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SOCIAL JUSTICE IN SOCIAL-ECOLOGICAL SYSTEMS: RESILIENCE THROUGH
STAKEHOLDER ENGAGEMENT

By

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Bachelor of Arts, University of Wisconsin, Madison, WI, 2008

Thesis

presented in partial fulfillment of the requirements
for the degree of

Master of Science
Systems Ecology

The University of Montana
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May 2017

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Social justice in social-ecological systems: resilience through stakeholder engagement

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Successful management of social-ecological systems (SES) is predicated on quality collaborative exchanges between project stakeholders and management. The Southwest Crown of the Continent Collaborative (SWCC) Collaborative Forest Landscape Restoration Program (CFLRP) provided an opportunity to explore landscape scale collaborative management and SES outcomes. Global change and future uncertainty of landscapes prompted the SWCC to employ restoration treatment alternatives throughout 1.4 million acres of forests, most of which are publicly held. The SWCC currently monitors environmental and economic variables, with plans to monitor social variables. This thesis formalizes a proposed framework to investigate SES resilience, and explores public engagement as an SES process in the SWCC landscape with recommendations for management improvements to bolster positive outcomes. Chapter two explores public engagement using a social justice theoretical lens, and is a stand-alone manuscript submitted to *Society and Natural Resources* (accepted with minor revisions on 3/26/2017). Public engagement is important for improving outcomes of social-ecological systems management. This manuscript reports on a study linking residents' attitudes toward public engagement processes to their overall satisfaction with outcomes of a restoration project in Western Montana. We hypothesized that engagement efforts must incorporate both the process control (PC) and decision control (DC) dimensions of procedural justice because DC directly affects stakeholder satisfaction while PC affects stakeholder satisfaction both directly and indirectly through DC. We tested these predictions using a path analysis of intercept survey data collected from residents within the project area. We found process control had a significant and positive effect on satisfaction, but was fully mediated by decision control, suggesting successful engagement requires opportunities for stakeholders to not only participate, but to clearly shape decisions and outcomes. We discuss implications for public engagement, human dimensions research, and social monitoring of social-ecological systems. I conclude by exploring extant SES frameworks and provide suggestions for potential changes to SWCC management, as well as suggestions to improve social monitoring. Among the myriad recommendations provided to improve SES outcomes, improved engagement processes hold primacy; the quality of engagement directly affects stakeholder satisfaction, and may bolster support. Further research questions are raised, which might expand knowledge of how engagement affects support for restoration treatment alternatives.

Acknowledgements

To begin, I would like to express my deepest thanks to my advisor, Dr. Alexander L. Metcalf for his steadfast commitment to my success, and his ever-present advocacy on my behalf. Without his guidance, patience, and perseverance, this thesis may have never been possible. From our first exchanges separated by thousands of miles, and multiple time zones, to a multitude of face-to-face interactions, I have grown immensely under his mentorship.

I would also like to thank the other members of my committee: Dr. Maurice H. Valett, Dr. Daniel T. Spencer, and Cory Davis, for their expertise, feedback, and myriad lessons, which I believe have made me a stronger researcher and better person. Their direct, and frank feedback was critical to my success.

I would like to thank Dr. Jakki Mohr, and Dr. Elizabeth Covelli-Metcalf, and Dr. Alexander L. Metcalf for their time and expertise in co-authoring the manuscript in this thesis. In addition to challenging me in my own writing, they introduced me to numerous new bodies of research and helped me understand the greater systemic connections to my own. I would also like to thank Ryan Barr for his help in collecting the data that ultimately informed our manuscript.

Additionally, I would like to thank Dr. John Goodburn, Dr. Ron Wakimoto, and Dr. Jon Graham for helping me understand forest science and statistics despite my paucity of experience. I learned a great deal about not only silviculture and statistics, but life, and owe a debt of gratitude to them for their assistance and instruction.

My deepest thanks go out to the University of Montana, the Department of Society and Conservation, the Southwestern Crown Collaborative, the Montana Institute on Ecosystems, and Montana NSF EPSCoR program for offering me the many opportunities and multiple projects with which to explore my research questions.

I thank all of the members of the Applied Forest Management Program for allowing me to proselytize my social science views during many hours of forest research, and for their support during the summer months. In particular, Justin Crotteau, as a true friend and companion, encouraged me throughout my journey.

I would like to thank my cohort in at the W.A. Franke College of Forestry and Conservation, department of Society and Conservation, and my colleagues in the Systems Ecology program and beyond for their endless engagement, and incredible insights. The students and professors of the Human Dimensions lab offered countless opportunities to improve my understanding of the complex landscapes of social science. Among my classmates, I would like to acknowledge Peter Ore, Zach Miller, Shefije Miftari, Mikky Helman, Lara Brenner, Alice Lubeck, Dylan DesRosier and Colin Maher for their help throughout my thesis and my defense.

Finally, I would like to extend my deepest appreciation to my family: my wife Chihiro Lauer, and son Hugo Lauer. Without their support, I would not have graduated. Chihiro traveled from Japan to live and work in Montana, and her strength encourages me every day in my own endeavors. My son's constant, gregarious, and positive approach to the world is my anodyne to many a trial. Words cannot express my gratitude for the sacrifices both have made for me; I am forever in their debt.

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Executive Summary

Unprecedented, and ongoing global change, is resulting in increasing levels of uncertainty about the future environment, which necessitates innovative, collaborative approaches to social-ecological systems management. Key to this endeavor is the idea of resilience, or “the capacity of a system, be it an individual, a forest, a city or an economy, to deal with change and continue to develop. It is about how humans and nature can use shocks and disturbances like a financial crisis or climate change to spur renewal and innovative thinking.” (Stockholm Resilience Centre 2015).

This thesis explores the social-ecological systems’ resilience to global change by 1) introducing a theoretical framework used as a lens to drive research, 2) exploring hypotheses in the context of a Collaborative Forest Landscape Restoration Program (CFLRP), 3) investigating social justice constructs and their applicability to collaborative-adaptive management frameworks through a manuscript to be published in a peer-reviewed journal, and 4) using results from that manuscript to inform future collaborative efforts including, but not limited to the CFLRP that was studied.

Chapter one introduces social-ecological systems resilience and the need for collaborative efforts to bolster it. Work with the Southwest Crown of the Continent (SWCC) CFLRP provided an opportunity to craft a systems model, and explore extant theoretical frameworks to be operationalized in a social survey monitoring tool. The socioeconomic monitoring group had and continues to struggle with approval from the Office of Management and Budget for approval to collect data to inform the systems model found in this text, which necessitated exploring other research opportunities to collect data.

An opportunity to explore a piece of the systems model in a different context provided the means to collect data to inform the manuscript of chapter two and the collaborative efforts of the SWCC and beyond. Thus, chapter two explores an actionable part of the systems diagram introduced in chapter one: engagement. The quality of engagement is looked at through the theory of social justice. Chapter two concludes with a discussion about the applicability of built measures toward future social monitoring efforts.

Chapter three concludes this thesis by broadening the discussion of results from chapter two and explicitly looks at their usefulness for the SWCC. Chapter three provides suggestions for future changes in collaborative efforts, as well as future research, which has the potential to further increase the efficacy of collaborative efforts. Emphasis is placed on a need to incorporate social monitoring into collaborative efforts, and the tools developed in chapter two are suggested as a positive addition to existing monitoring frameworks.

Chapter 1

Resilience of social-ecological systems (SES) is becoming an increasingly important subject as humans encroach on thresholds to the stability of our planet (Young et al. 2006). Human perturbations have destabilized the earth's systems, impacting genetic diversity and biochemical flows while creating ever growing uncertainties and risks associated with climate change and land-system change (Steffen et al. 2015). Global initiatives to combat these uncertainties include large-scale multi-governmental programs such as the Millennium Ecosystem Assessment, which assess the consequences of ecosystem changes and provide frameworks for global change (Reid et al. 2005). Regional programs, such as the US Forest Service's Collaborative Forest Landscape Restoration Program (CFLRP) in the United States, seek to restore resilience to local ecosystems through collaborative management networks which engage diverse stakeholders (Schultz et al. 2012).

Myriad factors contribute to SES resilience, and among them participatory approaches to management are critical to the resilience of SES (Walker et al. 2002). Biggs et al. (2015) acknowledge that participation can "play a role in supporting transparency, knowledge sharing, trust building, the legitimacy of decisions, and learning," all of which are important to SES resilience (Biggs et al. 2015; 201). Processes that encourage participation between managers and stakeholders in SES, and which allow for cycles of learning, help leverage the collective diversity of viewpoints and expertise toward shared understanding (Lebel et al. 2006; Walker et al. 2002). Polycentric governance frameworks like adaptive co-management can use stakeholder diversity and participation to encourage the learning and knowledge creation that is critical to the

resilience of SES (Biggs et al. 2015; Armitage et al. 2009). Through participation in adaptive co-management frameworks, stakeholders come to understand the inevitability of incomplete knowledge regarding the outcomes of management alternatives, which may make them more likely to accept alternative outcomes (Walker et al. 2002). Furthermore, participation increases knowledge by strengthening stakeholders' systemic understanding of myriad SES variables, changing how they see systems (Biggs et al. 2015; Armitage et al. 2009). While the importance of participation is well known generally, the specific pathways and necessary mechanisms that differentiate "good" from "poor" participation require further research.

This study investigates public participation dynamics in a landscape-scale riparian restoration project. Specifically, I use a social justice framework to understand how distinct domains of public perceptions regarding engagement processes relate to positive social outcomes. The thesis is organized in the following manner: Chapter One reviews the social monitoring effort of the Southwestern Crown Collaborative (SWCC) including the relevant constructs identified by the Collaborative; important research questions, and hypotheses I think are relevant to the SWCC work; predictions and suggested analyses. Chapter One also details survey approval struggles with the General Accounting Office, Office of Management and Budget (OMB) which has thus far precluded human dimensions data collection by the Collaborative. Chapter One concludes with an introduction of a new study context, the Clark Fork River, where I was able to explore limited, but important aspects of the research questions relevant to the Collaborative, including essential elements of public engagement processes for realizing positive SES management outcomes. Chapter Two introduces an application of social justice theory to

an environmental management context, and is a stand-alone manuscript which has been submitted for review to *Society and Natural Resources* (accepted with minor revisions on 3/26/2017). In this manuscript I further detail the new study context introduced in the first chapter, and use path analyses to investigate relationships between engagement mechanisms and positive SES management outcomes. Chapter Three relates these findings to SWCC and CFLRP management and proposes future direction for the Collaborative's social monitoring program.

COLLABORATIVE MANAGEMENT IN THE SOUTHWESTERN CROWN OF THE CONTINENT

Adaptively managed SES consist of a web of actions and outcomes built on collaborative problem assessment and shared stakeholder agreements on goals for social-ecological outcomes. Collaborative decision making structures can improve social outcomes as well as improve decision structures which advance ecological outcomes. Similarly, social outcomes are enhanced by ecological successes in many ways, particularly through improved ecosystem services. Management improvements feed back into restoration successes serving to further improve both social and ecological success. A better understanding of the human dimensions that impart SES resilience is necessary to properly adjust management cycles for future sustainability. The SWCC, a collaborative group working on a landscape scale restoration project involving multiple watersheds and communities, offers a compelling opportunity to explore the tapestry of variables that influence social and ecological outcomes. The social monitoring effort, employed in the SWCC, provided a unique opportunity to understand social dynamics related to SES resilience.

The SWCC CFLRP involves landscape scale forest, aquatic, and wildlife restoration treatments over 1.4 million acres, 70 percent of which is public land, to support a sustainable landscape and provide ecosystem services which improve economic and social conditions (SWCC 2010a). Restoration plans extend from 2010 through 2019. The goals of the program are to reduce the risk of uncharacteristic wildfire, maintain, decommission, or rehabilitate forest roads and water resources, improve fish and wildlife habitat, plan for future forest sustainability, improve watershed health, and maximize the productive use of forest products where appropriate (SWCC 2010a). The SWCC is committed to extensive monitoring of ecological, social, and economic impacts of restoration efforts, including relationships among these variables. To date, efforts have been made to monitor the ecological and economic impacts of restoration treatments, however, relatively little attention has been paid to human dimensions critical to adaptive management. The success of human and biophysical outcomes in SES may be tied to adaptive management decision structures as well as the involvement and cooperation of myriad stakeholders.

This study examines the human dimensions of SES management using an intercept survey of residents living in a restoration project area. Specifically, I assess how the quality of stakeholder engagement influences stakeholder satisfaction. A deeper understanding of the human dimensions that drive SES outcomes will improve CFLRP adaptive management processes by helping managers understand the interactions between social and biophysical variables. A better understanding of SES dynamics will also nurture resilience of sustainable systems by reducing doubt and highlighting interactions and feedbacks among biophysical and human dimensions.

BACKGROUND/CONTEXT

The CFLRP was created as part of the US Government's Forest Landscape Restoration Act in 2009 (Title IV of the Omnibus Public Land Management Act of 2009). One of the main purposes of this Act was to encourage ecological, economic, and social sustainability. Landscapes designated as CFLRP projects were to receive additional funding to achieve restoration goals through the US Forest Service (USFS) provided they met specific criteria. The requirements included complete or substantially complete restoration strategies which serviced areas of at least 50,000 acres comprised primarily of forested National Forest System Land; project areas could include Bureau of Land Management (BLM) lands or those under Bureau of Indian Affairs, other Federal, State, Tribal or even private control. Lands to be restored had to be done so through projects that were both socially sound (i.e. collaborative administration) and economically viable (e.g. local jobs, resource extraction; Omnibus Public Land Management Act of 2009). More detailed requirements were included in the Act and generally reflected the specific goals of CFLRPs to promote ecological, economic, and social sustainability initiatives. The Act also requires ecological, social, and economic monitoring of restoration outcomes.

The Act focused on priority landscapes, as determined through a highly competitive process (Schultz et al. 2012). Ten priority landscapes were initially selected as part of the first round of CFLRPs to be implemented on the landscape of the United States. They included the: Selway-Middle Fork Clearwater (ID), Southwestern Crown of the Continent (MT), Colorado Front Range (CO), Uncompahgre Plateau (CO), 4FRI

(AZ), Southwest Jemez Mountains (NM), Dinkey Landscape Restoration (CA), Deschutes Skyline (OR), Tapash Sustainable Forest Collaborative (WA), and Accelerating Longleaf Pine Restoration (FL and GA) (Schultz et al. 2012). Restoration efforts varied in landscape size with project areas ranging from 130,000 acres (Deschutes Skyline) up to 2.4 million acres (4FRI). All but two programs received 100 percent of funds requested for 2010 (Schultz et al. 2012). All the projects contained at least 70 percent public lands.

CFLRP AREA OF INTEREST

The SWCC landscape is situated in the southwestern sub-region of the Crown of the Continent, and consists of the Blackfoot, Clearwater, and Swan watersheds (SWCC 2010a). The landscape is a series of valleys surrounded by mountains and contains a number of small communities including Condon, Seeley Lake, Greenough, Ovando, and Lincoln. The communities within the SWCC project area have a combined approximate population of 9,000 residents in low density. The area is home to vast forests, rivers, and diverse wildlife.

Restoration projects that prioritize a wide range of economic and ecological objectives have been implemented since the program's inception (SWCC 2010a). The SWCC provides a unique opportunity to measure the effect restoration has on the landscape and its broader impacts on local communities. The SWCC project directly involves and influences the livelihoods of residents across the project area. Many local businesses are reliant on forest resources from the surrounding landscape including timber and other wood products (SWCC 2010a). The SWCC adds new dimensions to the

economic landscape of the communities by providing new opportunities in restoration projects (SWCC 2010a). Cleaner air and water benefit the health of local communities. Access to healthier ecosystems, both aquatic and terrestrial, improve recreation for all users. Improved understanding from social interactions gained from SWCC community engagement will empower stakeholders and prepare communities for uncertain futures.

A number of ecological and socioeconomic problems challenge the area.

Ecological issues include the reintroduction of fire to heavily managed forest systems and removal of noxious and invasive plants both terrestrial and aquatic (SWCC 2010a).

Socioeconomic pressures have manifested as declines in timber markets which negatively affected employment rates in the surrounding communities. These rural communities also face a number of future challenges in the face of climate change including predicted decreases in water availability and increases in fire severity (SWCC 2010a). Of course, social and ecological systems are inherently linked, making it critical to understand how social dimensions, such as communities' and individual actors' perceptions regarding management, reinforce the sustainability of the entire SES.

This study seeks to understand components of stakeholder engagement that bolster SES resilience by exploring how interactions between management and individual residents affect SES outcomes. We seek to help the SWCC adapt management in ways that embrace the social dynamics at play within the landscape, thus increasing the resilience of sustainable human communities and functional ecosystems. My analysis will benefit the future direction of the SWCC by elucidating how particular components of engagement processes can be operationalized to leverage positive collaborative SES

outcomes. Moreover, I believe these findings may be applicable to other collaborative ventures outside of the context of the SWCC and CFLRP program.

SOCIAL MONITORING EFFORTS

The SWCC has identified key categories for socioeconomic assessment within the project area through socioeconomic monitoring committee meetings and collaboration with Forest Service staff. Among the key components identified during committee meetings were: quality of life, healthy relationships with land managers, and the acceptability of project goals and implementation plans. The Collaborative related quality of life to job creation, recreation opportunities, aesthetics, a healthy environment including clean air and water, and public health and safety. Healthy relationships with land managers was used to capture trust in management, or why residents do or do not trust the Forest Service (particularly regarding the salience of management objectives), and opportunities for stakeholders to be heard and influence management decisions. Representation and discussions of engagement opportunities for stakeholders in the Collaborative emphasized the importance of residents and other concerned citizens having adequate opportunities to be involved; whether or not their perspectives were being heard; and how they preferred to be involved in management decisions (e.g., Smith and McDonough 2001). Overall, the Collaborative was interested in whether or not management objectives represented core values, were clearly communicated, and were being performed by trusted individuals (e.g., Davenport et al. 2007).

To inform these components of the SWCC's social monitoring charge, the Collaborative refined their information needs to include resident and stakeholder

perspectives on five areas: (1) Efficacy - perceptions of whether or not public land management had accomplished CFLRP goals, (2) Engagement - perceived feelings of involvement, (3) Core Values – perceived overlap in core environmental and place-based values between themselves, project managers, and decisions, (4) Trust - residents’ and stakeholders’ trust in land management agencies, and (5) Support - support among residents’ and stakeholders’ for restoration treatment types and locations. A more detailed explanation of each of these information needs follows.

Efficacy was defined as whether or not residents believe public land management is accomplishing specific CFLRP goals such as managing fire, restoring forest structure, maintaining and restoring forest roads and water, planning for future forest sustainability, improving watershed health, and maximizing the productive use of forest products where appropriate (SWCC 2010a). In relation to these goals, efficacy described whether residents perceive goals are being executed properly, including whether treatments are implemented in appropriate areas and using appropriate methods. Moreover, efficacy determines how important residents perceived these particular goals to be and whether they were priorities.

Engagement was defined in terms of perceptions of representation and opportunities for participation, not a quantification of meetings attended or the degree of participation in restoration efforts. Engagement explored how stakeholders feel regarding opportunities for involvement, whether or not they feel involved, and whether they feel their input shaped outcomes. An additional key information need was how stakeholders wanted to be engaged, whether through passive involvement or direct and active participation.

Core values characterized the values that stakeholders have and how commensal they are with management. Core values included utilitarian (anthropocentric), mutualist (biocentric), pluralist (seeking a balance between utilitarian and mutualistic views), and disconnected (i.e., no strong environmental value orientation) values (Steel et al. 1994; Vaske and Donnelly 1999; Winter et al. 2004). Additionally, it was clear place-related values, which measure how the importance and meaning of place influence attitudes about management, would prove important (Stedman 2002). These underlying values may inform preferences for management alternatives, engagement mechanisms, as well as dimensions of trust.

Trust focused on the confidence residents have regarding the Forest Service managers in their areas. Emphasis on the need to differentiate organization and local employees was highlighted in meetings to avoid generalizing resident perceptions. While some residents may be predisposed to distrust the Forest Service in general, it was recognized that local employees (regardless if they were employed by the USFS) may be more trusted due to their proximity and relationships with residents. Of greatest concern were questions such as how trust related to support and engagement.

The outcomes of this social monitoring effort aimed to provide quantitative measures of key human dimension variables to allow managers to measure change throughout CFLRP implementation and following project completion. Furthermore, it would enable analyses for investigating how support for proposed treatment alternatives is grounded in trust, engagement, and perceptions of efficacy. Social monitoring and the analysis of human dimensions was envisioned to provide necessary inputs to the adaptive management cycles, thus increasing resilience of the SES.

These five categories of information needs constitute the entirety of the SWCC social monitoring effort. My study will be couched within this effort, focusing on a subset of variables and the relationships among them. Specifically, my study will focus on residents¹ and explore: (1) to what degree residents believe they had control over engagement processes, (2) whether residents believe they were able to influence decisions (3) how residents' perceptions of their control over processes and influence over decisions affect their satisfaction with engagement. I focus my analysis on the above inquiries by applying social justice theory toward natural resource engagement with a quantitative survey instrument and a path analysis.

RESEARCH FRAMEWORK

Resilience

SES are composed of societal (human) and ecological (biophysical) elements (Gallopín 1994). Research suggests there is a critical necessity to understand how SES function as biophysical and human dimensions are inherently linked and dependent upon one another (Young et al. 2006). Globalization and human expansion have left few landscapes untouched by society (Moberg and Simonsen 2014). As such, flexible management scenarios, such as adaptive management, are increasingly used to create sustainability through resilience and the capacity to adapt to change (Folke et al. 2005; Williams et al. 2009). Adaptive co-management² is a useful tool in SES because of inevitable spatial and temporal changes which require flexible management strategies to

¹ Stakeholder NGOs and groups will be studied in a parallel, but subsequent effort.

² Olsson et al. (2004) summarize adaptive co-management as "a process by which institutional arrangements and ecological knowledge are tested and revised in a dynamic, ongoing, self-organized process of learning-by-doing" (Olsson et al. 2004, 83).

properly address the complex of linkages between social and biophysical domains (Liu et al. 2007).

Nurturing SES resilience requires adaptive approaches (Walker et al. 2002; Young et al. 2006). Ecological and social resilience are often linked in complex resource dependency paradigms which intertwine ecological, economic, and social systems (Adger 2000). SES Resilience is critical because it defends against unexpected changes which could change the system to a qualitatively different state (Holling 2001). SES resilience is greatly dependent on the collaboration of myriad stakeholders (Folke 2006). Managers in adaptive management systems play a critical role in SES resilience by providing, “trust, vision and meaning” to social systems (Folke 2006:262). These adaptive management systems are critical pathways for building knowledge, incorporating ecological knowledge into management, supporting systems that allow for flexibility to weather change, and fostering the ability to manage exogenous influences that may threaten social system’s resilience (Folke et al. 2005). Links within human communities are built on trust, reciprocity, common rules, norms and sanctions, and connectedness in institutions (Pretty and Ward 2001). Functioning relationships between community members and their ability to create trust make these relationships critical components of resilient SESs (Folke et al. 2005).

Trust

Trust (and its related domains) is an important component to SES resilience focused adaptive management as it streamlines communication and reduces doubt in management decisions (Pretty and Ward 2001; Beratan 2007; Berkes 2009; Fernandez-

Gimenez et al. 2008). Stern and Coleman identified four domains of trust: rational, affinitive, procedural, and dispositional (Stern and Coleman 2014). Rational trust is based on perceived past performance and efficacy of agencies; performance on past projects reflects a person's or agency's ability to achieve desired outcomes; have they been good to their word in the past? Affinitive trust is based on whether people believe agencies or other individuals share their core values. Procedural trust is trust built upon the idea that an individual/agency will be forced to perform in a particular way due to some constraint or rule. Dispositional trust characterizes the intrinsic trust people hold with regards to others – the intangible feelings of trust that may not be logical and/or based on non-verbal or subtle interactions. Other domains of trust have been identified as ability, integrity, benevolence, shared values, technical competency, and moral competency (Mayer et al. 1995; Smith et al. 2013).

Building trust is an important part of managing for SES resilience. Trust creates well-functioning institutions by reducing the cognitive burden placed on decisions; stakeholders are more willing to allow decisions to be made without constantly being involved in every aspect of the decision-making process (Pretty and Ward 2001). However, trust takes time to build, is ephemeral, and is easily broken (Pretty and Ward 2001). Trust is multidimensional and connected not only to intrinsic biases, but to perceptions of whether projects will be successful, whether they have been successful in the past, and whether they are linked to core values and norms (Stern and Coleman 2014). Trust helps reduce doubts and is often born of collaborative approaches to management (Beratan 2007; Berkes 2009; Fernandez-Gimenez et al. 2008). When communication breaks down and participants are less involved, trust can be lost

(Maynard 2013). As such, managers have been encouraged to focus on the quality of their communication and interactions with participants in collaborative projects (Druschke and Hychka 2015).

Core Values

Trust in management is built through incorporating core values and knowledge into management (Davenport et al. 2007). Conflicting core values between managers and stakeholders in particular have been shown to be problematic in building trust in management of natural resources (Stern and Coleman 2014; Davenport et al. 2007). Shared core values have been found to be one of the most important predictors of trust (Stern and Coleman 2014; Liljeblad et al. 2009). Quantitative measurements of trust have found it to be highly correlated with shared core values (Cvetkovich and Winter 2003; Davenport et al. 2007), however, trust is voluntary and often built on perceptions of efficacy related to procedural and rational domains of trust (Stern and Coleman 2014; Liljeblad et al. 2009).

Efficacy

Efficacy has been shown to be of great importance in the foundations of trust between residents and managers (Winter et al. 2004). Residents place importance on competency and ability to manage, concentrating on management track records of success (Winter et al. 2004). Past experiences with managers who are perceived to work against public interest negatively affected trust and efficacy (Winter et al. 2004). Efficacy is a combination of contributing factors including: previous experiences, competence,

effectiveness, uncertainty and reliability (Liljeblad et al. 2009). Furthermore, it has been shown that trust and efficacy play a significant role in determining future support particularly if residents perceive that a future treatment alternative will be implemented successfully (Vogt et al. 2005).

Engagement

Residents' engagement in natural resource decisions has shown to be a useful pathway to incorporate people's core values into ecosystem management projects (Smith et al. 1999). Engagement provides stakeholders a way to voice their opinions and inform decision-making (Lukensmeyer et al. 2011). Perceptions of fairness in decision making processes are also heavily influenced by engagement (Lauber 1999). Engagement may also increase perceptions of fairness by providing agency to participants during decision making processes (Colquitt and Rodell. 2015). Engagement empowers agencies, local governments, NGOs, and individual citizens to collaboratively determine the needs and desires of all parties (Smith et al. 1999). Engagement contributes to social exchanges and mutual understanding which helps communities cope with unanticipated changes by enhancing their ability to persist despite change (Reed et al. 2010). Engagement may manifest in different ways including online, face-to-face interactions, or formal public forums and may fall along a continuum from simply informed to fully empowered in decision making processes (Lukensmeyer et al. 2011). Subsequently, the quality of decisions in collaborative processes may be improved because of engagement as it takes into account myriad perspectives and values (Reed 2008).

In addition to improving the quality of decision making, it is also important that stakeholders feel involved in restoration activities, that their perspectives are represented, and that they have opportunities for engagement (in a way they prefer) even if they are not fully exercised. Often, feelings of exclusion preclude engagement in natural resource management projects (Méndez-López et al. 2014). Past work suggests that managers must make people feel their ideas are taken into account and that they are being heard (Smith et al. 1999). Feelings of engagement help rally support for management of ecosystems (Schultz et al. 2007). Regardless of how stakeholders are engaged, what is important is that participants feel they are being heard and that their opinions are taken into consideration during deliberations (Smith et al. 2001). An important component of engagement is the promise that contributions made by participants will work to change or influence future decisions and that all those involved listen to and learn from the engagement of others (Lukensmeyer et al. 2011). Moreover, feeling engaged and involved in restoration projects has been shown to increase support of the projects themselves (Druschke and Hychka 2015).

Successful adaptive management requires trust and engagement to build SES resilience. As such, managers adopting this approach must also be cognizant of the core values that stakeholders have which influence trust, other domains of trust, engagement, efficacy, and support. Core values form the foundation of our beliefs which influence our attitudes, behavioral intentions, and ultimately our behavior (Vaske and Donnelly 1999).

Satisfaction

A potentially important indicator of successful restoration may be residents' satisfaction with past management. Satisfaction has been explored in a variety of fields

and contexts including outdoor recreation (i.e., satisfaction with recreation experiences) and business (i.e., customer satisfaction). I propose to borrow meaningful constructs from these fields to determine residents' satisfaction with past management. This study defines past management broadly to include efficacy, engagement, and relationships with managers. Research has shown satisfaction is often a precursor of stakeholder preferences and support for future or continued interaction with businesses (Cronin and Taylor 1992; Sivadas and Prewitt 2000); other research has shown trust to be an important antecedent of satisfaction (Geyskens et al. 1998). In this study, I believe satisfaction may be an important predictor of residents' support for proposed treatment alternatives.

ORIGINAL RESEARCH Question, Hypothesis, Predictions, and individual Path Analyses

Research Question

How do perceptions of individuals regarding government agencies or NGOs influence aspects of social-ecological resilience in the context of landscape restoration?

Hypotheses

H₁: Perceived overlap in core values between individuals and government agencies or NGOs drives social-ecological resilience because affinitive perceptions increase satisfaction both directly and indirectly through increased trust.

H₂: The extent of perceived efficacy regarding restoration outcomes drives social-ecological resilience because positive attitudes increase satisfaction both directly and indirectly through increased trust.

H3: The degree of engagement of individuals by government agencies or NGOs drives social-ecological resilience because positive attitudes increase satisfaction both indirectly via perceptions of social justice and indirectly through increased trust.

Predictions

1. Individuals who perceive more core values overlap between themselves and government agencies or NGOs will express more trust through the affinitive domain of trust.
2. Individuals who perceive higher project efficacy will have more satisfaction; there will be direct components of this relationship as well as those mediated through procedural and rational domains of trust.
3. Individuals who feel more engaged will have more satisfaction; components of social justice will mediate this relationship as well as those mediated through procedural and dispositional domains of trust.
4. Individuals with more trust will have more satisfaction.

SYSTEM MODEL

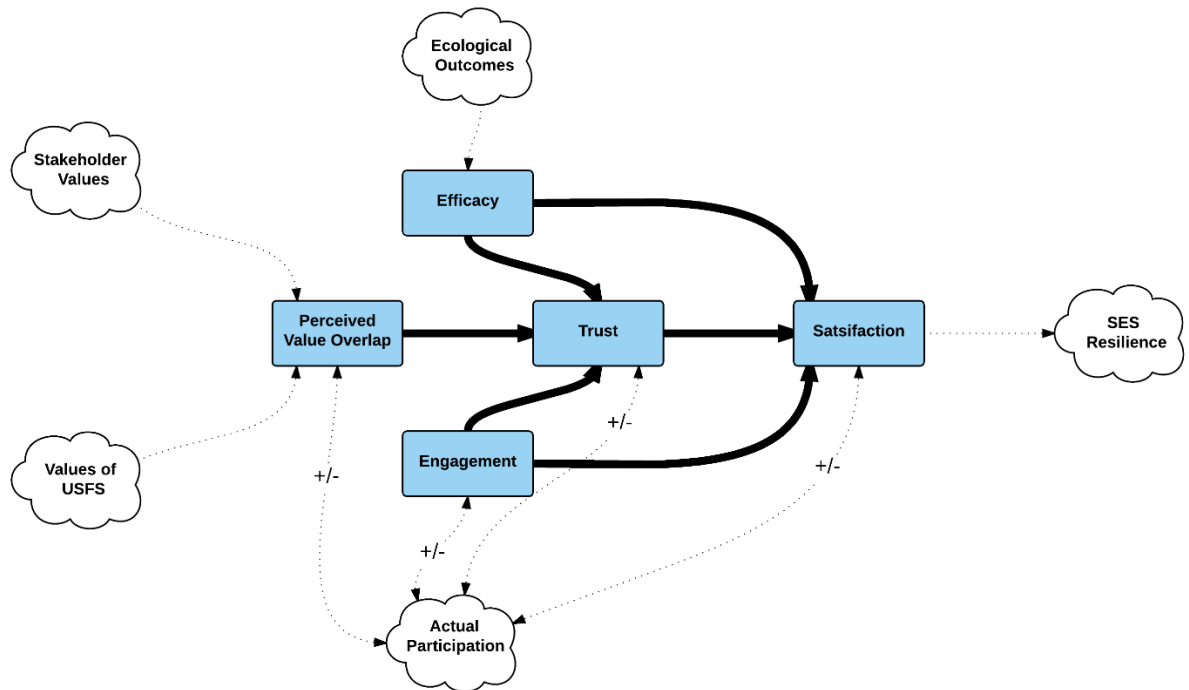


Figure 1: Conceptual model showing how residents' direct and indirect interactions with the restoration project, or with agency/NGO actors, may inform a number of attitudinal constructs (e.g., efficacy, engagement, trust, and perceived value overlap with managers). We hypothesize these constructs interact to influence satisfaction with project outcomes. Clouds and dashed lines represent constructs not directly measured by SWCC monitoring program. Blue boxes represent constructs to be monitored; solid arrows represent predicted directional relationships.

NEW STUDY AREA FOLLOWING OMB DELAYS

To generate data most useful to USFS managers, the SWCC pursued data collection approval through the Office of Management and Budget (OMB) – required for all new social science data collection conducted with agency oversight or involvement. With OMB approval for the socioeconomic monitoring tool (survey) to be employed in the SWCC landscape, the USFS could directly obtain data to inform future analyses as it saw fit. At the time of my thesis proposal, OMB approval was pending and a decision

was not expected before early or mid-2016. As of this writing, OMB approval is still pending.

In the meantime, an opportunity arose to collect similar data in conjunction with The Social and Ecological Foundations of Restoration Success (FRS) team. The FRS project is directed by the University of Montana with seed funding from NSF to investigate restoration capacity in the context of the Clark Fork River Superfund Restoration (see Chapter 2 for a more complete description of this study area).

FRS is a research project which seeks to understand the SES drivers of restoration success (FRS 2015). The concept of restoration success is dependent upon elements of social, scientific, and business dimensions (Mohr and Metcalf, *In Review*). FRS identified various elements of restoration success linked to the following social dimensions: trust, conflict, communication, and influence (FRS 2015). Social and business dimensions of success include overall project success, stakeholder engagement, and societal well-being/quality of life. Social dynamics are among the hypothesized drivers necessary to increase restoration success, including collaborative efforts which nurture social relationships. FRS project leaders acknowledged the benefits of stakeholder engagement, communication, and trust as precursors to restoration success (FRS 2015).

The FRS project goals are to investigate elements of restoration success of the Clark Fork Superfund river restoration project (FRS 2015). Bonner, MT, and other areas directly affected by the restoration, is notable for its connection to the river. Historically, the river has supported livelihoods as a source of clean water and a variety of services including transportation, power (e.g. kinetic energy to move timber, hydroelectric power), and sustenance from aquatic life. Moreover, intangible benefits abound from

cultural connections to the river and the reservoir. Various agencies, NGOs and individuals led management efforts during the restoration of the Clark Fork River (FRS 2015). Unlike the SWCC, characterized by ongoing restoration over a 10 year period, practitioners completed the Clark Fork River landscape restoration project at Bonner with no further restoration planned.

The FRS provided an opportunity to investigate a piece of my original research question, although some key differences existed between the FRS and SWCC areas (Table 1). The SWCC is located in a heavily forested landscape, dominated by public ownership while the FRS focuses on a central river system with myriad public and private landownership. Issues of forest restoration involve aspects of resource extraction which may differ from economic drivers on river systems that tend to be driven more by tourism and recreation. Forest management in the American West is dominated by concerns for fire, which can threaten life and property; river systems can flood, but the frequency and extent of human impact are qualitatively less; these differences may impact public perception of management which addresses risk.

Because of the timeframe and scope of these two projects, the focus of questions is also different. The SWCC seeks support of current stakeholders for ongoing forest treatment alternatives. Understanding the dynamics of social systems which drive support for forest alternatives often frames discussions of social monitoring. The FRS project seeks to understand whether one landscape scale restoration event was successful. There are no ongoing monitoring efforts that will be used to inform adaptive management in the area for the future.

Perhaps the most important difference is that the forest resources of the SWCC will remain there, managed to adapt to climate change and enhance forest structure and function. For the FRS study, nearby residents lost a reservoir, easy access to the river, and endured a host of problems associated with removal of the Milltown dam. While many laud the Clark Fork’s free flowing waters, local residents sometimes complain of the congestion of nearby roads for recreational floaters, and the unfinished facilities/amenities that were promised throughout the restoration process. The resources to which Bonner was accustomed have been fundamentally altered, although the river remains.

Table 1

<u>Dimension</u>	SWCC	FRS
Landscape context	Forested landscape	Central river
Livelihoods	Diverse forest industry jobs	Centralized mill and hydro-electric dam
Management	Centralized agency (Forest Service)	Decentralized with many agencies & NGOs
Timeframe	Long history of management	Relatively short implementation
Scope	Ongoing	Complete
Focus of questions	Support for future restoration	Success of past restoration
Resource alteration	Forest management (forest stays forest)	Loss of reservoir, re-establish free flowing river

Table 1. The SWCC and FRS have many differences highlighted in the table above. These include different: contexts, resident livelihoods, management styles, timeframe of management involvement, project scope, focus of research questions, and alteration of resources.

Despite these differences, the similarities between these systems are profound, providing opportunities for lessons about the Clark Fork system to inform monitoring efforts in the SWCC (Table 2). Differences in study area context do not extend to the

social constructs under investigation, which are universal to any SES. For example, some degree of trust regarding managers exists in either system, and that trust is influenced by the interactions of stakeholders with managers. Representation of stakeholder values in management decisions is likely to influence levels of trust in either study site. Perceptions of efficacy, and past experiences with managers and past projects may influence whether stakeholders’ expectations of a project will be positive, or circumspect. The quality and process of engagement will necessarily affect whether stakeholders are satisfied. Ultimately, how managers engage with stakeholders, and how they include them in decisions may affect their support of management alternatives.

Table 2

<u>Dimension</u>
Trust: exists (or does not) between residents and managers in both systems.
Values: values underlie human cognition in any context. Understanding perceived value overlap between residents and managers will help explain restoration success and support for future efforts.
Efficacy/Success: these two projects have used different terminology to address the same concept: has management been successful at achieving meaningful outcomes?
Engagement: specific means for involvement differed between projects, however, residents’ perceptions of involvement and how those perceptions influence other key variables is salient to SWCC and FRS.
Support: while not measured in the FRS context, past research has indicated support is predicated on satisfaction—a variable that will be measured in the FRS project.
Satisfaction: the antecedents of stakeholder satisfaction (e.g. trust, efficacy, engagement) exist in both systems.

Table 2. Despite the differences outlined in Table 1, both systems share many attributes constructs which are important in any collaboratively managed social-ecological system: trust, representation of values, efficacy/success of projects/management, stakeholder engagement, and stakeholder support.

Due to OMB struggles and delays, I choose to explore how aspects of engagement affected satisfaction in stakeholders of a landscape scale restoration project near the Clark Fork River. I explored concepts using a social justice theoretical framework to help shed light on particular engagement mechanisms which I hypothesized were critical for increasing stakeholder satisfaction. Moreover, I employed quantitative measures and analysis to investigate the relationships between engagement mechanisms and stakeholder satisfaction, a field where qualitative methods generally dominate.

My study presents a new opportunity to merge quantitative research of social justice concepts with SES management. While quantitative research of social justice constructs exists in social psychological research context, explorations in SES management contexts are in their infancy (van den Bos 2003). Although not directly applicable to the SWCC, I hope my work in the FRS will advance quantitative measurements of social justice constructs and begin to investigate the relationships between these variables and public satisfaction of SES management. These methodological and theoretical advancements will help the SWCC project (and others) formulate testable hypotheses and valid means for understanding the social dynamics of restoration projects in their unique context(s).

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Chapter 2

Stakeholder engagement is well established as an effective and necessary means for improving social-ecological systems (SES) management outcomes (Higgs 1997; Reed 2008; Couix and Gonzalo-Turpin 2015; Metcalf et al. 2015; Virapongse et al. 2016). Ecologically, SES management is successful when it bolsters diversity and system function (Berkes et al. 2003; Wortley et al. 2013). Social success in SES management is multifaceted, and ranges from the degree of stakeholder support for management action to improved human well-being following project completion (Adger 2000; Palmer et al. 2004; Aronson et al. 2006; Woolsey et al. 2007). While both ecological and human dimensions are important to management success, there has been a disproportionate emphasis of research on ecological outcomes (Wortley et al. 2013). Recent efforts have sought to broaden the focus of research and management to include all SES elements and their interrelationships (Clewel and Aronson 2013; Virapongse et al. 2016).

Engaging stakeholders can bolster SES management outcomes by leveraging diverse viewpoints, facilitating learning, building trust among partners, and increasing support for project implementation (Palmer et al. 2004; Olsson et al. 2004; Reed 2008). Public engagement also offers a promising means for increasing satisfaction and acceptance of SES management efforts (Lauber and Knuth 1999; Schultz et al. 2007; Woolsey et al. 2007; Arnold et al. 2012). To achieve these outcomes, practitioners must meaningfully engage diverse stakeholders in fair decision making processes (Palmer et al. 2004; Woolsey et al. 2007; Reed 2008).

Means for effective public involvement differ in form and style, including face-to-face interactions, public forums, online interactions, or workshops (Chess and Purcell

1999); these tools engage stakeholders in various degrees along a continuum from informed to fully empowered (see Figure 1; Arnstein 1969; Germain et al. 2001; Lukensmeyer et al. 2011). Multiple methods of engagement can be employed in combination to incorporate myriad perspectives and values and to broaden the scope of alternatives (Laird 1993; Smith et al. 1999; Druschke and Hychka 2015). Allowing flexible participation options may help facilitate ongoing engagement throughout projects' lifespans (Stringer et al. 2006; Metcalf et al. In Press).

Regardless of where they fall on this continuum, successful engagement methods help stakeholders feel their perspectives were represented and that they had acceptable opportunities for participation, even if they were not fully exercised. Interpersonal interactions and mutual understanding resulting from these opportunities enhance social learning and facilitate desired outcomes (Reed et al. 2010). Some authors have suggested managers should endeavor to make stakeholders feel their time has been well spent, their ideas have been heard, and opinions considered (Smith et al. 1999; Smith and McDonough 2001; Lukensmeyer et al. 2011).

Despite this strong theoretical work, there have been few efforts to quantitatively investigate how participation and the subsequent influence of public input on decisions affects stakeholder satisfaction with SES management. For instance, is it sufficient for stakeholders to express themselves, or does their satisfaction depend on clearly understanding how their input was considered and used to shape decisions? In this manuscript, we frame public engagement using social justice theory and quantitatively explore relationships among justice constructs and stakeholder satisfaction to inform SES management.

SOCIAL JUSTICE

Legal and organizational scholars have long used social justice theory to identify and describe equitable procedures. Adams (1965) identified the feelings of inequity which manifest when a person perceived an inconsistency in the ratio of inputs–to–outcomes between themselves and others. Subsequently, ideas of fairness became popular in psychology and philosophy, often defined as ‘distributive justice’ or the “fairness of outcome distributions or allocations” (Colquitt et al. 2001, 425; Adams 1965; Rawls 1971). Another domain of justice, procedural justice, is defined as, “the fairness of procedures used to determine outcome distributions or allocations” (Colquitt et al. 2001, 425).³

Procedural justice was originally articulated and defined by Thibaut and Walker (1978) and Leventhal (1980). These authors established that divergent procedures affected perceptions of fairness in legal proceedings (see Bobocel and Gosse 2015 for a review). Two complementary yet distinct dimensions of procedural justice include process control and decision control. Justice in the process, or process control (PC), exists when “procedures provide *opportunities* to voice an opinion,” while justice of the decision, or decision control (DC), exists when participants are able to exert “*influence* over outcomes” (emphases added; Colquitt and Rodell 2015, 189). While others have suggested additional complexity to the concept (e.g., Leventhal 1980; Colquitt et al. 2001), these two dimensions of procedural justice can be powerful mechanisms for understanding how public engagement efforts might influence perceptions of equity,

³ Another domain, interactional justice, or the “quality of interpersonal treatment people receive when procedures are being implemented,” has been developed and debated throughout organizational research, but is not central to our research questions (Colquitt et al. 2001, 426).

particularly because they can be operationalized by managers to enhance outcomes (Colquitt and Rodell 2015).

SOCIAL JUSTICE AND NATURAL RESOURCES

While much of social justice theory has been developed in legal, organizational, and workplace fields, a few important contributions appear implicitly and explicitly in natural resource contexts. Some authors have investigated how fair processes (i.e., procedural justice) and equitable outcomes (i.e., distributive justice) impacted environmental management (e.g., Lachapelle and McCool 2005; Reed 2008; Leciejewski and Perkins 2015). Lachapelle and McCool (2005) illuminated the potential for equitable participation to bolster a sense of process ‘ownership’ by stakeholders. Reed (2008) demonstrated how increased participation improved equity and empowerment, among other important outcomes. Leciejewski and Perkins (2015) showed how inequity in engagement processes led to disputes which undermined collaborative efforts.

While these studies and others suggest that both dimensions of justice are important, and that equity is essential to collaborative projects (e.g., Dalton 2006; Chase et al. 2004), others have emphasized the salience and primacy of procedural justice, de-emphasizing the role of distributive justice. From this perspective, since equitable outcomes do not require equal division of resources among stakeholders, they can be described more simply as outcomes which affected parties agree are fair (Chase et al. 2004; Dalton 2006; Leciejewski and Perkins 2015). For example, Germain et al. (2001) examined stakeholder perceptions of efficiency, effectiveness, and equity in procedures and outcomes associated with an appeal of a particular national forest’s management decisions. Their

results showed a strong connection between perceived procedural inequities and stakeholder discontent, regardless of resource allocation (Germain et al. 2001). Smith and McDonough (2001) explored notions of justice using focus groups during two separate stages of a management project and found participants were unsatisfied simply because engagement processes did not fully capture their voices and failed to represent their concerns (Smith and McDonough 2001). Still others have indicated that failed procedures lead to disinterested participants, and that increased fairness may have had myriad benefits (Lawrence et al. 1997).

Although natural resource studies have emphasized the importance of procedural justice, they have not explicitly considered its unique dimensions (i.e., PC and DC), operationalized them as distinct measures, nor compared their independent and combined effects on outcomes. According to social justice theory, increases in either PC or DC dimensions of procedural justice should lead to improved outcomes (Houlden et al. 1978; Lind et al. 1990). However, outcomes may not depend simply on one or the other, but rather on whether both are sufficiently provided. For example, without opportunity to voice an opinion (PC absent), it is difficult to influence outcomes (DC unachievable; Lachapelle and McCool 2005; Tyler and Blader 2003). Exceptions to this logic may be found in instances where opportunities were limited at the individual level, but robust at the group or aggregate level (i.e., strong representative decision making structures; Leach 2006). Some research has suggested that outcomes can be negatively affected when people were allowed to participate (PC present), but their input was not considered (DC absent; Firestone 1977; Burchfield 2001). Other researchers have raised similar questions, but did not definitively answer them. For example, are people happy with

processes where they were allowed to provide input, even if that input did not clearly influence the outcome, or are they *less* satisfied with outcomes when they feel their input was solicited, but not considered (Smith 1998)? Must people see how their comments shaped outcomes in order for them to be satisfied (Lachapelle and McCool 2005)? These studies were almost exclusively qualitative or descriptive, leaving a need for reliable quantitative measures of justice constructs, and the testing of their various and combined effects on satisfaction.

Public engagement processes for SES management may benefit from expanded consideration of these social justice constructs. For example, the National Environmental Protection Act (NEPA) requires opportunities for public comment, but does not explicitly require demonstration of how or if stakeholder input influenced decisions (Hoover and Stern 2014a). When considering NEPA comments, regulations and planning documents guide decision makers to prioritize comments which are scientifically and legally sound, as well as substantive and able to improve management decisions (Predmore et al. 2011). Prioritizing comments may help decision makers avoid legal battles by removing value-oriented comments in favor of scientifically-sound ones, or by simply focusing on those comments they believe are relevant to management decisions (Hoover and Stern 2014a). Regardless, this process emphasizes PC without demonstrating a clear link to DC (Hoover and Stern 2014b). Diminishing DC, no matter the rationalization, may alienate stakeholders and reduce satisfaction (Burchfield 2001; Lachapelle and McCool 2005).

To guide successful public engagement efforts, managers and researchers must understand more fully the effects of PC and DC on SES management outcomes. Satisfaction can provide a useful measure of social outcomes of SES management.

Satisfaction constructs developed in the marketing and customer service literature traditionally emphasized the importance of meeting and exceeding the expectation of the “customer” (Lee et al. 2004). This concept has been widely used in other fields to understand the tension between people’s expectations and perceived outcomes. There is general acceptance that satisfaction is a multidimensional concept, based on an individual’s perceptions, and can be influenced by many variables (Manning 2011). In natural resource settings, researchers used recreation visitors’ satisfaction to capture a range of their experiences (Manning 2011). Hence, satisfaction captures the idea of positive social impact, a foundation of SES management success. While SES management is inherently different than traditional businesses or even recreation experiences, the idea that the public holds certain expectations for how they should be engaged, which in turn they use to evaluate their actual engagement, can have implications for SES management goals. Satisfied stakeholders are more likely to support project outcomes politically and financially, reducing time and cost while increasing public ‘ownership’ of decisions (Lachepelle and McCool 2005; Thompson et al. 2005).

STUDY PURPOSE

We sought to understand how dimensions of procedural justice (i.e., PC and DC) related to stakeholder satisfaction with the outcomes of an SES management project. We were curious if PC and DC both significantly affected stakeholder satisfaction, if the effects of PC and DC on stakeholder satisfaction were independent, or if the relationship was more complex. When DC was absent, would PC significantly improve stakeholder

satisfaction on its own? Did DC partially or fully mediate the relationship between PC and stakeholder satisfaction? Specifically, we hypothesized that:

H₁: Engagement efforts must incorporate both the PC and DC dimensions of procedural justice because DC directly affects stakeholder satisfaction while PC affects stakeholder satisfaction both directly and indirectly through DC.

Based on this hypothesis, we predicted the following (Figure 1, page 39):

P₁: PC will have a significant positive effect on stakeholder satisfaction.

P₂: PC will have a significant positive effect on DC.

P₃: DC will have a significant positive effect on stakeholder satisfaction.

P₄: DC will partially mediate the relationship between PC and stakeholder satisfaction.

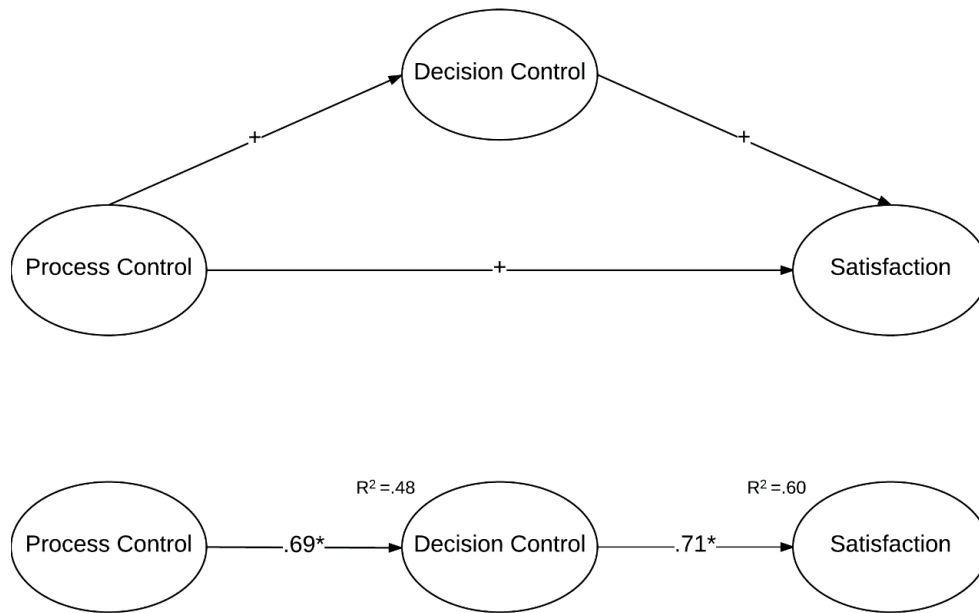


Figure 1. Hypothesized relationships among procedural justice dimensions and stakeholder satisfaction (above) and the final path model (below). Coefficients are standardized path coefficients; only significant path coefficients are displayed. * $p < .001$

These predictions build from a proposition that stakeholder satisfaction with SES management depends on the provision of both the PC and DC dimensions of procedural justice. From this, we predict stakeholders' satisfaction is positively related to the opportunities they had to provide input, and to substantively shape outcomes. Without the opportunity for participation in decision making (i.e., no PC), we predict stakeholders will be less satisfied. If such an opportunity is afforded, but the input given is not clearly incorporated into final decisions (i.e., no DC), we predict satisfaction may be improved, but only marginally. Only when people are given an opportunity to participate and understand how their voices shaped outcomes do we predict significantly higher satisfaction.

STUDY AREA

The Clark Fork River flows north from its headwaters near Butte, MT through the Deer Lodge Valley and west to its confluence with the Blackfoot and Bitterroot Rivers near Missoula, MT. A major tributary of the Columbia River system, the Clark Fork carries the largest volume of water of any river in Montana. Near its confluence with the Blackfoot River lie the communities of Bonner, West Riverside, Pinegrove, Piltzville, and Milltown (hereafter: Bonner-West Riverside), home to approximately 1,717 residents (US Census 2014). In the late 1860s, gold discoveries throughout the watershed led to a century of extractive industries whose waste often found its way into the river (Quivik 1998; Woelfle-Erksine et al. 2012). In 1908, a need for energy to power homes, businesses, and a lumber mill in Bonner-West Riverside prompted construction of the Milltown dam, which disrupted the flow of the Clark Fork and created Milltown reservoir (Brooks 2015). Shortly after its completion, an historic flood washed mining contaminants 125 miles downstream from Butte to the dam (Moore and Luoma 1990). Along the way, contaminants accumulated in the floodplains and several million cubic yards settled in the reservoir behind the dam (Moore and Luoma 1990). From 1908 until its removal in 2008, the iconic dam and reservoir provided recreation opportunities for nearby residents who swam, fished, and enjoyed viewing wildlife (Brooks 2015).

In 1980, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, colloquially known as Superfund) was passed, which allowed designation of sites requiring remediation due to industrial activities with expansive and destructive environmental impacts (U.S.C. 1980). The Clark Fork River upstream from Bonner-West Riverside was designated a Superfund site in 1983 and remains one of the

largest Superfund sites in the United States (Woelfle-Erksine et al. 2012). This designation aided remediation while restoration efforts have been supported by a \$260 million settlement awarded in 1999 to the State of Montana from BP-ARCO (which purchased the Anaconda mining company, originally responsible for much of the contamination). Restoration has entailed removing Milltown dam, draining Milltown reservoir, extracting contaminated sediments, and engineering a new river channel. The 2008 removal of the dam's powerhouse allowed the Clark Fork and nearby Blackfoot rivers to run free for the first time in over a century (Brooks 2015). Numerous NGOs, state, federal, and private agencies/organizations, and tribes were involved in community outreach and restoration efforts (Metcalf et al. 2015). Among the goals set in these meetings were community-focused items such as the installation of state parks on either side of the river. To date, the removal and restoration of the Milltown Superfund site is complete although certain goals, such as the state park on the Bonner-West Riverside bank of the river, remain unfinished.

METHODS

Data were obtained using an intercept survey of randomly selected residents of Bonner West-Riverside, Montana. An address-based sample (n = 894) was purchased from Survey Sampling International (SSI). This initial sample size was selected to achieve approximately 200 responses based on the overall population, an anticipated completion rate of 20 percent, and a desired sampling error of 5 percent (Dillman et al. 2014). Research questions and methods were approved by the University of Montana

Institutional Review Board prior to survey administration. The homes at each address were visited in person from late January to the end of March, 2016.

All respondents were at least 18 years of age and had lived in the Bonner-West Riverside area for at least three years; newer residents were not sampled due to limited experience with public engagement efforts throughout the restoration process.

Respondents were provided cards detailing response options while interviewers read questions and recorded responses on an electronic tablet using the Qualtrics survey package (Qualtrics 2016). Residents who declined the in-person survey were offered a postcard with a unique URL to allow online completion of the survey.⁴

Respondents were asked about their opportunities for engagement and satisfaction with outcomes regarding removal of the Milltown dam and the Clark Fork River cleanup. PC and DC were measured with eight independent items, replicating previous authors' measures where possible and employing new measures developed from social justice literature where existing measures were unavailable or inapplicable (see Table 1 for all items). Overall satisfaction was measured with four items adapted from previous satisfaction research to fit our specific study area and context (Oliver 1980; Lee et al. 2004; Burns & Graefe 2006).

Composite scores were calculated as the mean of the summed items within each construct, ranging from full disagreement (1) to full agreement (5). We used reliability analysis to assess the consistency of item responses for all composite variables (Cronbach 1951). We tested for multicollinearity using Variance Inflation Factor (VIF) procedures with a cutoff of <5.0 for each explanatory variable (Craney and Surles 2002). We confirmed other regression assumptions by conducting residual analyses for each linear

⁴ The majority of respondents completed the survey in person; only nine were completed online.

regression, testing for influential outliers using Cook's D with a cutoff of $D > 4.0/n$ (Cook 1977; Bollen and Jackman 1990) and with residual plots and tests, and confirming normality via normal quantile plots and Shapiro-Francia tests. We used factor analysis with multiple orthogonal rotations to verify the separate dimensions of justice.

To determine whether DC partially or fully mediated the relationship between PC and satisfaction, we conducted a path analysis of our hypothesized relationship by sequentially testing: (1) PC effect on satisfaction, (2) PC effect on DC, and (3) combined effects of PC and DC on satisfaction, using a p-value of 0.05 to determine significance (Baron and Kenny 1986; Vaske 2008). We included a variety of covariates commonly used in public participation studies, including education, gender, age, income, reported participation, and importance of various management objectives to see if any significantly influenced the relationship between variables. We used the Sobel (1982) Test for Indirect Mediation Effects to confirm the indirect effect of PC on satisfaction via the mediator, DC. We completed all analyses in R using psych, psy, nortest, and udsm packages (R Development Core Team 2014).

RESULTS

Initial sample size was 894. Of these, 36 addresses were vacant lots (usually in trailer parks), 15 were unoccupied houses, 122 were inaccessible (e.g., due to locked fences, threatening dogs, or no trespassing signs), 238 had no physical address (i.e., PO Box only), and 66 were owned by residents who were not eligible for participation because they had lived in the area less than three years, resulting in a total possible sample of 417. Completed surveys totaled 123, resulting in an overall response rate of

29.5 percent (123/417). Survey mailings to non-physical locations and follow-up contacts were not possible due to limited resources.

Table 1 shows item wording, mean scores with standard deviations, and Cronbach alpha scores for composite variables. Mean scores of Process Control seem to suggest, that in general respondents felt they had opportunity to comment on the river restoration process. However, despite their ability to comment, and voice an opinion, many respondents' answers regarding their influence in decisions tended toward disagreement. This lack of influence in decisions is reflected in the mean scores of Decision Control, which tend toward disagreement. Many respondents felt that decisions had already been made before procedures began, which may have negatively influenced their perception of personal impact in decision making processes. Mean scores for satisfaction suggest that, overall, respondents were neither greatly satisfied or dissatisfied. However, the quantitative result belies a qualitative explanation: many respondents who responded with high agreement in PC and DC dimensions felt satisfied, whereas those with high disagreement did not.

Cronbach alpha scores were all well above the 0.65 cutoff (Vaske 2008). Residual and quantile plots showed no departures from normality for any variables. VIF values for PC and DC were 1.95 and 3.23, respectively, indicating no issues with multicollinearity. Shapiro-Francia normality tests of each regression demonstrated a departure from normality in the third model (PC+DC = Satisfaction). Three outliers were responsible for the lack of normality; each had a Cook's D statistic above thresholds, so we confirmed the influence of these observations by removing them from the data set and repeating the Shapiro-Francia test. Without the outlier observations in the data, our tests showed no

departures from normality. We chose to include the three observations as they did not change the outcome of any results. We used factor analysis to confirm the two distinct dimensions of procedural justice, PC and DC. The PC and DC dimensions were confirmed as distinct using principal component factor analysis using three rotations: varimax, promax, and equimax. Item PC3 loaded heavily on both factors, but slightly higher on DC. Alternative composite PC and DC variables were explored (by including PC3 in DC vs PC). However, there were no substantive differences in our results; thus we proceeded with our initial theoretical conceptualization of these variables. Future research could explore alternative measurement items which might more fully differentiate PC and DC dimensions as delineated in social justice theory.

Table 1. Item means, standard deviations, and Cronbach's α for composite variables

Variable	Mean	SD	Cronbach's α
Process Control¹	3.1	1.1	0.87
"I had sufficient opportunity to comment on the river restoration process" ^a	3.2	1.3	
"There were ample opportunities for public input" ^a	3.4	1.2	
"The local community was involved in the decision making process" ^b	3.0	1.2	
"I was able to participate in decisions about the river restoration" ^b	2.7	1.2	
Decision Control¹	2.7	1.1	0.89
"Public comments were seriously considered" ^c	2.9	1.2	
"Minds were made up before the public had a chance to comment" ^{a, b, 2}	2.4	1.2	
"Public comment felt meaningless" ^{b, 2}	2.8	1.2	
"Final decisions balanced the concerns of all people" ^b	2.9	1.2	
Overall Satisfaction¹	3.1	1.2	0.93
"I am satisfied with the outcome we achieved here in the Milltown dam removal and river cleanup" ^d	3.0	1.4	
"Overall, I would describe the Clark Fork River cleanup as a success" ^d	3.2	1.3	
"I am satisfied with the Clark Fork River cleanup project as a whole" ^d	3.1	1.3	
"The outcome from the Milltown dam removal and river cleanup did NOT meet my expectations" ^{d, 2}	3.0	1.3	

¹ Exact question wording was "On a scale of 1 to 5, where 1 is "Strongly Disagree" and 5 is "Strongly Agree," how strongly do you agree or disagree with the following statements?"

² Item reverse coded for analysis

^a Adapted from Germain et al. 2001

^b Adapted from Smith and McDonough 2001

^c Adapted from McComas et al. 2007

^d Adapted from Oliver 1980; Lee et al. 2004; Burns & Graefe 2006

PATH ANALYSIS

Consistent with P_1 , we found PC had a significant and positive effect on satisfaction ($\beta = .54, p < .001$) when DC was not included in the model (see Table 2 for full path analysis results). PC also had a significant and positive effect on DC ($\beta = .69,$

p<.001), confirming P₂. However, when both PC and DC were included in the model, only DC had a significant, positive effect on satisfaction ($\beta = .71$, p<.001), thus confirming P₃. Hence, in this final model with both PC and DC included, PC had no significant direct effect on satisfaction; instead, DC fully mediated the relationship between PC and satisfaction (Figure 1). This final finding means that P₁ is disconfirmed in the presence of DC; in addition, rather than partial mediation as predicted in P₄, the finding supports full mediation. Sobel's test confirmed the fully mediated model ($z = 6.402$, $p < 0.001$). No covariates were significantly related to satisfaction at any stage in our analysis and were thus excluded from our final model.

These results provided evidence for rejecting our null hypothesis and accepting H₁, with an important modification: For stakeholders to feel satisfied with outcomes, engagement efforts must incorporate both the PC and DC dimensions of procedural justice because DC directly affects stakeholder satisfaction while PC *indirectly affects stakeholder satisfaction through DC*.

Table 2. Final path model results

Regression Model	n	R ²	F-Statistic	β	Standardized Path Coefficients	p-value
Satisfaction = PC	112	0.30	F(1,110)			
PC				0.614	0.54***	p < 0.001
DC = PC	114	0.48	F(1, 112)			
PC				0.714	0.69***	p < 0.001
Satisfaction = PC + DC	109	0.60	F(2, 107)			
PC				0.087	0.08	p = 0.370
DC				0.786	0.71***	p < 0.001

*** p<0.001

DISCUSSION

Past research engaging social justice literature in natural resource settings has emphasized the importance of procedural and distributive justice (Lawrence et al. 1997; Smith and McDonough 2001). Distributive justice (distribution of resources) does not necessitate an equal distribution; instead, it only requires that parties perceive the allocation of resources to be equitable. Thus, some authors have suggested that distributive justice can be achieved procedurally (Chase et al. 2004; Dalton 2007). Consequently, to realize procedural justice, many researchers have espoused the necessity of robust stakeholder engagement in natural resource decisions (Higgs 1997; Reed 2008; Couix and Gonzalo-Turpin 2015). According to social justice theory, increased participation is important, but must be accomplished using fair processes which allow people to provide input and influence outcomes (Colquitt and Rodell 2015). The unique

roles of process control (PC) and decision control (DC) dimensions of procedural justice have been acknowledged, yet their combined effects on satisfaction with project outcomes remained empirically untested.

We found a direct, positive impact of DC on stakeholder satisfaction, underscoring the importance of ensuring stakeholder input is clearly used to shape decisions. The opportunity to influence decisions (i.e., DC) does not exist without an opportunity to participate (i.e., PC); however, the effect of the opportunity to participate (PC) on stakeholder satisfaction was fully mediated by DC. Contrary to our hypothesis, our findings suggested no direct effect of PC on satisfaction when controlling for DC. The opportunity to participate did not significantly affect satisfaction on its own. Satisfaction was significantly improved only when stakeholders believed their input had helped shape decisions.

These results suggest the PC and DC elements of procedural justice do not independently relate to satisfaction, but are instead hierarchical: to achieve satisfactory outcomes, stakeholders must have been given an opportunity to participate; however, the opportunity to participate will not affect satisfaction unless stakeholders also see how their participation shaped decisions. Given this finding, it is possible that scenarios where PC is present, but DC absent, risk undermining other variables, such as project acceptance, trust, support for management actions, and willingness to participate in future collaborations, although we did not directly test for these relationships in this study.

The distinction between PC's and DC's effects on satisfaction may seem trivial to some, but the implications for public engagement processes in SES management are profoundly important. Managers should not merely provide opportunities for stakeholders

to be present and comment on management decisions. Instead, effective engagement requires that stakeholders feel their participation is valued and influential. Without allowing people to participate (removing PC) or adequately addressing their concerns and demonstrating how their feedback was considered and/or used (removing DC), satisfaction with the process and outcomes may suffer. For example, if decisions are already made before stakeholders are asked to provide input (or stakeholders perceive as much), satisfaction may be undermined. Opportunities to voice opinions about preconceived decisions are unlikely to bolster satisfaction (Lachapelle and McCool 2005). SES management projects which offer public engagement opportunities yet limit or fail to communicate the resulting influence(s) on decisions, have the potential to sour stakeholder attitudes and suppress future participation (e.g., Cheng and Mattor 2006). Successful public engagement depends on effective and frequent communication among project managers and stakeholders (Druschke and Hychka 2015). Managers should strive for transparency and open communication with stakeholders which can help demonstrate how stakeholder input was used to shape decisions, as well as explain why other input was not used. Preferably, decisions about whether or not and how to incorporate stakeholder input will be done through deliberation with stakeholders, not behind closed doors (Leach 2006). Lack of communication and transparency may lead stakeholders to conclude their input was ignored, even if it was in fact fully considered. Stakeholders who perceive low levels of DC may become disillusioned, making them less likely to participate in the future. Decreased participation may erode trust and threaten future

collaborative efforts (Metcalf et al. 2015).

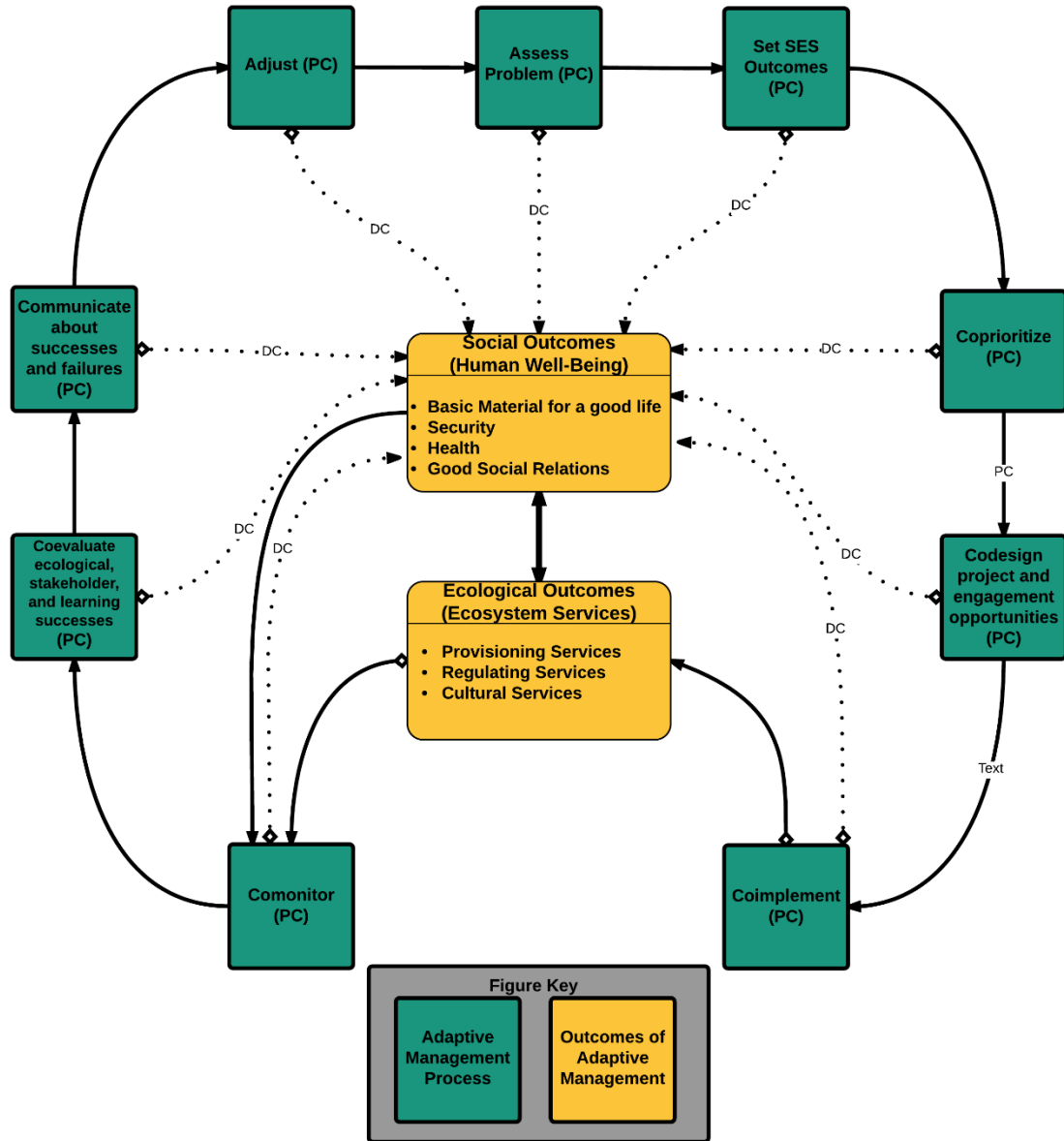


Figure 2. Social and ecological outcomes and procedural justice within an adaptive management cycle. Adapted from Druschke and Hychka (2015) and Alcamo et al. (2003). Solid, unidirectional lines in the figure represent the sequential steps of adaptive management; each step affords an opportunity to bolster PC by including stakeholders. Dashed lines suggest procedural effects on social and ecological outcomes; DC can be bolstered at each step by clearly demonstrating how stakeholder participation has been considered or shaped outcomes. Solid, bidirectional arrows between social and ecological outcomes suggest human well-being and ecosystem services are interrelated.

Managers may benefit from employing collaborative approaches which emphasize democratic processes for guiding SES management. Inclusive and representative processes which empower stakeholders while being deliberate, impartial, and transparent may be key to shaping positive stakeholder perceptions of the process (Leach 2006). Furthermore, sustainable ecological outcomes may be directly related to stakeholder participation in management decisions (Persha et al. 2011). Process and decision control, as forms of procedural justice, are embedded in adaptive management cycles where stakeholders are involved from the beginning SES management projects to improve social and ecological outcomes (Figure 2). Starting with problem assessment through to implementation and monitoring, stakeholders should be invited to participate and provided clear evidence their participation has shaped decisions at each stage. For example, opportunities to co-create problem definitions, identify desired outcomes, and implement alternatives can increase both dimensions of procedural justice simultaneously.

Monitoring social variables, as well as ecological, following implementation of any management alternative is crucial for subsequent adaptation (Virapongse et al. 2016). Managers should strive to adjust future decisions to improve social and ecological outcomes. Specifically, monitoring the degree to which participants perceive PC and DC may help guide future efforts by encouraging social learning and adaptive governance (Stroh 2015). If PC is deemed absent, or low, work can be done to provide or improve engagement opportunities. If PC is present, but DC is low, efforts should be made to allow more stakeholder influence. Demonstrating the collective nature of decision-

making can facilitate trust and partnership toward common goals and effective change (Kuenkel 2016).

CONCLUSION

Successful SES management achieves both social and ecological outcomes. Social justice theory can assist SES managers and researchers by better explaining dynamics driving social outcomes. Our results demonstrated that the influence of stakeholder input on decisions (i.e., DC) fully mediated the effect of stakeholder participation (i.e., PC) on satisfaction. To be satisfied, stakeholders needed to be afforded opportunities for participation, and clearly understand how their input influenced final decisions. The opportunity to provide input was insufficient on its own for increasing satisfaction.

This is not to say input from stakeholders should or can always be easily incorporated into management decisions. Instead, our results emphasize the importance of communicating with stakeholders to ensure they see how their input was fully considered. This may be even more important when input was rejected; stakeholders may easily see how input was accepted when it shaped decisions or outcomes, but be understandably confused when input was fully considered yet unused or deemed unacceptable or irrelevant. Communication in these latter instances may be even more critical for buoying stakeholder satisfaction.

We developed reliable, quantitative measures of process control and decision control based on natural resource and social justice literature. These scales, developed from existing literature and expanded using social justice theory, may prove useful for

researchers seeking to quantify public perceptions of engagement, measure attitudes regarding SES management, or incorporate social justice constructs into more robust models of SES dynamics. Managers may also find these scales valuable for monitoring key human dimensions variables during adaptive management processes.

Future research may benefit from a more in-depth investigation of procedural justice dimensions and investigating complements between social and environmental justice. Leventhal (1980) suggested that just procedures are consistent, suppress bias, are accurate, are correctable, are representative, and are ethical. Applying these criteria may help identify other procedural elements which affect social outcomes. Additionally, SES management may benefit from a more comprehensive integration of social justice theory with environmental justice. For example, whereas social justice scholars often equate distributive and procedural justice, environmental justice theory clearly asserts distributive justice as the equitable distribution of ecosystem services (or risk) across different segments of society (Schlosberg 2004). Expanding the collaborative process to include dimensions from both justice fields may help to understand their relative impacts on social and ecological outcomes.

Our research explored these concepts in a small community in western Montana. Work is needed to understand if and how our findings differ in other SES management contexts. Replication of this work in diverse settings will aid in assessing the reliability of our measures and generalizability of our results. With corroboration, these findings may provide expanded, actionable insights about public engagement for improved SES management grounded in social justice theory.

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Chapter 3

AN UNCERTAIN FUTURE

It is fallacious to assume an understanding of the past is sufficient to divine future outcomes of complex problems (Mobus and Kalton 2015). In an immutable world, judicious conclusions might be possible, however, dynamic SES beget uncertain futures, and embedded system complexity precludes the formation of absolute future insights (Mobus and Kalton 2015). Contemporary scientists now predict unprecedented rates of global change marked by compounded uncertainty and increased pressures on critical Earth thresholds (Steffen et al. 2015). Our referent of the past—one of comparatively more stable climatic conditions—is becoming increasingly irrelevant as an indicator of the future. Now, new approaches to understanding complex systems are even more paramount.

For researchers and managers of SES, understanding the dynamics of complex systems aids in crafting expectations about the future. Active refinement of systems understanding improves global change predictions (Mobus and Kalton 2015). These problems may be defined as wicked problems, or “complex issue[s] that def[y] complete definition, for which there can be no final solution, since any resolution generates further issues, and where solutions are not true or false or good or bad, but the best that can be done at the time” (Brown et al. 2010, 4). At appropriate scales, understanding components of complex systems is possible, but this understanding only represents part of the whole; some system characteristics remain unaccounted for and oversights omit critical connections (Mobus and Kalton 2015). As actors within systems, human behavior must be addressed to prevent further externalities of anthropogenic global change.

Addressing human behavior via education and improved communication is unlikely to deliver the outcomes it sets out to achieve. While our knowledge, mediated via new information determines how our behavior changes, simply educating the public does little (Mobus and Kalton 2015; Heberlein 2012). Even if the message were sufficiently simple and clear (which it seems to be) – that contemporary growth and global scale changes are unsustainable – it is unlikely that any type of communicative effort can provide the necessary catalyst for substantive change (Heberlein 2012; Steffen et al. 2015; Kollmuss and Agyeman 2002). A better approach may reside in reshaping our existing institutions which often become the vehicles which shape beliefs and behaviors (Mobus and Kalton 2015, Hirsch and Norton 2012). Refocusing the cause of environmental degradation at the scale of individual human beliefs may be the only way to affect systemic change. Vaske and Donnelly (1999) theorized in a cognitive hierarchy that values inform beliefs, attitudes, intentions and finally behavior (Vaske and Donnelly 1999). While it may seem appropriate to address change by engaging at global scales, these strategies avoid the true causal drivers of change: the aggregate outcome of individuals' behaviors. Rather than focus on general/optimal strategies to address the complex problems which generate degraded landscapes, further attention regarding the inherent complexities resultant from nested/interconnected and interdependent systems is necessary (Ostrom 2007). Polycentric co-adaptive governance strategies may provide the necessary frameworks to bolster stakeholder understanding of complex systems and satisfaction in outcomes of management decisions (Armitage et al. 2009; Biggs et al. 2015; Walker et al. 2002).

Adapting to global change entails rescaling solutions and fostering improved collaboration. The cognitive power of any individual is inadequate to perceive the scale and inherent complexity of nebulous global changes whose spatial extents extend beyond their immediate surroundings (Endsley, 1995). Global change requires refocusing the scales at which humans perceive their impacts on the Earth. Moreover, individuals need a better conception of how systems interact with one another so that they do not make unsound judgements about processes, attributing cause when cause is not clear. Regardless of the intended virtue in our decisions, changes to any system ultimately results in unintended trade-offs (Mobus and Kalton 2015). Therefore, engendering new ways of thinking which leverage holistic approaches to solving problems and the capacity to weather uncertainty is critical.

Regionally, the landscape of the SWCC is challenged by global change. This extant nebulous character is considered throughout the SWCC's project plans, and reflected in the Collaborative's concerns for the sustainability of environmental, economic and social dimensions of their SES (SWCC 2010a). Increased fire severity, and decreased water availability are just some examples of how stakeholders in the SWCC project areas may be challenged in the future (SWCC 2010a). While the results presented in Chapter 2 may be no panacea, applying social justice frameworks to ongoing collaborative efforts in the SWCC may prove useful in preparing communities and managers for uncertain futures. Ongoing adaptive management, and polycentric governance in the SWCC may provide the tools necessary to build resilience, and increase the stakeholders' adaptive capacity—a necessary prerequisite for future development and sustainability (Folke et al. 2002).

SES RESILIENCE FRAMEWORKS AND SYSTEMS APPROACHES TO CHANGE

The extent and ubiquity of ongoing, unsustainable global change requires new approaches to solving problems of ecosystem management. Of particular importance is recognizing the fundamental influence, interconnectedness, and interdependency of people and ecosystems (Biggs et al. 2015). Many now see inadequacies in conceptualizations of the world which separate the ecological and social components of systems, and instead embrace the coupled nature of human and natural systems (Liu et al. 2007). Indeed, it is difficult to conceive of any ecological system untouched by human activities, however distant they may be. This transition in thought from social *and* ecological to social-ecological promotes positive reorientations in peoples' beliefs regarding the biosphere by elucidating humanity's embedded nature in earth systems (Liu et al. 2007). Without understanding the influential role of humans, further unchecked and destructive activities are likely to increase the risk of critical and irreversible transitions in the Earth's biosphere (Barnosky et al. 2012). A focused reinterpretation of human and nature connections, therefore, is paramount.

Recent frameworks have been introduced which may help increase SES resilience. The Post Carbon Institute suggests six foundations for SES resilience: people, systems thinking, adaptability, transformability, sustainability and courage (Lerch 2015). The Stockholm Resilience center suggests 7 key concepts to invoke SES resilience: diversity and redundancy; management of connectivity; managing slow variables and feedbacks; fostering complex adaptive systems thinking; encouraging learning; broadening participation; and promoting polycentric governance (Biggs et al. 2015). Of note is the primacy of people in these frameworks. Lerch (2015) summarizes this

sentiment well when he says, “the people of the community build resilience—and they are the ones who need courage for all the pieces of resilience building” (Lerch, 2015: 30). Incorporating SES resilience frameworks in co-adaptive management may further bolster successful restoration; it connects people to landscapes, restores, encourages participation, and increases the diversity of participants in restoration activities. Moreover, it can encourage people to work with others, learn to understand SES problems systemically, and gain the capacity to adapt and change when needed (Lerch 2015). While it may slow the pace of collaboration, increased engagement that cedes some control over procedures and decisions while incorporating feedbacks and learning may help increase resilience in restoration projects, because engagement may increase trust (Zolli and Healy 2012; Lerch 2015).

Co-adaptive management frameworks (Chapter 2, Figure 2, pp 51) focus on procedural elements of SES resilience by allowing stakeholder input while monitoring social and ecological objectives. These frameworks have the capacity to incorporate social learning to facilitate numerous objectives of SES resilience (e.g., people, complex adaptive systems thinking, adaptability, transformability, sustainability, courage, broadened participation, and promoting polycentric governance). While many managers seek particular outcomes from management alternatives, resilience of sustainable systems is a unique outcome from the prioritization of processes. Unlike a focus on ecological outcomes only, a focus on SES resilience may help managers cope with non-linear and uncertain futures through complex adaptive systems (CAS) thinking (Biggs et al. 2015; Redman 2014).

CAS thinking is essential for the resilience of SES (Biggs et al. 2015). Providing opportunities for input and influence by all stakeholders helps to bring forth myriad mental models, which better elucidate the systemic structures of SESs, encouraging participants to embrace uncertainty (Biggs et al. 2015; Biggs et al. 2010). CAS thinking helps establish communities who can anticipate nonlinear changes, and work to adapt to them (Biggs et al. 2015). Without being able to accept all manifestations of ecosystem change, social systems may repeat similar control focused management that has created so many of the problems, which exist today. Engendering new ways of thinking which leverage holistic approaches to solving problems and the capacity to weather uncertainty is critical.

Operationalizing the outcomes of my study (i.e. providing opportunities to influence procedures and outcomes) provides an avenue for stakeholders to engage with managers in ways that may enhance learning, and encourage CAS thinking; it provides an opportunity to apply theory toward praxis. Stakeholder participation in the definition of problems, and prioritization of management alternatives may help reduce uncertainty in management decisions, bolster trust and satisfaction, and vest their interest in the outcomes of projects (Walker et al. 2002). Moreover, if my model holds true, and quality engagement (i.e. engagement allowing for both process and decision control) is leveraged, trust may be enhanced, achieving a key goal of the SWCC management strategy (SWCC 2010b; Jahansoozi 2007).

A ROADMAP FOR CHANGE

Creating collaborative processes that provide for clear and open communication can assist in setting goals that not only account for assumptions, but actively work to overcome and change them (Biggs et al. 2011; Senge 1990). Co-adaptive collaborative governance has the potential to operationalize this transformation to affect solutions that properly account for unclear futures (Biggs et al. 2015). When new information is presented that is not easily ignored, learning processes have the potential to expand an individuals' concept of a problem, but are unlikely to change approaches to it. What is necessary is active, introspective changes which challenge individuals to reflect on their values and change false beliefs (Biggs et al. 2011).

My results from Chapter 2 point to an important connection between stakeholder engagement and satisfaction; engagement without decision control (i.e., actual influence on decisions) is unlikely to lead to satisfied participants; engagement that leverages not only increased involvement, but increased understanding of how decisions are made is likely to be more successful than engagement which only solicits stakeholder input. Existing engagement paradigms often solicit input, but rarely do they demonstrate where input was used, or where it was not and why (Maynard 2013). Social justice constructs are poised to be directly applicable to natural resource management. Collaborative natural resource projects and work done in legal/organizational studies are fundamentally human projects, and perceptions of equity may affect outcomes regardless of setting (Colquitt and Rodell 2015). Adopting social justice concepts into adaptive management frameworks to show explicitly the impact of stakeholders is a necessary step toward stakeholder satisfaction.

Future research should explore the role of engagement as it relates to trust. I suspect public engagement plays a primary role in creating trust, satisfaction, and SES resilience, and that an increase in satisfaction is further mediated through increased trust due to the quality of engagement. For example, processes that engage stakeholders genuinely without pretense and with the ultimate goal of incorporating their input into final decisions may increase satisfaction. Stakeholders may perceive this type of engagement as ostensibly higher quality than engagement which lacks transparency and clear stakeholder influence. Engaged stakeholders, who have an opportunity to influence final decisions, may trust process facilitators more (Kuenkel 2016). If facilitators show participants how their engagement matters, and demonstrate that they brought stakeholders to the process to influence outcomes, it seems likely that trust may be bolstered.

LESSONS FOR THE SWCC FROM THE CLARK FORK

Environmental, economic, and social sustainability are explicit goals of the SWCC (SWCC 2010a). The SWCC identified monitoring as an important tool for achieving these goals (SWCC 2010a). Monitoring helps improve adaptive management frameworks by providing information for subsequent management efforts, and through learning (Fernandez-Gimenez et al. 2008; Lyons et al. 2008; Walters and Holling 1990). Currently, the Collaborative monitors environmental and economic variables, and they are poised to undertake social monitoring upon overcoming OMB hurdles. Recent estimates suggest that social monitoring may begin as early as the first half of 2017 (SWCC 2016). However, original plan estimates from the SWCC estimated that treatments would occur between 2011-2019 (SWCC 2010a). Given this timeframe it

seems unlikely monitoring will substantively inform management before the end of CFLRP in 2019, but may be useful for ongoing resource management in the area.

Of primacy to the SWCC endeavors was the desire to improve stakeholders' quality of life, healthy relationships with land managers, and the acceptability of project goals and implementation plans (SWCC 2010a). Results presented in Chapter 2 indicate that improving engagement processes throughout collaborative efforts may bolster these SES outcomes, particularly when participants perceive decision control. SWCC social monitoring efforts may benefit from adapting stakeholder engagement processes which operationalize these social justice constructs. This insight seems most salient to the SWCC's goal of encouraging and maintaining healthy relationships with land managers, as it relates to notions of representation and discussions of engagement opportunities for stakeholders in the collaborative. In addition to engagement processes and outcomes, the SWCC still plans to measure perceptions regarding efficacy, core values, trust, and support. Engaging a much larger sample size in the context of the SWCC would provide an opportunity to replicate the measures presented in Chapter 2 in a different context, and the potential to investigate other systemic connections between variables, such as those hypothesized in Figure 1, Chapter 1, pp 20.

The Collaborative is curious if public engagement can improve perceptions of representation in management decisions (SWCC 2010a). The measures employed in Chapter 2 do much to answer these questions, and are directly applicable to the SWCC provided they cater questions to the SWCC landscape. It is possible that the Collaborative may not be able to use the results of their monitoring tool to influence future management, especially if treatments end in 2019. However, these questions will

elucidate stakeholder perceptions of the Collaborative's work, provide an opportunity to understand whether it was positively received or not, and can be used to guide management in the future, which may not depend on CFLRP funding from the USFS. Moreover, the opportunity to replicate these measures provides an opportunity to help inform future collaborative efforts in virtually any setting. Incorporating these measures will allow the Collaborative to assess the current satisfaction of stakeholders for comparison in the future.

Absent from the SWCC's monitoring tool are any measures of satisfaction. Satisfaction may predict support for social and financial support of projects. (Lachepelle and McCool 2005; Thompson et al. 2005). A compelling future research question may revolve around whether support of restoration efforts is similarly related to social justice constructs. If the SWCC wants future project support, focusing on satisfaction may require transforming engagement procedures to operationalize social justice constructs. Engagement efforts should begin with process definition, and allow stakeholders some control over the engagement process (PC). Similarly, after stakeholders are provided opportunity to participate, they must also be explicitly shown that their participation mattered. They should be told how and why their input was incorporated into decisions, and why when their suggestions were not.

The Collaborative seeks to understand whether the quality of engagement can predict support for restoration efforts. Trust is hard earned, and built over time (Pretty and Ward 2001), but the results of my research found a direct connection between improved engagement procedures and satisfaction. Understanding how engagement influences trust is a positive next step, however, the knowledge that engagement

influences satisfaction may provide the leverage necessary to make positive changes now to increase support for management alternatives in the future. Decision control's mediation of process control is a clear indication that how participation influences decisions is important. Stakeholders must be heard, and their input must help shape management alternatives. Simply having the opportunity to participate in meetings may be ineffective at increasing support. Future research may be necessary to explore whether participation without influence undermines healthy relationships with managers, and whether project support and trust also suffer as a result.

FUTURE RESEARCH

I began this research with the question: how do individuals' perceptions regarding government agencies or NGOs influence social-ecological resilience in the context of landscape restoration? My analysis of FRS data did not answer this question directly, but did help elucidate an important character of engagement that may affect the quality of interaction between stakeholders and government agencies or NGOs. Future research or monitoring in the SWCC could explore how engagement affects stakeholder trust, or whether trust affects satisfaction. Future research efforts could also explore the explicit effects of incorporating core values into decision making, and how trust affects satisfaction, as both have been suggested to be important to building SES resilience (Lerch 2015).

I predicted that individuals who feel more engaged would have more satisfaction; components of social justice will mediate this relationship as well as those mediated through procedural and dispositional domains of trust. My research suggests that procedural justice (i.e., process control and decision control) indeed affects satisfaction,

however, the effect of different domains of trust remains unanswered. Research suggests a strong relationship with satisfaction, and future research should quantitatively explore whether or not this is true, and whether or not the quality of engagement affects levels of trust (Geyskens et al. 1998). If stakeholders are satisfied with outcomes, perhaps their perceptions regarding future projects and their levels of procedural trust may change (Stern and Coleman 2014). Furthermore, by increasing the effectiveness of collaboration through increased transparency in decisions, it is less likely that stakeholders will resort to dispositional judgements (i.e. all government is inherently untrustworthy) of governments and NGOs (Leahy and Anderson 2008).

In my systems diagram in Chapter 1 (Figure 1), trust is a driver of satisfaction in collaborative projects. Some theorize trust to be an important component of SES resilience which facilitates collaboration and learning (Zolli 2012). However, trust, much like satisfaction, may be an outcome of engagement if the engagement is of sufficient quality and transparency that stakeholders find their participation has impact. The primacy of focusing on procedures and not outcomes cannot be overstated. Government agencies and NGOs should strongly consider the procedures they use to engage stakeholders and continually work to improve them. If my systems model represents the social landscape accurately, then focusing only on outcomes to the detriment of the engagement process is likely to undermine trust, decrease satisfaction, and ultimately undermine social and ecological outcomes (Druschke and Hychka 2015; Schultz et al. 2007; Schultz et al. 2011).

I explored numerous connections between processes and outcomes of co-adaptive management frameworks, and I identified key components of engagement (process and

decision control) that help shape better social outcomes when explicitly included in engagement design. Further research might look at other systemic structures (Chapter 1 Figure 1) to uncover more processes, which could provide high leverage toward positive change. Moreover, providing heuristics and systems maps of these processes may help stakeholders understand more clearly their role in engagement, and the role of government agencies and NGOs (Stroh 2015).

A clearer understanding of how perceptions of overlapping core values, perceived efficacy of government agencies and NGOs, and engagement influence trust in co-adaptive management frameworks is a necessary next step to clarifying the systemic interactions between stakeholders of landscape scale collaborative projects. Working collectively with stakeholders to define the important drivers of these variables may help to overcome differences and come to shared/aligned visions (Kuenkel 2016).

Investigating and applying available multi-stakeholder frameworks toward adaptive management could be promising way to incorporate social justice and reach shared goals (Kuenkel and Aitken 2014). Exploring whether trust mediates the relationship between engagement and satisfaction may help the SWCC to determine whether their engagement efforts could achieve multiple goals. Future monitoring efforts should attempt to establish to what degree satisfaction affects stakeholder support of management alternatives. Should satisfaction prove to bolster support of treatment alternatives, and should trust prove to mediate the relationship between engagement and satisfaction, then quality stakeholder engagement may be the high leverage that managers need to increase support for future treatments (Cronin and Taylor 1992; Sivadas and Baker-Prewitt 2000).

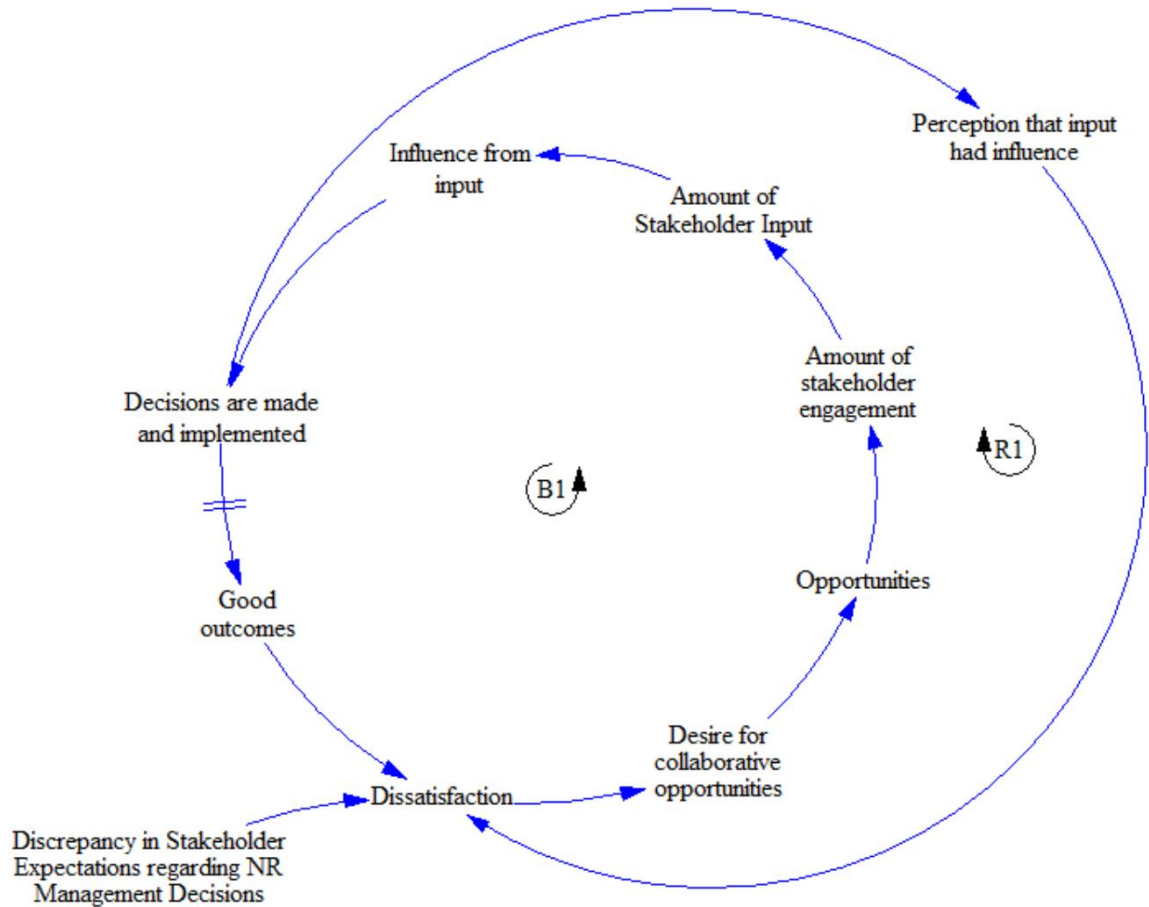


Figure 1. Example systems dynamics model of potential drivers and pathways of engagement. The inner circle represents a feedback loop which can act to balance the outer feedback loop. Engagement begins with a discrepancy (gap) in expectations regarding natural resource management decisions, which initially leads to dissatisfaction and a desire to have one's voice included in decisions. If decisions are made collaboratively, and lead to good outcomes, they may ameliorate feelings of dissatisfaction. Simultaneously, final decisions reflect to stakeholders whether their input was considered. Increased perceptions of decision control is theorized to decrease dissatisfaction. A combination of both process control leading to good outcomes and a reflection of voice in decisions leads to reinforcing feedbacks, which both decrease dissatisfaction.

Working together with stakeholders through engagement models such as The Collective Leadership Institute's Dialogic Change Model and the David Stroh's Four-Stage Change Process, while difficult, can empower stakeholders, improve relationships, provide goal and process clarity, increase knowledge and competence, increase

credibility of government agencies and NGOs, bolster a sense of ownership, increase feelings of inclusiveness, and deliver collaborative outcomes all while facing current realities and reorienting stakeholders toward desirable futures (Kuenkel 2011; Stroh 2015). Multi-stakeholder endeavors are not the most expeditious procedures toward change, but they may help build SES resilience long-term.

Exploring relationships to the key variables (e.g., Chapter 1 Figure 1) is critical to understanding what tools to apply to stakeholder engagement. Process oriented tools like the Dialogic Change model and the Four-Stage Change Process, only have qualitative backing (Kuenkel and Aitken 2015; Stroh 2015). Combining existing tools and monitoring with quantitative research to establish further variable relationships may prove useful to verify the validity of frameworks, and create buy-in for government agencies and NGOs. Furthermore, collaboratives such as the SWCC should continually endeavor to improve how they engage stakeholders. I hope that the outcomes of this research lead to better informed citizens, more approachable government agencies, and more resilient social-ecological systems.

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Appendix I

SURVEY INSTRUMENT

FRS Survey

Q1 Dear Montana Resident, The University of Montana is conducting a study about recent work on the Clark Fork River and we need your help. You were randomly selected to participate in this study as a Montanan living near the Clark Fork River — your responses will help future interactions between project managers and residents like you. This survey contains questions about your experiences and views regarding the Milltown dam removal and Clark Fork River cleanup. Your participation in this survey is completely voluntary and you may stop at any time or skip any question you do not wish to answer. Your responses will be anonymous—we will only report summaries of our findings. You must be at least 18 years old to participate in this survey. The questionnaire should take about 15-20 minutes to complete. If you have any questions, please contact me. Dr. Elizabeth Metcalf, Assistant Professor College of Forestry and Conservation elizabeth.metcalf@umontana.edu 406.243.4448

Q2 To determine whether you qualify to take this survey, please tell us how many years you have lived in the Bonner-West Riverside Area?

1 - 2 years (1)

3 -5 years (2)

6 - 10 years (3)

More than 10 years (4)

Q3 The following questions ask about opportunities you had to be involved in the decision making process and to influence the outcomes of the river restoration. Restoration is defined as the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.

Q4 On a scale of 1 to 5, where 1 is “Strongly Disagree” and 5 is “Strongly Agree,” how strongly do you agree or disagree with the following statements?

	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly Agree (5)
I had sufficient opportunity to comment on the river restoration process. (1)					
There were ample opportunities for public input. (2)					
The local community was involved in the decision making process. (3)					
I was able to participate in decisions about the river restoration. (4)					
Public comments were seriously considered. (5)					
Minds were made up before the					

public had a chance to comment. (6)					
Public comment felt meaningless. (7)					
Final decisions balanced the concerns of all people. (8)					

Q5 In what ways did you participate?

Attended public meetings (1)

Talked to neighbors (2)

Contacted elected officials (3)

Wrote a letter to the editor (4)

Volunteered (5)

Joined citizen advisory committee (6)

Read the newspaper (7)

Watched TV news (8)

Other (9) _____

Q6 The following questions ask you to assess the importance of several river restoration goals.

Q7 On a scale of 1 to 5, where 1 is “Very Unimportant” and 5 is “Very Important,” how important are the following goals to you? The _____ goal is:

	Very Unimportant (1)	Unimportant (2)	Neither unimportant nor important (3)	Important (4)	Very Important (5)
Quality of wildlife habitat (1)					
Human health (2)					
Quality of fish/aquatic habitat (3)					
Economic					

health of local communities (4)					
Access to quality recreation opportunities (5)					
Increased tourism for our local community (6)					
Aesthetic quality of the landscape (7)					
Clean water (8)					
Controlling invasive species (9)					
Healthy river vegetation (10)					

Q8 What other goals (if any) are important to you?

Q9 The following questions ask about your general thoughts about interacting with other people.

Q10 On a scale of 1 to 5 where 1 is 'Strongly Disagree' and 5 is 'Strongly Agree,' how strongly do you agree or disagree with the each of the following statements?

	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly Agree (5)
You can't be too careful dealing with people. (1)					
People are generally					

interested in their own welfare. (2) One has to be alert or someone is likely to take advantage of you. (3)					
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Q11 The following questions help us understand which organizations/agencies you had the most opportunity to interact with during the river restoration project and your perceptions of them.

Q12 As you think back on the river restoration project, is there one organization or agency that was most involved in making decisions? Can you remember which agency that was?

Yes (Please enter the name of the agency below) (1) _____

No (2)

Q13 This next set of questions are specifically about Montana Department of Environmental Quality (DEQ). To what extent do you remember their role in the cleanup?

I don't remember their role at all. (2)

I remember their role a little bit. (3)

I remember their role well. (4)

Q14 On a scale of 1 to 5 where 1 is 'Strongly Disagree' and 5 is 'Strongly Agree,' how strongly do you agree or disagree with the each of the following statements?

	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly Agree (5)	Don't Know (6)
The DEQ supports my views. (1)						
The DEQ has similar goals to mine. (2)						
The DEQ thinks like me. (3)						
The DEQ shares my values. (4)						
DEQ personnel were well trained. (5)						
DEQ personnel were knowledgeable about technical matters. (6)						
DEQ personnel were self-serving in decision making. (7)						
DEQ personnel really cared what happens to me. (8)						
DEQ personnel were sensitive to the local impacts of their decisions/actions. (9)						
DEQ personnel did a good job communicating with the public. (10)						

I could relate to DEQ personnel. (11)						
My interactions with DEQ personnel were generally positive. (12)						
DEQ personnel were outsiders. (13)						
DEQ personnel were easy to get along with. (14)						
I felt I could connect with DEQ personnel. (15)						

Q15 The following questions ask about how satisfied you were with the restoration process.

Q16 On a scale of 1 to 5 where 1 is 'Strongly Disagree' and 5 is 'Strongly Agree,' how strongly do you agree or disagree with the each of the following statements?

	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly Agree (5)
I am satisfied with the outcome we achieved here in the Milltown Dam removal and river cleanup. (1) Overall, I would describe the Clark Fork River cleanup as a success. (2)					

<p>I am satisfied with the Clark Fork River cleanup project as a whole. (3)</p> <p>The outcomes from the Milltown Dam removal and river cleanup did NOT meet my expectations. (4)</p>					
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Q17 On a scale of 1 to 5 where 1 is 'Very Unsatisfied' and 5 is 'Very Satisfied,' please indicated how satisfied you are with the following statements since the completion of the Milltown dam removal and river cleanup.

	Very Unsatisfied (1)	Unsatisfied (2)	Neither satisfied nor unsatisfied (3)	Satisfied (4)	Very Satisfied (5)	Don't Know (6)
Dam removal and river cleanup (1)						
Access to quality recreation opportunities in the restored area (2)						
Aesthetic quality of the restored landscape (3)						
Quality of wildlife habitat in the restored area (4)						
Quality of fish/aquatic habitat in the restored area (5)						
Health of river vegetation in the restored area (6)						
Cleanliness of water in the restored area (7)						
Increased						

tourism for our local community (8)						
Control of invasive species in the restored area (9)						
Protection of human health in the local community (10)						
Economic health of local communities (11)						

Q18 The following questions ask about the future of economic development of your community.

Q19 On a scale of 1 to 5, where 1 is “Strongly Disagree” and 5 is “Strongly Agree,” how strongly do you agree or disagree with the following statements? When I think about the future economy of my town, I would like to see:

	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly Agree (5)
...more technology oriented jobs (such as computer programming) (1)					
...more opportunities to make a living through web-based businesses (2)					

<p>...more education-related jobs (3)</p> <p>...more professional jobs (4)</p> <p>...more retail stores built (5)</p> <p>...more restaurants (6)</p> <p>...more amenities to attract tourists (7)</p> <p>...more recreational outfitters (8)</p> <p>...more jobs in construction (9)</p> <p>...more jobs in the timber industry (10)</p> <p>...more manufacturing (11)</p>					
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Q20 Are there other economic opportunities you would like to see? If yes, please describe them below.

Q21 What is your gender?

Male (1)

Female (2)

Q22 What year were you born?(Please enter the date as a number. For example: 1984)

Q23 What is the highest level of education you have completed?

Less than High School (1)

High School / GED (2)

Some College (3)

2-year College Degree (4)

4-year College Degree (5)

Masters Degree (6)
Doctoral Degree (7)
Professional Degree (JD, MD) (8)

Q24 What was your approximate annual household income before taxes for the year 2015 (optional)?

Less than \$10,000 (1)
\$10,000 to \$19,999 (2)
\$20,000 to \$39,999 (3)
\$40,000 to \$59,999 (4)
\$60,000 to \$79,999 (5)
\$80,000 to \$99,999 (6)
\$100,000 to \$119,999 (7)
\$120,000 to \$139,999 (8)
\$140,000 or more (9)
Prefer not to say (10)
Don't know (11)

Q25 Thank you for taking this survey. If you have any comments please include them in the space below.