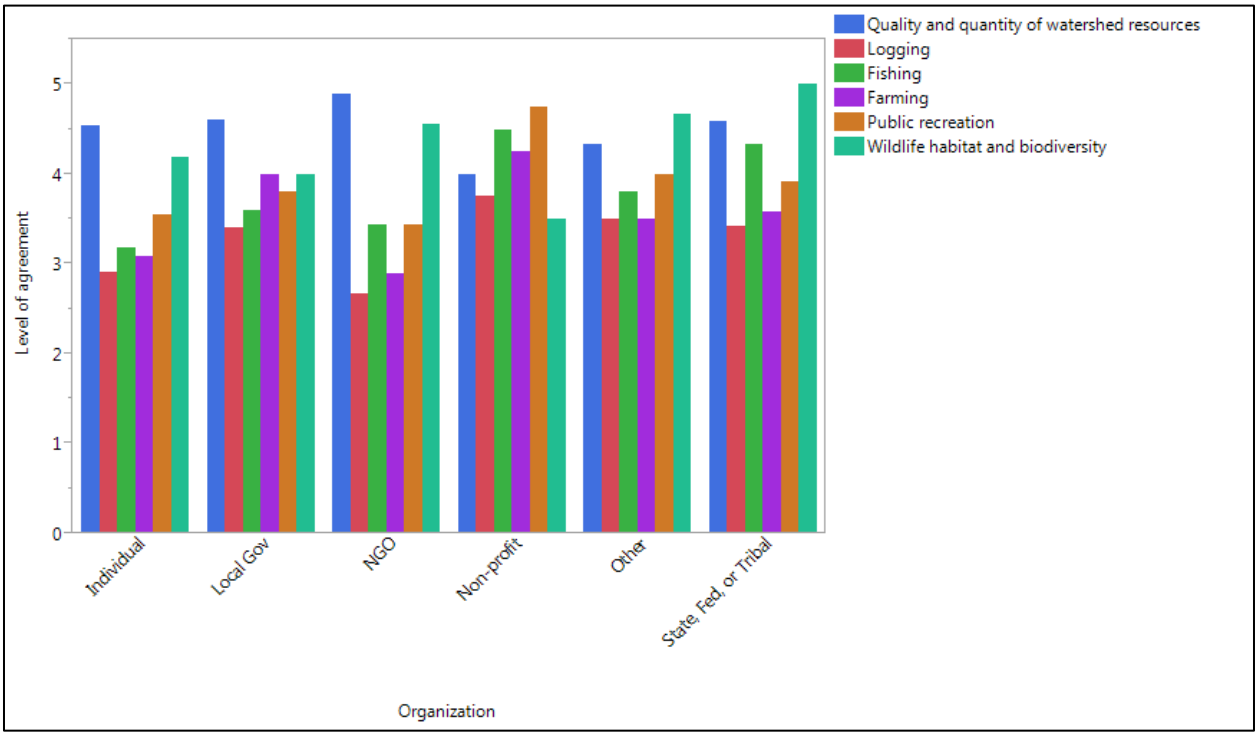

Figure 10. Mean responses across stakeholder organizations about the relative importance of watershed goods and services in the Nisqually Watershed

Identifying Potential Coalitions

Two K-means cluster analysis were performed, one on the first three categories of questions that were about level of agreement and the second on the fourth category of questions that asked respondents to rank watershed goods and services according to relative importance and with consideration to limited available resources for conservation. A preliminary exploration of qualitative and quantitative data was the first step to identifying potential stakeholder coalitions. Hierarchical cluster analysis using Ward's method and applying squared Euclidian distances as the similarity measure was used to determine the optimal number of clusters prior to running the K-means cluster

analysis. Analysis of the first three categories of questions in the survey dataset revealed two main groups who shared similar values and were distinctly different from the other groups based on their responses. Respondents were coded according to their potential coalition identified from the K-means cluster analysis of two clusters. Potential coalitions were identified through analysis of mean responses to survey questions as well as thematic coding of qualitative responses to interview questions. The two coalitions were thematically named according to similar beliefs:

1. *Problems for watershed services in the Nisqually Watershed are primarily caused by human development, increased impervious surfaces, and the accumulation of many individual actions. These problems need immediate action using best available science and a combination of regulatory methods and market-based incentives.*
2. *Problems for watershed services in the Nisqually Watershed are primarily caused by human development and the accumulation of many individual actions, but not by land-use decisions or natural resource management on private lands. These problems need to be addressed using market-based incentive approaches, not government guidance or regulatory methods.*

Table 2 shows mean responses to the survey questions for each coalition. The largest differences in mean responses for each question primarily pertain to the causes of problems. Specifically Coalition 2 disagrees that land-use decisions of private landowners or natural resource management on private lands are a major cause of environmental problems. These potential coalitions are supported by responses to interview questions regarding institutional and regulatory mechanisms.

Table 2. Mean responses across coalitions to scaled research questions.

(Bold text indicates largest differences in mean responses)

Part I: Attitudes towards watershed services in the Nisqually Watershed

	Coalition 1 Mean Responses	Coalition 2 Mean Responses
It is important to conserve watershed services for future generations	4.95	3.60
It is important to spend money and use public funds to conserve watershed services	**4.79**	**3.40**
The quality of watershed services from the Nisqually watershed is high	4.29	4.00

Part II: Perceptions of the severity and causes of problems for watershed services in the Nisqually Watershed

	Coalition 1 Mean Responses	Coalition 2 Mean Responses
Pollution is a severe environmental problem for watershed services	4.16	2.40
Increased impervious surfaces (e. g. pavement) is a severe environmental problem for watershed services	**4.53**	**2.60**
Fewer forested areas is a severe environmental problem for watershed services	4.37	2.80
The accumulation of many individual actions (such as the use of lawn chemicals or littering) is a major cause of environmental problems for watershed services	4.39	3.20
Land use decisions of private land owners are a major cause of environmental problems for watershed services	**4.05**	**2.00**
Natural resource management practices on public lands are a major cause of environmental problems for watershed services	3.21	1.60
Natural resource management on private lands (e.g. logging and related erosion and sediment deposition) are a major cause of environmental problems for watershed services	**3.92**	**2.00**
Farming practices and related nutrient inputs are a major cause of environmental problems for watershed services	4.08	2.20
Human development (e. g. deforestation and conversion to housing) is a major cause of environmental problems for watershed services	4.66	3.40

Part III: Potential Solutions for watershed services in the Nisqually Watershed

	Coalition 1 Mean Responses	Coalition 2 Mean Responses
Stronger enforcement of existing regulations and/or stricter regulations are good ways to improve the environmental quality of watershed services	**3.97**	**2.60**
Increased public land ownership (i.e. government agencies) is a good way to improve the environmental quality of watershed services	3.55	2.40
Government guidance of land and natural resource use on private property through land rights and/or zoning is a good way to improve the environmental quality of watershed services	**3.76**	**2.00**
Providing financial incentives to private landowners for sustainable resource management and stewardship practices is a good way to improve the environmental quality of watershed services	4.42	3.80

Part IV: Relative Importance and preferences for watershed services

	Coalition 1 Mean Responses	Coalition 2 Mean Responses
Quality and quantity of water resources provided by watersheds	4.69	4.29
Traditional industry of logging in forested watersheds	**2.48**	**4.29**
Traditional industry of fishing in watersheds	3.45	4.29
Traditional industry of farming in watersheds	**2.97**	**4.29**
Places for public recreational activities in watersheds	3.52	4.24
Wildlife habitat and biological diversity in watersheds	4.59	4.18

Potential Coalition 1:

Problems for watershed services in the Nisqually Watershed are primarily caused by human development, increased impervious surfaces, and the accumulation of many individual actions. These problems need immediate action using best available science and a combination of regulatory methods and market-based incentives.

Coalition 1 is made up of the majority of survey respondents (n=38) and consists of representatives from all stakeholder groups based on organizational affiliation, including NGOs, State, Federal, or Tribal agencies, Individuals, local governments, conservation non-profit organizations, and other. Mean responses of Coalition 1 showed high agreement on the questions pertaining to attitudes and indicated that this group believes that it is important to conserve watershed services for future generations, and spend money and public funds to do so.

Mean responses of Coalition 1 also indicated high agreement on several questions regarding the severity and causes of environmental problems for watershed services. Specifically, that major issues and causes of problems included increased impervious surfaces, the accumulation of many individual actions, and human development (conversion to housing). Mean responses of Coalition 1 also indicated a high level of agreement on several potential solutions for improving watershed services, including primarily providing financial incentives to private landowners combined with stronger enforcement of regulations and/or stricter regulations, and government guidance of land-use and natural resource management on private property.

Potential Coalition 2

Problems for watershed services in the Nisqually Watershed are primarily caused by human development and the accumulation of many individual actions, but not by land-use decisions or natural resource management on private lands. These problems need to be addressed using market-based incentive approaches, not more government guidance or regulations.

Coalition 2 is made up of 5 survey respondents from individuals that identified themselves with organizations including individuals, local governments, State, Federal, or Tribal agencies, and other. There were no respondents in this coalition from NGOs or conservation non-profit organizations. With regards to questions pertaining to core values and attitudes towards watershed services, mean responses of coalition 2 indicated the lowest level of agreement that it was important to spend money and use public funds to conserve watershed services for future generations. Coalition 2 had the lowest mean response for questions relating to the severity and causes of environmental problems for watershed services. Specifically, this indicates that coalition 2 had the lowest level of agreement that natural resource management on public and private lands are a major cause of environmental problems for watershed services, and that land-use decisions of private landowners are a major cause of environmental problems for watershed services.

Mean responses of Coalition 2 also indicated the lowest levels of agreement on the questions that government guidance of land and natural resource use, increased public land ownership, and stronger enforcement of existing regulations and/or stricter regulations are good ways to improve the environmental quality of watershed services. However, mean responses of Coalition 2 indicate that this group did agree that providing financial incentives to private landowners for sustainable resource management and

stewardship practices is a good way to improve the environmental quality of watershed services.

Potential Coalitions Regarding the Relative Importance of Watershed Services

A separate K-means cluster analysis was run for the questions regarding relative importance of watershed services in the Nisqually Watershed because the survey structure was different than for previous questions. Respondents were asked to rate 6 different watershed services according to their level of importance (1 = least important – 5 = most important). Preliminary exploration of data also indicated that different groups of stakeholders shared similar beliefs than for the previous questions. K-means cluster analysis of the survey data subset showed two main clusters of stakeholder groups whose shared values differentiated them from the other group, although there was some overlap between coalitions. Respondents were also coded according to their potential coalition for further analysis of stakeholder groups. Table 2. Part IV shows the mean responses for relative importance of watershed services for each coalition. The potential coalitions were thematically named according to their similar beliefs.

Potential Coalitions

A. *The quality and quantity of water resources, and wildlife habitat and biological diversity are the most important watershed goods and services to maintain in the Nisqually Watershed.*
B. *All the watershed goods and services are important to maintain in the Nisqually Watershed, including the traditional industries of logging, fishing, and farming.*

Coalition A consisted of 17 respondents from all six organizations (State, Federal, or Tribal agencies, other, NGOs, local governments, individuals, and conservation non-profits). Mean responses of Coalition A indicated the belief that the most important watershed goods and services to maintain in the Nisqually watershed are the quality and quantity of water resources (mean =4.69) and wildlife habitat and biological diversity (mean = 4.59). Mean responses of Coalition A indicated that this group believes that the traditional industries of farming and logging are of least importance (means = 2.97 and 2.48 respectively) to maintain in the Nisqually Watershed.

Coalition B consisted of 29 respondents primarily from State, Federal, or Tribal agencies, NGOs, and individuals, with 3 respondents from other and 3 from local governments. Mean responses of Coalition B indicated the belief that the quality and quantity of water resources and the traditional industries of logging, farming, and fishing were all of equally high importance (means = 4.29). Mean responses of Coalition B indicated a slightly lower level of importance for places for public recreation and for wildlife habitat and biological diversity in the Nisqually Watershed. However, the mean responses of Coalition B indicate that this group believes that all watershed services are nearly equally important (mean responses were between 4.18 and 4.29) to protect and maintain in the Nisqually Watershed.

Chapter 5: Discussion

The potential coalitions identified in this study support the Advocacy Coalition Framework (ACF) hypothesis that coalitions will form around similar beliefs but members will not necessarily be from the same organization or share similar preferences. Many respondents that shared organizational affiliation responded differently to survey and interview questions and were grouped into different coalitions. Additionally, individual coalition members varied in their responses to certain survey questions, which indicated differences in preferences within coalitions. For example, for the statement "Government guidance of land and natural resource use on private property through methods such as land rights and zoning is a good way to improve the environmental quality of watershed services" the answers of Coalition 1 ranged from "disagree" to "strongly agree." Similarly, Coalition 2 responses to the statement "The accumulation of many individual actions (such as the use of lawn chemicals or littering) is a major cause of environmental problems for watershed services" ranged from "disagree" to "strongly agree." These differing responses within coalitions may reveal individual preferences and secondary beliefs rather than divergent policy core beliefs around which coalitions often form. Furthermore, the potential coalitions identified through cluster analysis demonstrate a diversity of stakeholder categories. The only stakeholder organizations that were not represented in both coalitions were NGOs and conservation non-profits, which were absent from Coalition 2.

The potential coalitions that formed around similar beliefs regarding the importance of maintaining individual watershed goods and services also demonstrated differences in organizational affiliation. Coalition A was described based on common

themes and mean responses to each question, which indicated a shared belief system that the quality and quantity of water resources and wildlife habitat and biological diversity are the most important watershed goods and services to maintain in the Nisqually Watershed. This coalition consisted of representatives from all 6 organizations (although there was only one respondent from a conservation non-profit organization). Likewise, Coalition B was thematically described, based on the mean responses indicating a shared belief system. The mutual importance placed on all the watershed goods and services being maintained in the Nisqually Watershed also had representation from all 6 organizations. Furthermore, individual coalition members varied in their responses to certain questions, which indicated differences in preferences within coalitions. For example, Coalition A answers to the question pertaining to wildlife habitat and biological diversity ranged from "least important" to "most important." Similarly, Coalition B answers to the question pertaining to maintaining fishing in the watershed ranged from "least important" to "most important." These variations in responses to specific questions indicate a diversity of individual preferences for the most and least important watershed services to maintain in the Nisqually Watershed.

The survey results also indicated differences in preferences and levels of agreement in response to specific questions among stakeholder organizations. The most significant of these were differences in preferences for watershed goods and services. Specifically, wildlife habitat and biological diversity was ranked as most important on average by State, Federal, or Tribal agencies whereas conservation non-profit organizations gave it a mid-level (3.5) of importance relative to the other watershed goods and services with consideration to limited available resources to protect these

services in the Nisqually Watershed. This result reflects the initial decision based on stakeholder discussions to focus on watershed services such as the provision of drinking water rather than biodiversity for the pilot PES program in the Nisqually Watershed. There were also differences between organizations regarding beliefs about causes as well as potential solutions to problems for watershed services (Figure 8 and Figure 9). These results indicate that there are variations in beliefs and preferences among stakeholder organizations in addition to the differences between and within coalitions.

The level of agreement for this type of incentive-based approach to conserving forest cover and protecting watershed services was reported in the interviews as being high in terms of overall goals as well as the basic concepts of Payments for Ecosystem Services (PES) programs. The survey results also indicated a high level of agreement around stakeholder beliefs and attitudes in the Nisqually Watershed and the need to spend money and public funds to conserve watershed services for future generations. The combination of these results reflects the high level of collaboration and partnerships among diverse organizations that have been involved in the pilot project and the history of collaborative watershed management in the Nisqually Watershed.

However, results from the interviews also indicated that regulatory agencies in Washington State may be reluctant to accept market-based conservation methods if they believe these programs could undermine their authority or ability to take action on forest practices or water quality issues. This represents a possible barrier to PES programs in Washington State. If the current institutional structures and mechanisms are not fully supportive of incentive-based programs such as this it will be very challenging to get the programs implemented on a larger regional or statewide scale.

The combination of the interview responses and survey results also indicated that the primary areas of potential conflict or differentiated beliefs between coalitions were related to the preference of regulatory versus market-based approaches to conservation. Coalition 1, which consisted of the majority of survey respondents (38), shared the common belief that problems for watershed services need immediate action using the best available science and a combination of regulations with market-based incentives. On the other hand, Coalition 2 shared the common belief that regulations are not the preferred solution and that providing financial incentives to private landowners for conservation and stewardship practices is a good way to address problems for watershed services.

This divergence in beliefs regarding the preference of regulatory versus market-based approaches to conservation was explored further through follow-up questions. One interviewee elaborated on the underlying schools of thought that result in preferences for certain policy tools. This interviewee highlighted the contrast between stakeholders that favor more command-and-control (top-down) regulatory methods and ones that favor more incentive and market-based solutions "that make better use of human nature and human motivational tendencies" (Craig Partridge). This interviewee also pointed out that there is another divergence in preferences between the people who are more concerned about "upstream" outcomes (sellers) of producing the services (forest retention) and those that are focused on the "downstream" water resource outcomes (buyers) and that are usually accountable for the provision of those ecosystem services (i.e. drinking water utilities). This interviewee's insights on stakeholder dynamics explained that when combined, those differences between policy tool and outcome preferences can manifest as skepticism towards PES programs. Specifically, the buyers may be reluctant to invest

in ecosystem services because not only do they have regulatory requirements to uphold but they often have full accountability to their rate payers to justify spending money in certain ways. Furthermore, it could be very difficult to raise support for a water utility rate increase or justify new ways of spending public funds. Interview and survey results indicated that these factors and divergent beliefs and preferences surrounding regulatory and policy tools may have influenced the outcomes of this pilot project and the lack of a successful watershed services transaction within the projects timeframe.

An important result of the interviews was the indication that natural resource managers and key stakeholders in this project believe that upcoming scientific developments may suggest that forest practices and regulations need to be changed to better protect watershed services. However, interviewees also believed that action on environmental issues cannot wait for more scientific justification or for the lengthy process of adapting regulations. This is where incentive-based methods that strive for better environmental protection and stewardship are seen to have the potential to be complimentary to regulatory methods. PES programs have the potential to fill the gap between new scientific findings and subsequent adaptation of management practices.

Furthermore, the primary challenge to PES programs identified through this case study of the Nisqually pilot project was predominantly issues with the limitations of science related to ecosystem service valuation. Two-thirds (8 out of 12) of the interviewees discussed that scientific information is critical to validate the market-based methods of PES programs but that it is difficult to value ecosystem services and measure additional benefits obtained through certain forestry practices. These limitations of economic valuation have been show in the literature, primarily that there is not enough

scientific understanding and data on the cause-effect relationships between ecosystem functions and the goods and services produced for markets (Chee, 2004; Daily et al., 2000). These concerns were stressed by the interviewee's beliefs that it is necessary to take action now, with the best available science, to conserve forested ecosystems before environmental degradation increases.

The interview results also indicated an opposition between different stakeholder's preferences for the timing of public outreach and broader communication strategies. Although this topic was not covered in the surveys to determine if potential coalitions may be forming around these divergent beliefs, it is an important consideration for PES program development. Communicating PES concepts and benefits to the general public and decision-makers was considered crucial by two-thirds of the interviewees. However, the timing of this communication with the broader public was an area of divergence in beliefs between respondents. Specifically, three interviewees believed that it was too early to involve the public and that a successful PES pilot project was needed as an example for an effective communication campaign. On the other hand, four interviewees believed that more public outreach, awareness, and support were needed in order for the pilot project to be successful in the first place.

The differences in opinions with regards to the timing of public outreach indicate different individual preferences as well as possible stakeholder coalitions growing around these divergent beliefs. The ACF literature suggests that coalitions communicate information strategically and that in collaborative policy subsystems, scientific information is most likely to be used instrumentally for policy-oriented learning rather than politically to prove a point, as in adversarial subsystems (Weible, 2008). However, if

there is not a clear story to tell (or in this case a successful watershed services transaction to point to) coalitions with a strategic objective may be reluctant to use new information to raise public support primarily because of the uncertainty of how it will be perceived and utilized. This may explain the reluctance of several stakeholders to communicate with the public about PES programs and the pilot project before it is completed and considered successful.

Positive lessons from the pilot project and future directions for these kinds of PES programs were discussed in the interviews of key stakeholders. Although interviewees disagreed on the timing of public outreach, they agreed that the next step will need to include mounting a good communication campaign to raise awareness and support for future PES programs. The interviewees discussed the need to clearly communicate the underlying concepts of PES programs to the public and convince decision-makers of the investment opportunity in natural capital and proactive conservation measures. This agreement on public outreach being important for the further development of PES programs indicates that the differences in beliefs surrounding timing of communication demonstrates individual preferences rather than policy core beliefs around which future coalitions may form. However, this divergence in preferences for specific actions may have influenced the outcomes of the pilot project. One-third of the interviewees shared the belief that the pilot project may have been more successful if there had been more initial public outreach and support.

As collaborative watershed management and creative conservation mechanisms such as PES programs continue to evolve in Washington State, coalitions of Nisqually Watershed stakeholders may form around shared values similar to the ones identified by

this study. However, there are other factors that influence stakeholder values and the structure of coalitions that were not discussed in the scope of this study. Coalitions and the values of stakeholders are also influenced by available resources (i.e. finances) and political windows of opportunity as well as the coalition's ability to coordinate over time (Weible & Sabatier, 2009). The coalitions identified in this study are not necessarily groups of people that know each other. However, because of the specific subject and limited geographical scope, it is likely that many of the stakeholders involved in this study do know each other and have the potential to collaborate effectively over time to accomplish long-term goals. Nevertheless, this study does not suggest that these specific individuals (or the organizations they represent) will form coalitions; rather it is formulated as a means to identify shared values. Understanding the extent of stakeholder value systems provides watershed managers a method to develop more effective communication and outreach strategies that are targeted to the values and beliefs of specific individuals or organizations.

Chapter 6: Conclusions

This exploratory study reveals that the Nisqually Watershed stakeholder community is much more complex than one might expect, and that assumptions about stakeholder beliefs are likely incorrect or inadequate. The amount of diversity that was found in individual preferences and coalitions with members from a wide variety of organizations necessitates that watershed mangers not only understand stakeholder beliefs but also have clear and explicit communication. Understanding potential coalitions provides a useful tool for watershed managers, enabling them to tailor communication and outreach strategies to a specific stakeholder audience for increased efficacy. Watershed managers can use information about the different beliefs and values of potential coalitions to develop specialized outreach materials. For example, this study revealed a potential coalition that preferred to maintain and protect all watershed services equally. A focus on overall watershed protection with this group may be sufficient for outreach. However, for the potential coalition that favored the protection of water resources it would be more effective to focus on those specific watershed services for outreach and communication. Another example is the potential coalition whose members did not think regulatory methods were the best way to protect watershed services. Outreach to these individuals and other stakeholders whose values align with this group would be more effective if it focused on voluntary and incentive-based conservation methods.

Furthermore, understanding potential coalitions provides watershed managers and conservation programs with a tool to determine if they are involving the multiplicity of stakeholders in planning and outreach efforts. If they are simply involving stakeholders

based on geographical location or organizational affiliation, the diversity of values and beliefs may not be fully represented. By considering potential coalitions as well as location and category a more representative group can be reached. Moreover, this method can be used to form community groups or advisory committees that include all the potential coalitions and stakeholder belief systems as well as categories by organization and location. These potential coalitions can be determined using survey and interview materials similar to the ones in this study. In this way, the range of stakeholder values is represented and watershed managers may avoid unexpected delays through lengthy appeals or costly litigation.

Results from this study and the history of cooperative watershed management in Washington State indicate that the pilot project is operating within a collaborative policy subsystem that is in the middle stages of forest and watershed conservation efforts. This is evidenced by the presence of consensus based institutional venues, the NW Environmental Forum that helped to facilitate learning among stakeholders, and joint-fact finding endeavors in the pilot project. These combined efforts strove to cultivate scientific information and learning opportunities to better inform decisions with regards to PES program development. However, the ACF literature suggests that, once fully formed, coalitions may become entrenched in their beliefs and opposition to alternative viewpoints will tend to increase. The unfortunate result of this is scientific information becomes a strategic weapon to support their arguments rather than leading to policy-oriented learning across coalitions (Weible & Sabatier, 2009). In this way, a collaborative policy subsystem might shift to an adversarial policy subsystem and coherent environmental policy making could break down in the process of people becoming

entrenched in their own beliefs and refusing to see alternative viewpoints. An adversarial policy subsystem with coalitions that have become entrenched in their opposing beliefs often results in a "hurting stalemate" (political gridlock that has negative results for everyone involved) and difficult negotiations must be made to change the status quo (Lipsky & Ryan, 2011).

Educating stakeholders and utilizing tailored outreach strategies at an early stage could prevent the formation of entrenched, antagonistic coalitions and avoid the shift to an adversarial subsystem. Thus, understanding potential coalitions not only provides managers with a tool to tailor communication to a specific audience, but it also allows for the opportunity to facilitate communication and learning among stakeholders with different values *before* they form entrenched coalitions (evidently this is the case in the mid-process of the Nisqually Watershed Services transaction efforts). Venues for joint-learning such as the NW Environmental Forum, workshops, the formation of community advisory groups, and tailored communication and public outreach may be effective methods to facilitate policy-oriented learning that properly utilizes scientific information, prevent coalitions from becoming entrenched in their beliefs, and maintain a collaborative policy subsystem.

The results of this study are consistent with the ongoing efforts to improve collaborative watershed management in Washington State. This is implemented through coordinated objectives among natural resource managers, conservation non-profits, non-governmental organizations, and other stakeholders, as well as the development of effective communication strategies. It is evident from the results of this study that there was a high level of collaboration among key stakeholders and organizations, which was

identified as being very critical to the pilot project. These highly involved stakeholder groups also represented a larger group of less involved stakeholders. However, the findings of this study revealed a lack of broader stakeholder and public outreach. For PES programs to be successful on a larger scale, local stakeholders and the more general public should be aware of and support these projects. Especially if the funding source, as proposed in this pilot project, will be public water utility companies then rate payers must understand the concepts of PES programs, why it is important to invest in natural capital, and support using public funds in such a way. Other important lessons from this study included the need for institutional structures and regulatory agencies to support the exploration of creative conservation mechanisms, and the advancement and clear communication of new scientific information to inform environmental policy and decision-making. Progress on any of these critical factors (communication and outreach, institutional support, and utilization of scientific information), combined with policy-oriented learning across coalitions, has the potential to increase collaboration, influence change within the policy subsystem, and lead to significant advancements in watershed management and the development of payments for ecosystem services programs in Washington State.

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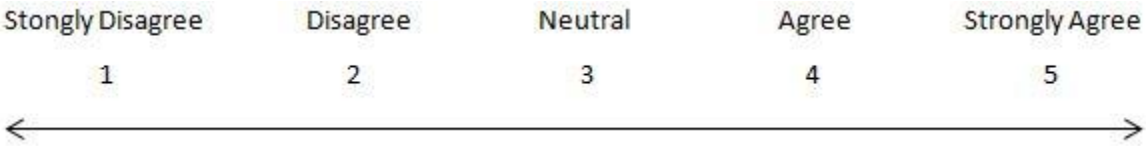
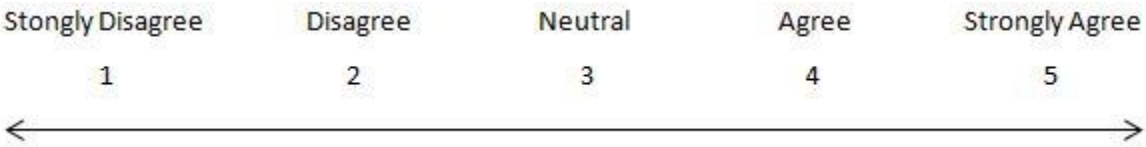
Appendix A

Survey Questionnaire

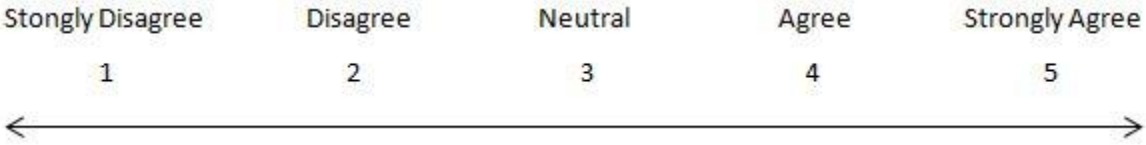
1) It is important to conserve watershed services for future generations



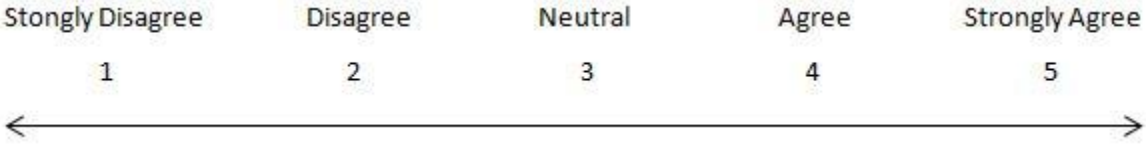
2) It is important to spend money and use public funds to conserve watershed services



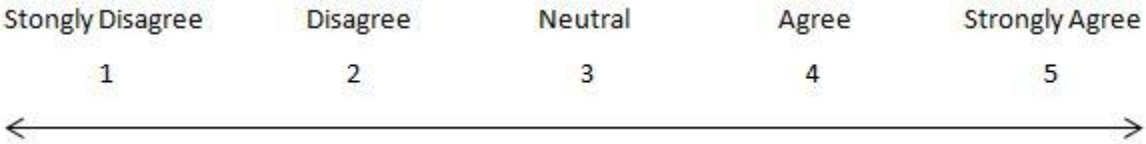
3) The quality of watershed services from the Nisqually watershed is high



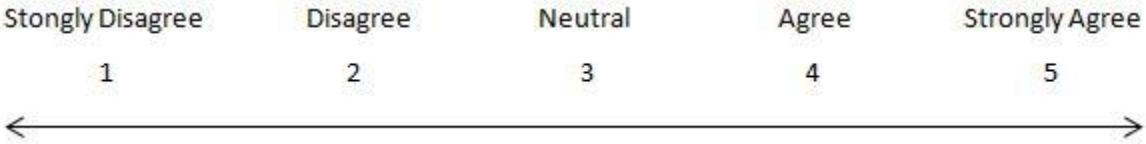
4) Pollution is a severe environmental problem for watershed services



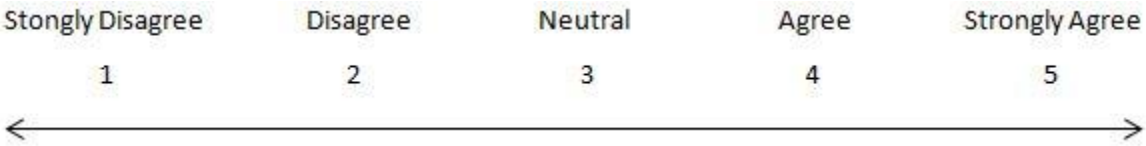
5) Increased impervious surfaces (e. g. pavement) is a severe environmental problem for watershed services



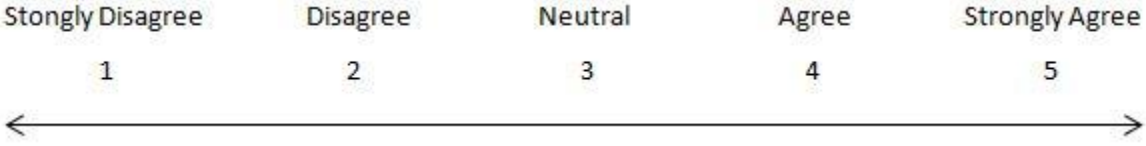
6) Fewer forested areas is a severe environmental problem for watershed services



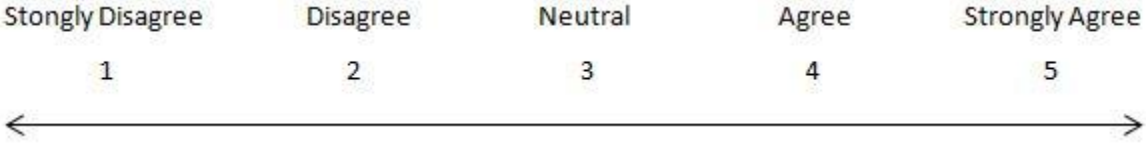
7) The accumulation of many individual actions (such as the use of lawn chemicals or littering) is a major cause of environmental problems for watershed services



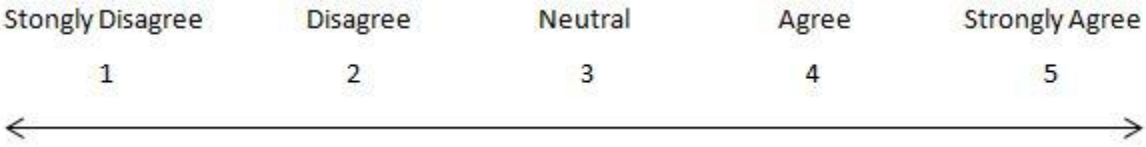
8) Land use decisions of private land owners are a major cause of environmental problems for watershed services



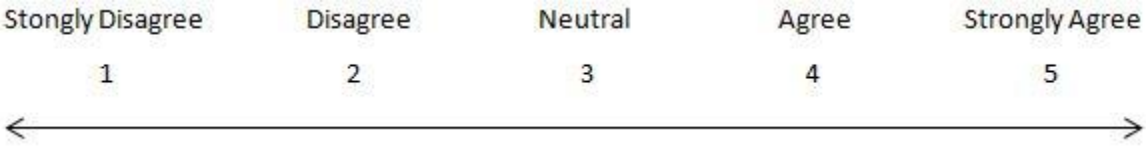
9) Natural resource management practices on public lands are a major cause of environmental problems for watershed services



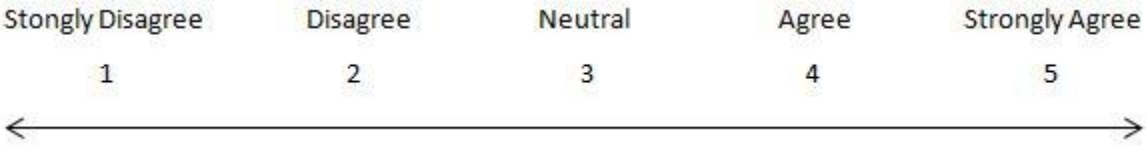
10) Natural resource management on private lands (e.g. logging and related erosion and sediment deposition) are a major cause of environmental problems for watershed services



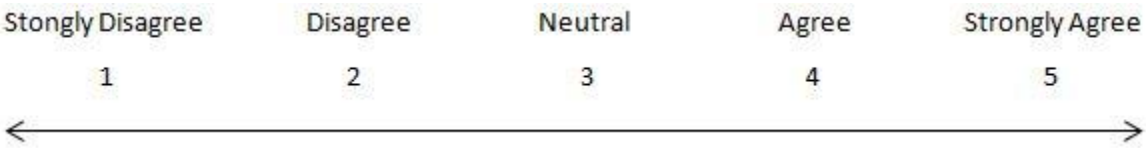
11) Farming practices and related nutrient inputs are a major cause of environmental problems for watershed services



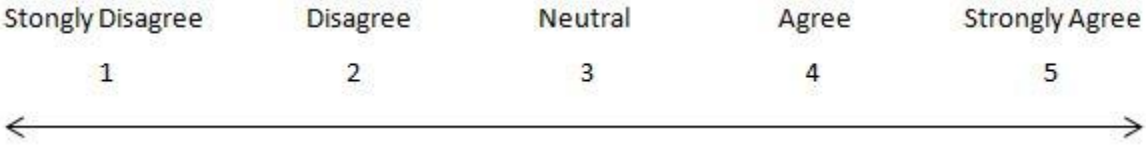
12) Human development (e. g. deforestation and conversion to housing) is a major cause of environmental problems for watershed services



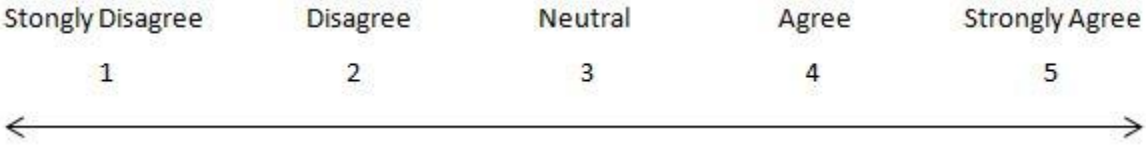
13) Stronger enforcement of existing regulations and/or stricter regulations are good ways to improve the environmental quality of watershed services



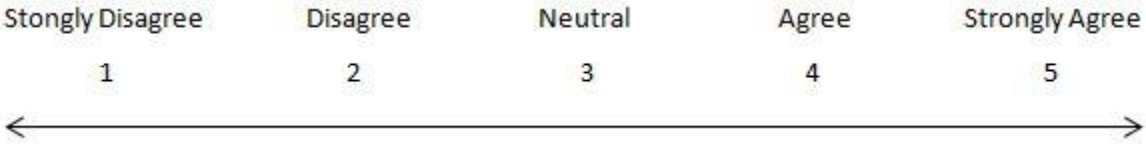
14) Increased public land ownership (i.e. government agencies) is a good way to improve the environmental quality of watershed services



15) Government guidance of land and natural resource use on private property through land rights and/or zoning is a good way to improve the environmental quality of watershed services



16) Providing financial incentives to private landowners for sustainable resource management and stewardship practices is a good way to improve the environmental quality of watershed services



For the next set of questions please rate what you think is the relative level of importance of each for the Nisqually Watershed. It is essential to keep in mind that there are limited resources available and that it may not be possible to protect all these watershed services equally.

17) It is important to maintain the traditional industry of logging in forested watersheds

18) It is important to maintain the traditional industry of fishing in watersheds

19) It is important to maintain the traditional industry of farming in watersheds

20) It is important to maintain the number of places for the public to engage in recreational activities in watersheds

21) It is important to maintain the quality and quantity of water resources from watersheds

22) It is important to maintain wildlife habitat and biological diversity in watersheds

Appendix B

Interview Questions

1) What are the main goals with maintaining and enhancing watershed services?

2) What role did scientific information play in the Nisqually pilot project?

3) What role did institutional mechanisms play in the Nisqually pilot project?

4) What role did stakeholder and public involvement play in the Nisqually pilot project?

5) Are there other critical factors involved in this project and what role did they play?

6) Who were the most influential players in the Nisqually pilot project and who should have been involved that was not?

7) Was there a specific type of stakeholder communication that either did or should in the future promote positive outcomes for watershed services?

8) Who did you primarily coordinate and exchange information with regarding the pilot project?

9) How would you describe the level of agreement on the efficacy and desirability of this kind of approach to achieving positive watershed outcomes? Are there particular entities that were relatively high or low in their level of support?

10) What were the main challenges and lessons with maintaining and enhancing watershed services in the Nisqually pilot project?