DISSERTATION

IS THERE AN HEIR APPARENT TO THE CROWN? A MORE INFORMED UNDERSTANDING OF CONNECTIVITY AND NETWORKED ENVIRONMENTAL GOVERNANCE IN THE CROWN OF THE CONTINENT

Submitted by

Richard Patrick Bixler

Department of Sociology

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Doctoral Committee:

Advisor: Peter Leigh Taylor

Michael S. Carolan
Jennifer E. Cross
Antony S. Cheng

ABSTRACT

IS THERE AN HEIR APPARENT TO THE CROWN? A MORE INFORMED UNDERSTANDING OF CONNECTIVITY AND NETWORKED ENVIRONMENTAL GOVERNANCE IN THE CROWN OF THE CONTINENT

Multi-actor and multi-level processes characterize contemporary environmental governance where a multiplicity of actors and modes of governance are operating in diverse and overlapping spheres of authority. No fixed spatial or temporal level is appropriate for governing ecosystems and their services sustainably, effectively, and equitably. Rather, ecological processes interact across a range of spatial scales, which has led to an increased interest in the way networks operate and govern environmental processes across landscapes. These governance schemes involve communication and coordinated action by federal, state, and local agencies working with private landowners, nonprofit organizations, and industry. They involve multiple, interconnected issues within contexts that are complex, dynamic, and involve uncertainties. Working across multiple levels reveals governance and coordination challenges that often outstrip capacities, structures, and decision-making processes of the individuals or organizations involved. The processes of initiating multi-actor governance is not politically neutral, nor does it exist in a vacuum. It rather reflects competing interpretations of the appropriate distribution of power in a network and how information and knowledge are created and acted upon for environmental governance.

Through this dissertation, I maintain that making progress towards these challenges requires a concerted effort and focus on the role of community-based conservation within the

broader and emerging cross-scale networks of environmental governance. These cross-scale networks of landscape governance can either strengthen the role of community-based natural resource management or undermine them. To this end, my dissertation entitled: “Is there an Heir Apparent to the Crown? A More Informed Understanding of Connectivity and Networked Environmental Governance in the Crown of the Continent” uses social network analysis and qualitative interviews to explain the mechanisms that nurture cross-scale linkages that enhance collaborative community capacity in environmental governance.

Building on a fundamental premise of landscape conservation, ecological connectivity, I develop three conceptual ideas in this dissertation: that *social connectivity* is a necessary prerequisite for network governance and landscape-scale conservation. Social connectivity includes concepts of social networks and is concerned with how information flows between individuals and organizations. *Discourse connectivity* is that crucial next step that links the social and the ecological together through a process of narrative and problem framing. Finally, I develop the idea of *assemblage connectivity.* The interest here is how the previous three concepts (ecological, social, and discourse) catalyze the conditions for cross-scale conservation that strengthens the role of community-based natural resource management. This framework is then applied across three empirical issue ‘case-studies’, invasive species management, grizzly bear conservation, and climate adaptation.

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The dissertation that exists herein is itself a representation of what it contains. It is an emergent property of many dimensions of my life that have “assembled” together in such a way to deliver this product, in this place, at this particular time. This dissertation is a social assemblage in terms of contingencies rather than necessities, which by nature takes into account the trans-scalar connections between seemingly disconnected individuals and places. Although this dissertation may have sole authorship, it would not have been possible if I were not deeply embedded in a network of support and encouragement. First and foremost, I cannot express enough gratitude for the support and patience of my friend, turned fiancé, now wife during this process, thanks Audrey Barrett Bixler. Only you have the heart and understanding to plan a wedding while I was living in a small cabin in the Montana woods with no phone reception during this research. Likewise, this journey would not have been possible without the love and support from my family, thanks Rick and Melanie for your consistent encouragement for me to pursue my dreams, regardless of where in the world they took me.

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CHAPTER ONE: INTRODUCTION TO CONNECTIVITY AND MULTI-LEVEL GOVERNANCE

"When we try to pick out anything by itself, we find it hitched to everything else in the universe." -John Muir

1.1 Introduction

Multi-actor and multi-level processes characterize contemporary environmental governance where a multiplicity of actors and modes of governance are operating in diverse and overlapping spheres of authority. No fixed spatial or temporal level is appropriate for governing ecosystems and their services sustainably, effectively, and equitably. Rather, ecological processes interact across a range of spatial scales. This shift towards considering broader ecological dynamics has led to uncertainty over the 'root cause' of environmental problems. That is, issues such invasive species management, grizzly bear population decline, and climate adaptation have many distributed causes and consequences and the solutions are much more complex than source point pollution problems that typified environmental problems of the past. Contemporary issues today manifest at larger spatial scales and system processes, whether it is a migration corridor, a watershed, or the atmosphere. Moreover, these problems are interconnected. Climate change will reassemble plant communities and influence the distribution of land cover changing existing and potential core habitat for species and connectivity corridors connecting those core areas. These complex ecological questions have led to an increased interest in the way networks operate and govern environmental processes across landscapes.

Emerging network governance schemes involve communication and coordinated action by federal, state, and local agencies working with private landowners, nonprofit organizations,

and industry. They involve multiple, interconnected issues within contexts that are complex, dynamic, and involve uncertainties. Working across multiple levels brings to the fore governance and coordination challenges that often outstrip capacities, structures, and decision-making processes of the individuals or organizations involved. The processes of initiating multi-actor governance is not politically neutral, nor does it exist in a vacuum devoid of context. It rather reflects competing interpretations of the appropriate distribution of power in a network and how information and knowledge are created and acted upon for environmental governance.

In this dissertation I build upon the conceptual apparatus provided by the science of landscape ecology, ecological connectivity, to develop three conceptual frameworks: social connectivity, discourse connectivity, and assemblage connectivity. Ecological connectivity, scientifically speaking, is the ability to support animal movement, gene flow, range shifts, and other ecological and evolutionary processes that require large areas (Soule and Wilcox 1980). My interest in connectivity emerges from this premise: a prerequisite for sustaining biodiversity is maintaining connectivity. However, this goes well beyond the resource management decision to maintain habitat patches and corridors and into the social and cultural realm of governance. The problem can be characterized by a focus on the way ecological processes interact across a range of spatial scales on the one hand, and a focus on incorporating multiple stakeholder processes on the other. Being connected 'socially' is a necessary prerequisite for networks of governance seeking to overcome these challenges. Moreover, giving attention to the processes of problem framing and linking that frame to broader cultural narratives in ways that resonate across stakeholders provides another layer of connectivity, serving as the "glue" that holds the network together. These ecological, social, and cultural dimensions - in addition to technologies and non-human actors - ultimately 'assemble' together in particular ways illustrative of broader

contours of power relations to make networks of landscape governance. In this dissertation, I apply this framework - ecological connectivity, social connectivity, discourse connectivity, and assemblage connectivity (explained in depth in chapter two) - across three empirical issue 'case-studies': invasive species management (chapter four), grizzly bear conservation (chapter five), and climate adaptation (chapter six). These case studies were strategically selected for the lessons a cross-case comparison can provide. The cases increase in their respective degree of social-ecological complexity on the one hand, and the barriers to conservation action on the other. Given the multi-stakeholder and multi-level governance context of natural resource management, conservation action must incorporate aspects of social justice across stakeholder groups in addition to contributing to long-term ecological resilience of the landscape. See figure 1.1 below.

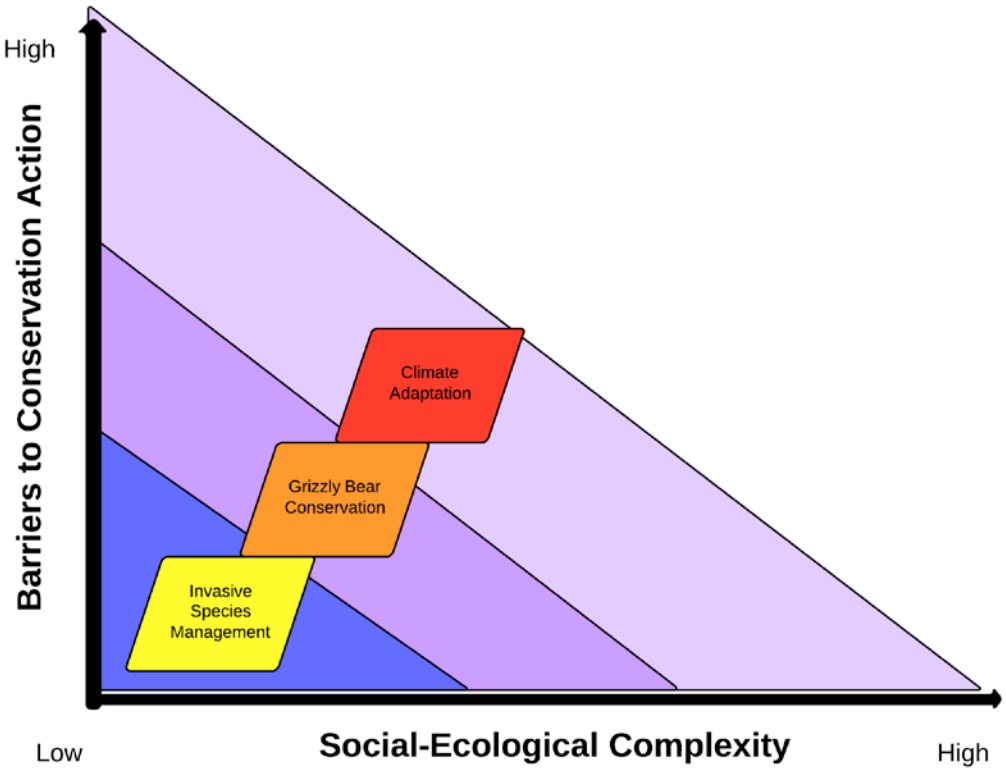


Figure 1.1 Issue Case Studies Along a Matrix of Complexity and Barriers

Through this dissertation, I maintain that making progress on these challenges will require a concerted effort and focus on the role of community-based conservation within the broader and emerging cross-scale networks of environmental governance. Cross-scale networks of landscape governance can either strengthen the role of community-based natural resource management or undermine the role that communities play. To this end, my dissertation entitled: "Is There an Heir Apparent to the Crown? A More Informed Understanding of Connectivity and Networked Environmental Governance in the Crown of the Continent" uses social network analysis and qualitative interviews to explain the mechanisms that nurture cross-scale linkages that enhance community-based natural resource management.

An inherent tension exists between levels of governance because of differences in social organization, differences in the ways in which information is generated, shared, and applied, and the ways that power is exercised to coordinate conservation action. Who should undertake what activities at which level and how organizations network together collectively across complex jurisdictional, cultural, and ecological boundaries are enduring questions in environmental governance (Brondizio et al. 2009; Lemos and Agrawal 2006; Young 2002). There is a "paradox of scale" at play, where on the one hand, there is the normative need to address "large-scale landscape conservation" and on the other hand, a primacy on "community-scale" collaboration. From a normative perspective, the linking of organizations across multiple levels is essential for the long-term protection of ecosystems and the services they provide for society. However, large scale has always implied "government management" and empirically, in many cases, it remains this way as governments can leverage substantial resources to implement actions that may or may not correspond to collaborative governance agreements. This is the problem I engage in this dissertation.

1.2 The Problem

Contemporary environmental governance is a context that is rich in clusters of organizations working towards common objectives but often disconnected from each other. The spectrum of stakeholders includes State and Federal agencies, landowners, foundations that provide funding, practitioners, land trusts, and a growing number of non-governmental organizations working on natural resource conservation and policy. Importantly, this complex field of organizations focuses their attention on varied, and often overlapping, land bases. My interest in the 'context' of this dissertation emerged from over six years of professional and scholarly engagement with one particular community-based group, the Blackfoot Challenge (more on the Blackfoot Challenge later in this chapter). I have been collaboratively working with the Blackfoot Challenge since 2007, while I was completing my masters in Rural and Environmental Sociology at the University of Montana. Over the past six years, I've been 'embedded' in their organization (as their executive director likes to say) on multiple occasions for varying purposes. In 2010, on a Center for Collaborative Conservation fellowship, I spent a summer in the Blackfoot researching aspects of 'transferring' the community-based conservation model. This particular community-based organization was also a critical entry point to this dissertation research beginning in January of 2013. During these two periods of research, I have officially interviewed over 30 participants of the Blackfoot Challenge, had many hours of unrecorded informal conversations (including three Blackfoot Valley raised and grass finished steak dinners at different rancher-board members houses), and have been a participant at two, week-long "transferability" workshops the organization has hosted in Montana (September 2012) and Idaho (October 2013).

During this time, I have personally witnessed an ebb and flow of tension, contradiction, and engagement between the leadership of the Blackfoot Challenge and requests from 'higher-level' or 'larger-scale' conservation initiatives wanting the Blackfoot Challenge to be involved with their respective 'landscape-level' initiative. During some conversations, the significance of connecting the Blackfoot Challenge to higher levels of governance seemed generally recognized and important. There is a realization that the social and ecological connectivity of the Blackfoot is dependent upon broader social and ecological dynamics. In fact, many of the resources that have accrued to the Blackfoot Challenge are because of the landscape-level ecological integrity of the larger region (money follows intact ecosystems and charismatic species such as grizzly bear, wolves, bull trout, etc.).

However, at other times the conversation veered towards contempt at the audacity of the assumption that the Blackfoot Challenge would participate in any initiative that didn't follow an established process of their consensus and partners-based approach developed over three decades of local collaboration. The heart of this dissertation inquiry is the tension that connects these multiple levels of social organization. A brief story can further illustrate this point.

In September 2011, at the 2nd Annual Roundtable on the Crown of the Continent, a long-time Blackfoot Challenge leader expressed nearly uncontrollable frustration when informed that 'the Roundtable' had listed the Blackfoot Challenge as a member of the leadership team on a document to be distributed to participants at the annual workshop. His frustration was not directed at being associated with the goals, objectives, or agenda of this "Roundtable", but rather that the Blackfoot Challenge was listed as a leadership team member based only on one Roundtable meeting (that the Blackfoot leadership participated) and prior to the leadership of the Blackfoot Challenge taking it to their board for a collaborative and consensus approval. This

caused significant stress to the relationship between the Blackfoot Challenge and the Crown Roundtable and the Blackfoot Challenge kept their distance from the leadership team for the next year and a half.

However, flash forward to January 2013 and the Blackfoot Challenge attends a two-day Roundtable on the Crown of the Continent 'leadership team' retreat outside of Glacier National Park with ten other individuals (strategically selected to represent different areas of the Crown of the Continent landscape) and remarks to me that the Roundtable has "found their niche and should continue focusing on what they are doing well - connecting people." As of January 2014, the Blackfoot Challenge remains very engaged with 'the Roundtable' leadership team, both providing direction to the broader Roundtable initiative and benefiting from the resources that the Roundtable on the Crown of the Continent is bringing into the region through their adaptive management initiative.

Interestingly, while participation in one landscape-level initiative has increased, tensions exist in others. Specifically, the Great Northern Landscape Conservation Cooperative (GNLCC) wants the Blackfoot Challenge to actively engage and participate in their initiative too. The Blackfoot Challenge is viewed as a source of legitimacy and credibility for the GNLCCs broader conservation and management efforts, and senior leadership of the GNLCC note to me in frustration that they "won't participate in anything if the decision isn't made at Trixie's" (the local bar in the Blackfoot Valley). The Blackfoot Challenge remains cautious at best of any type of formal connection to this landscape level initiative. Nonetheless, in spite of the lack of a formal or strong tie to the GNLCC, weak and indirect ties link the two organizations and the GNLCC has funded research and conservation projects in the Blackfoot watershed.

These stories illustrate the social and cultural complexity that make up the empirical context in the northern Rockies region, a region hereafter referred to as the Crown of the Continent landscape (note: Crown of the Continent *landscape* will be used to reference the region known as the Crown of the Continent so as not to confuse with the Roundtable on the Crown of the Continent organization). Moreover, these stories highlight the myriad of reasons that community-based conservation organizations would be involved in cross-scale networks, and the benefits, risks, and costs of being involved. There is a broad spectrum of incentives and barriers that exist for community-based organizations to engage in cross-scale networks, and integrating these multiple levels of social organization - either by design or by emergence - is an enduring question for environmental governance.

1.3 The Crown of the Continent Landscape and Its Organizational Complexity

The Crown of the Continent landscape in Northwest Montana is a socially and ecologically diverse area, which covers approximately 44,000 square kilometers (16,000 square miles or 18 million acres) and includes protected areas such as the Bob Marshall wilderness complex and Waterton-Glacier International Peace Park (see figure 1.2 below). The 18 million acres of the Crown of the Continent landscape stretches from the area north of Missoula and west of Helena in Montana, extending up into southwestern Alberta north of Canmore, and southeastern British Columbia. The Crown of the Continent landscape is a unique ecological crossroads where plant and animal communities from the Pacific Northwest, eastern prairies, southern Rockies, and boreal forests mingle. The glacier-carved mountains are also the headwaters for the major rivers of North America, including tributaries for both the Columbia and Mississippi Rivers, and where rivers originate and flow to the Pacific Ocean, Gulf of Mexico, and Hudson Bay. This particular landscape still retains its full complement of native

habitat and native predators - wolves, grizzly and black bears, cougar, coyote, fox, wolverine, bobcat, and lynx - as well as large populations of moose, elk, bighorn sheep, pronghorn, and deer. These factors make the Crown of the Continent one of the premier mountain ecoregions in the world (Prato and Fagre 2007).

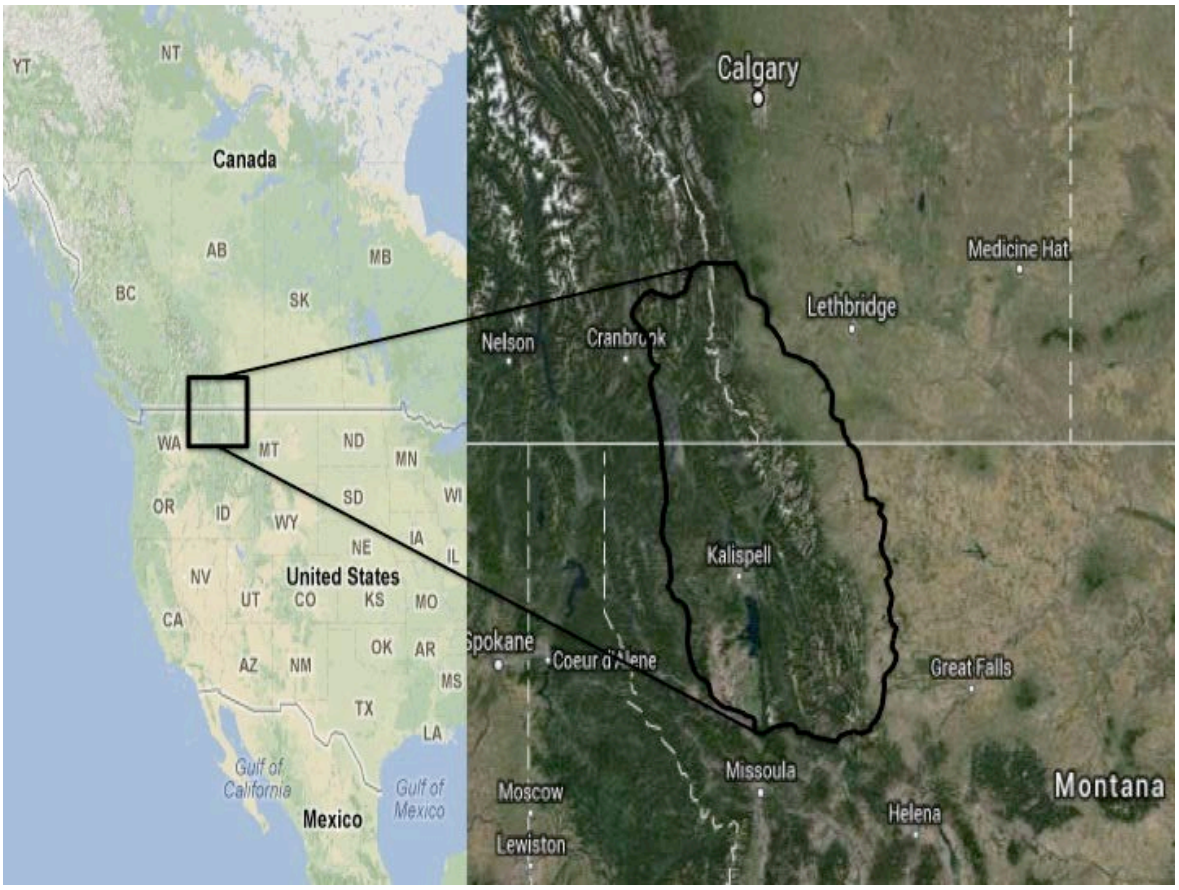


Figure 1.2. Map of the North America and Inset of the Crown of the Continent

Public lands comprise 83% of the Crown of the Continent Landscape, and are managed for multiple uses, including: recreation, biodiversity, water supply, timber extraction, and fish and wildlife habitat (Pedynowski 2003). National, state/provincial, municipal, and private lands make up the varied ownership and management jurisdictions. These variegated ownership patterns pose management challenges and this “jurisdictional fragmentation” requires that management at the landscape level engage in cross-tenure collaboration (Prato and Fagre 2010).

Across these tenures, there is a strong momentum to maintain the rural cultural and social fabric of regional economic livelihoods and traditional practices characterized in rural communities and tribal nations. This makes it an ideal region for experimental implementation of networked landscape conservation initiatives.

The organizational landscape is as complex and diverse as the ecological landscape. There are eight organizations that focus at the level of the Crown of the Continent landscape, of these I will primarily focus on and discuss two: the Crown Managers Partnership (CMP) and the Roundtable on the Crown of the Continent: (COCR). Additionally, there are several groups that work at continental scales of which the Crown of the Continent landscape is nested. Primarily, these include the Great Northern Landscape Conservation Cooperative (GNLCC) and the Yellowstone to Yukon initiative (Y2Y). Over the course of the dissertation, I will discuss Y2Y briefly, and the GNLCC will be a part of the discussion in several sections. Moreover, there are at least 20 community-based partnerships in the Crown of the Continent landscape that are local level, often private-landowner based, organizations interested in shaping the governance natural resource conservation. These include watershed partnerships such as the Teton River and Sun River watershed groups on the Rocky Mountain Front; groups such as the Clearwater Resources Council and Swan Ecosystem Center in the Seeley-Swan area; the Blackfoot Challenge; and numerous community-based groups working in the Flathead Valley. Tribal lands are also a part of the Crown landscape, and the Confederated Salish and Kootenai adds an important dimension to this research and I include them as community based groups in this research. See figure 1.3 below for the geographical distribution of these different groups (also, see figure 2.2 in chapter two for inset map of community-based groups).

Many of these community-based partnerships have worked hard to unite divergent interests in their locales, and are themselves already functioning networks. However, many of these local level initiatives must now think about how their interests fit within the even larger geographical, ecological and political levels of organization. To provide more context to the various organizations that work in this landscape, I will describe several in more detail below. Although I will not discuss every organization involved in this study in as much detail as those found in the next section, the snapshots will give a good overview of the types of organizations that were a part of this study.

Figure 1.3. Sample of Study Organizations and Operating Boundaries in the Northern Rockies

The Great Northern Landscape Conservation Cooperative

Landscape Conservation Cooperatives (LCC) were first proposed in June of 2009 as a climate change strategy, and in September of 2009 they were established by DOI Secretarial Order No. 3289. Facilitated by the Department of Interior (DOI), LCC's compliment and build upon existing science and conservation efforts – such as fish habitat partnerships and migratory bird joint ventures – as well as water resources, land, and cultural partnerships to aid in a collaborative, science based response to climate change. As stated in the LCC's information bulletins, these cooperatives seek to ameliorate the problems associated with habitat fragmentation, climate change, and water scarcity. It is important to note that the LCC's are mostly collaborations among professional science and technical expertise government agencies and NGOs, rather than a citizen-oriented or community-based network. A central premise for the LCC's is that by functioning as a network of interdependent units rather than independent entities, the partnerships can accomplish more than any single agency or organization can alone. The core functions of the LCC's are:

- Identify common science and conservation goals and priorities
- Develop science-based tools and solutions to meet shared conservation goals
- Support biological planning, conservation design and adaptive management
- Evaluate the effectiveness of scientific information and conservation actions.

The LCC that geographically covers the Northern Rockies is the Great Northern Landscape Conservation Cooperative (GNLCC).

The GNLCC encompasses the mountain and transitional habitats in the regions of Wyoming, Montana, Idaho, upper Green River basin in southern Wyoming and small parts of Colorado and Utah, and portions of the Interior Columbia Plateau reaching into Oregon and

Washington westward to the Cascade Mountains. The GNLCC also includes interior British Columbia and Alberta, Canada, to cover the entirety of the northern Rocky Mountains and mid-continent lowlands of the interior northwest. The GNLCC spans over 447,000 square miles, 57% of which is in the United States and 43% in Canada. The GNLCC is one of the largest LCC's in the country by surface area. Public lands managed by federal, state, and tribal agencies dominate the Great Northern geographic area. The area also includes extensive private timber, agricultural, and ranching lands providing a great opportunity to support ecosystem resilience in a coordinated fashion (GNLCC 2010).

The Crown of the Continent Roundtable

An ad hoc and informal landscape level regional conservation organization is the Roundtable on the Crown of the Continent (hereafter, the Roundtable or COCR). The Roundtable began as an informal workshop to explore common interests of regional citizens in 2007, and has subsequently developed into a regional forum where major stakeholders, communities, and agencies in and around the ecosystem can discuss shared challenges and opportunities to work together to sustain and enhance the region's cultural, community, and conservation values. In some cases, these members are science and technical expertise professionals such as found in the LCCs, other stakeholders are more community oriented NGO-types. The Roundtable is not a formal organization, but an initiative seeking to provide a space for dialogue among the various stakeholders in the Crown of the Continent region and has self-labeled itself a 'network of networks'.

The Lincoln Institute of Land Policy started the Roundtable as a forum to exchange ideas, build relationships, identify shared values and interests, and facilitate working relationships. In addition to periodic forums, workshops, and an annual conference, the Roundtable has taken

steps to convene policy leaders representing major jurisdictions within the Crown of the Continent landscape and views itself as a large-scale experimental pilot project on large landscape conservation implementation. It does so by aiming to minimize the distance between organizations, agencies, and individuals interested in conservation. Even though it has only been in place since 2007, with more than 100 participants spanning the public and private sectors, this "network of networks" has built an impressive foundation for connecting a wide variety of interests in the Crown of the Continent landscape. The Roundtable invites interested individuals, organizations, communities, partnerships, and/or agencies to be a signatory of the Friends of the Crown statement. This statement indicates that the signatory upholds the common values and shared principles (such as healthy landscapes, working lands, local economies, livable communities, learning, working across boundaries, etc.) and that any action taken supports these values. For more on the Roundtable see Wyborn and Bixler (2013). The Roundtable on the Crown of the Continent sponsors the Adaptive Management Initiative that will be discussed in detail in chapter six.

Blackfoot Challenge

The Blackfoot watershed in Montana is located in northwest Montana, at the southern end of the Crown of the Continent landscape. The Blackfoot River flows 132 miles from the headwaters at the continental divide northwest of Helena to the confluence with the Clark Fork River just outside of Missoula. The Blackfoot Watershed totals about 1.5 million acres, with private ranchlands (24%) comprising most of the foothills and lower valley and the upper, forested and mountain areas being owned and managed by the State (5%) and Federal (49%) governments as well as Plum Creek Timber Company (20%).

In 1991 the Big Blackfoot chapter of Trout Unlimited sponsored a meeting with the objective of creating a new organization as a conduit for information sharing in the Blackfoot valley (Bixler and Taylor 2012). Two years after the initial meeting was organized by Trout Unlimited, the 'Blackfoot Challenge' was officially formed as a 501 3 (c) non-profit in 1993 (for a more complete analysis of the institutional evolution and organizational development of the Blackfoot Challenge in the early years see Weber 2009). Today's Blackfoot Challenge is a landowner-based organization that coordinates management of the Blackfoot River watershed from ridgetop to ridgetop, including tributaries and adjacent lands with a stated mission to enhance, conserve and protect the natural resources and rural lifestyles of the Blackfoot River Valley for present and future generations (Blackfoot Challenge 2013). The Blackfoot Challenge has expanded beyond its initial focus on water to include conservation, education, forestry, weeds, and wildlife as indicated by the organizations internal committee's. Participants in these committees span the public-private bridge, including federal agency personnel (USFWS, USFS, BLM), state agencies (Montana Fish, Wildlife, and Parks), local and national non-profits (e.g. The Nature Conservancy and Five Valley's Land Trust), and local ranchers and landowners.

Clearwater Resource Council

The Clearwater River is one of four primary tributaries of the Blackfoot River in the Southwestern Crown of the Continent that is comprised of a series of lakes, wetlands, and streams that drains the Seeley Lake basin. The Clearwater River is a source of clean, cold water to the Blackfoot River and is located between the Mission Mountains to the west and the Swan Range (the western boundary of the Bob Marshall Wilderness Complex) to the east. The riparian habitat is home to hundreds of animals, plants, waterfowl, and songbirds and the river and its streams support some of the few remaining genetically pure populations of westslope cutthroat

trout and populations of threatened bull trout. Native terrestrial species include grizzly and black bear, bald eagle, and other small mammals that use riparian corridor as migration and foraging areas.

Recognizing these important ecological values, the Clearwater Resource Council formed in 2003 with a mission to initiate and coordinate efforts that will enhance, conserve, and protect the natural ecosystems and rural lifestyle of the Clearwater River Watershed of Montana for present and future generations. The organization is based in Seeley Lake, Montana where approximately 2,200 people reside year around. Landownership patterns in the watershed reflect a mix of state, federal, and private lands and the amount of non-industrial private land is relatively small at 8%, most of which is clustered around Seeley Lake. With this relatively small "footprint", Seeley Lake has transformed itself from its early days as a logging camp and a few summer lake homes to the largest town in the greater Blackfoot Watershed and the largest unincorporated town in Montana. The family-owned, Pyramid Lumber sawmill is the single largest employer and the timber industry remains the largest employment sector in the community.

Two initial projects helped establish CRC in the community and the broader organizational field of the Crown of the Continent. First, the Council worked with wildfire management agencies to craft a fuel reduction program, allocating federal grant assistance to homeowners to thin their properties. This effort resulted in the formation of the Seeley Lake Fuels Mitigation Task Force that has obtained over $500,000 in funding to assist private landowners with fuels mitigation in the valley. A second effort has been the work of the CRC weed task force that has developed a coordinated invasive weed management strategy for the valley. The noxious weed committee has mapped weed locations or absence on over 600 miles of

roads, trails, and transects in the Valley and is funding strategically located control of the weeds that have been mapped. As part of this project, they also provide educational materials on re-vegetation options following weed reduction.

1.4 The Road Ahead

Following this section, chapter two will present the background methods and methodology, as well as the 'grounded' analytical framework that was developed to analyze across the empirical chapters. After first addressing the ontological and epistemological approach I take, namely a perspective of critical realism, I then proceed to discuss both the qualitative and quantitative methods. I present the stakeholder categories of the research participants as well as describe the process of 'grounded theory' I employed in this research. Through the grounded analysis of the qualitative and SNA data, an overarching analytical framework emerged for this analysis: social, cultural, and assemblage connectivity.

Chapter three will present the background literature for the dissertation. One key argument is that the emergence of landscape conservation and network governance is the confluence of two increasingly important resource management tools and theories: landscape ecology and community-based conservation. The literature base that informs this project is interdisciplinary and complex and the literature review begins with discussing the trend to conceptualize environmental governance. In many ways, this has emerged from several decades now of community-based conservation research both domestically and internationally. More recently, many strands of resource management theory have emerged that include different varieties of 'collaborative' and 'adaptive' approaches. These will be discussed, followed by a review of an important piece of these approaches – the nature of knowledge, knowing, and learning. Then the literature on network governance and social networks in natural resource

management will be addressed. The review then shifts to a brief discussion of the landscape ecology, non-equilibrium ecology and resilience, leading towards a discussion of the current state of the literature on 'landscape conservation.'

Following chapter three, I present my first empirical chapter: invasive species management. Invasive species management, primarily noxious weed control, is not a flashy attention grabber like carnivorous and charismatic mega-fauna. However, it is an issue with widespread salience and relevance across a spectrum of individuals and organization types as indicated by being brought up in interviews by a large majority of research participants. The way local groups are organized illustrates the importance of this topic for those 'on-the-ground', moreover, the highest level of Department of Interior officials have also emphasized their interest in weed management through the America's Great Outdoors Crown of the Continent demonstration landscape project. Certain variables are highlighted to illustrate important factors that contribute to a broader network alignment that achieves landscape-scale outcomes while enhancing community-based conservation. This chapter will illustrate that certain network characteristics are noteworthy, such as community-based groups being at the 'core' of this broader network and regional initiatives holding key positions that 'bridge' different network groups. However, a narrow focus on network structure doesn't explain the motivations for participants to engage in the network and so here I turn to problem framing and the role of narratives, discourse connectivity. Invasive species are framed as the ultimate 'other' and this is illustrated by invasives being framed as 'invaders' and as 'economic threats.' Weeds are also illustrated here as an active 'actor' in this network of landscape conservation.

Chapter five presents the next issue case study, grizzly bear conservation. Analyzing the informal networks of grizzly bear conservation illustrates the ways that 'weak-tie' relationships

between scientists and land conservation practitioners move information to inform land conservation (conservation easement) opportunities. Importantly, several organizations are positioned to 'bridge structural holes', and as such these organizations have an informational advantage that puts them in a key 'boundary-spanning' position. Moreover, as this section illustrates, often these boundaries are cultural and grizzly conservation also illustrates important dimensions of problem framing and narrative building. "Where the grizzly walks the earth is healthy," says one research participant, illustrating the dimension that the grizzly is an umbrella species and this informs a broader narrative about the value of grizzly bears on the landscape. Moreover, I illustrate how changing social contexts and practices can build narratives that are inclusive of grizzlies and how technologies and non-human actors become a part of the network of landscape conservation.

The final issue case study deals with climate adaptation. Climate change adaptation is of a central concern for cross-scale governance networks because many of the impacts, and adaptation, will occur locally. Strengthening the role of community-based conservation may be a fundamental key to broader systemic adaptation efforts for both local livelihoods as well as natural resources. In many ways, climate change drives this push towards landscape governance and thinking in terms of ecological connectivity. Ecological connectivity is crucial to the maintenance of biodiversity under scenarios of a warmer climate, giving species the freedom to range across north-south latitude as well as seek habitat at higher elevations. To implement these effects, a strong base of social connectivity needs to exist. I will discuss primary aspects of relationship and trust building because regardless of the 'scale' or magnitude of the challenge, effective conservation must require a foundation of relationships and trust. Boundary spanners

can play an important role in trust building. I will illustrate that the framing of ‘scale’ goes hand-in-hand with framing the problem.

As will be illustrated (or as may be obvious), the cases work in a progression of social-ecological complexity culminating with the contemporary challenge of natural resource management and climate adaptation. Exploring cases where cross-scale networks have effectively mobilized towards governance ends may help shed light on how to mobilize similar networks towards climate adaptive natural resource management. The conclusion will discuss the theoretical and practical implications of this research.

CHAPTER TWO: METHODS AND ANALYTICAL FRAMEWORK

2.1 Ontology and Epistemology

Descriptions of research methodology often begin with a discussion of the philosophical basis on which the research rests. Critical realist positions in the social sciences deny that we can attain a single, "correct" understanding of the world and agree that all theories about the world are grounded in a particular perspective and world view, and that all knowledge is partial, incomplete, and fallible. A critical realist position combines ontological realism with epistemological constructivism (Sayer 2000). In many ways, early sociologist of knowledge Karl Mannheim (1936) put forth a very similar perspective. In particular, I adopt and apply a version known as critical realism as established by Bhaskar (1989) and Cook and Campbell (1979), and applied elsewhere (Bixler 2013). A critical realist perspective acknowledges that knowledge creation and action are contextualized within an assumed independent material reality (Benton 2001). These arguments are relevant to debates concerning the management of ecological resources. On the one hand, it assumes an independent ecological reality where biogeophysical processes occur that sustain life and therefore ontologically distinguishes itself from relativist deconstruction. As Jasanoff states, "if our field [science and technology studies] is to regain the significance it was once thought to hold for public policy, it will need, first and foremost, to get rid of the label 'deconstruction'" (2004: 65).

However, on the other hand, critical realism is differentiated from scientific objectivism by highlighting how scientific explanations of environmental change provide only partial insights into complex biophysical processes, and that existing models of explanation reflect the agendas of societies that created them (Forsyth 2001). Critical realism, thus, acknowledges that there is a distinction between the way things are and our knowledge claims about those objects of

knowledge (Carolan 2005). This distinction is relevant as explanations of 'real' ecological problems may only address certain aspects of biophysical change and may not represent the interests of social groups not included in the science process.

Nonetheless as a study centered on the role of particular actors and organizations within the processes of governance, policy making, and conservation delivery, this research has conceived of these contextual processes as occurring through networks and as influencing and being influenced by problem frames and institutions. This perspective suggests a relational, constructivist ontology where knowledge is influenced and constructed through relationships. The focus on problem frames and institutions suggests an interpretivist or hermeneutic epistemology and the focus on networks points to the ways in which our connections influence the interpretation of the world.

2.2 Research Methods

The empirical basis for this dissertation began in September 2012 with participant observation, and then four months of on-site fieldwork from January 2013 to April 2013. For this project, I utilized data collection and analytical techniques that combine social network analysis (SNA) with qualitative field research methods. Substantial benefits have flowed from combining SNA with interviews, ethnography and historical research (Cross 2011). Mixing social network data with other methods adds the context to help interpret network data. It can also produce an outside view of the network structure to add to an inside view of the content, quality and meaning of network ties. Mixing methods also provides a focus on network dynamics through mapping the evolution of network structure and exploring the reason for these changes. The combination of quantitative and qualitative data allows us to capture both structure and process of these relationships.

There is also a theoretical justification for the use of mixed methods in this research. In the context of these environmental governance systems, structures and processes/personalities play a reflexive role in shaping each other. SNA explicitly assumes that actors participate in social systems connecting them to other actors, whose relations comprise important influences on one another's behavior. The regular patterns of relations that connect actors influence perceptions, beliefs, decisions, and actions by a variety of structural mechanisms that are socially constructed by relations among entities. Direct contacts and more intensive interactions dispose entities to better information, greater awareness, and higher susceptibility to influencing or being influenced by others. Those patterns of relations also influence process. Networks are considered a "meso-" level concept that mediates relationships between macro-level institutions (both formal and informal) and micro-level individual behavior (Evans 2001). This helps conceptualize how micro and macro variables influence the structure of networks, how the structure of networks in turn influences micro-level behavior and macro-level variables, and how the constellation of macro-level variables, microlevel behavior, and network structure implicit in a governance system will influence outputs and outcomes (Lubell et al. 2012).

The central objective of combining network analysis and qualitative inquiry is, then, to represent those structural relations accurately, and to explain both why they occur and what are their consequences. Moreover, as this dissertation will discuss, understanding the ways that networks and narratives interact is foundational to understanding each on its own.

2.2.1 Qualitative Methods

The fieldwork followed a qualitative research methodology that included two interrelated methods, participant observation and interviewing (Lofland et al 2006). Moreover, my approach is grounded in ethnographic research where immersion, frequent visits and participant

observation establish trust between researcher and respondents, and provide depth knowledge of people, their activities, and a place (Cresswell 1998).

I began my interview sample through previously established contacts in three landscape conservation initiatives, the Great Northern Landscape Conservation Cooperative (GNLCC), the Roundtable on the Crown of the Continent (COCR), and the Southwestern Crown Collaborative (SWCC), and the community-based initiative the Blackfoot Challenge. I used a purposive snowball technique in which I asked participants to provide me with names of others with valuable perspectives (Bryman 2004). This brought me into contact with key decision-makers, community leaders, and a range of conservation professionals and practitioners. An interview guide was used to ensure consistency across participants; however, participants were also encouraged to talk about topics of interest to them (see Appendix A for survey tools). The interviews, which ranged from approximately 40 minutes to 1.5 hours in length, were digitally tape-recorded and transcribed verbatim to permit detailed coding (Strauss and Corbin 1998). In total, I conducted interviews with 62 participants. While the sampling was purposive, it also followed a rough quota framework; that is I sought proportional representation from community-based practitioners and landscape-level practitioners working in the Crown of the Continent landscape. See map below for location of interviews (note: the entire sample is not indicated on the map as more than one interview took place in the same town/location).

As the table 2.1 below indicates, I interviewed 25 participants from community-based organizations, 25 from landscape-level initiatives, and an additional 12 participants of which the majority were practitioners working in the Greater Yellowstone Area (GYA).

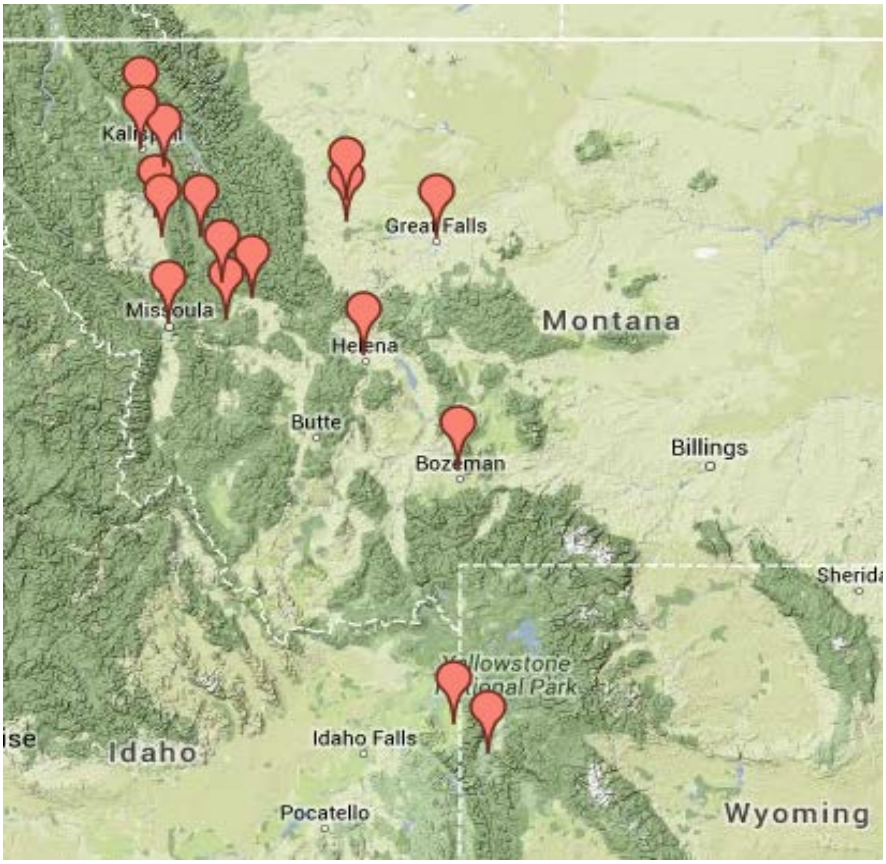


Figure 2.1. Map of Interview Sites

Table 2.1. Interview Research Participants by Subgroup

Community-based Groups	**25**
Blackfoot Valley	5
Rocky Mountain Front	5
Clearwater and Swan Valley	6
Confederated Salish and Kootenai Tribe	4
Flathead Valley	5
Landscape Initiatives	**25**
Southwestern Crown Collaborative	9
Crown of the Continent	8
Great Northern LCC	8
Additional Participants	**12**
(Primarily includes organizations from the Greater Yellowstone Area = 7; native restoration contractor that works in the Blackfoot = 1; Regional conservation NGOs = 2; and southern Crown NGOs = 2)	
Total	**62**

Moreover, I sought representation from the major geographical ‘community-based areas’, including the Blackfoot (5), Rocky Mountain Front (5), Clearwater and Swan (6), Confederated Salish and Kootenai (4), and Whitefish and the Flathead Valley (5). See figure 2.2 below for community.

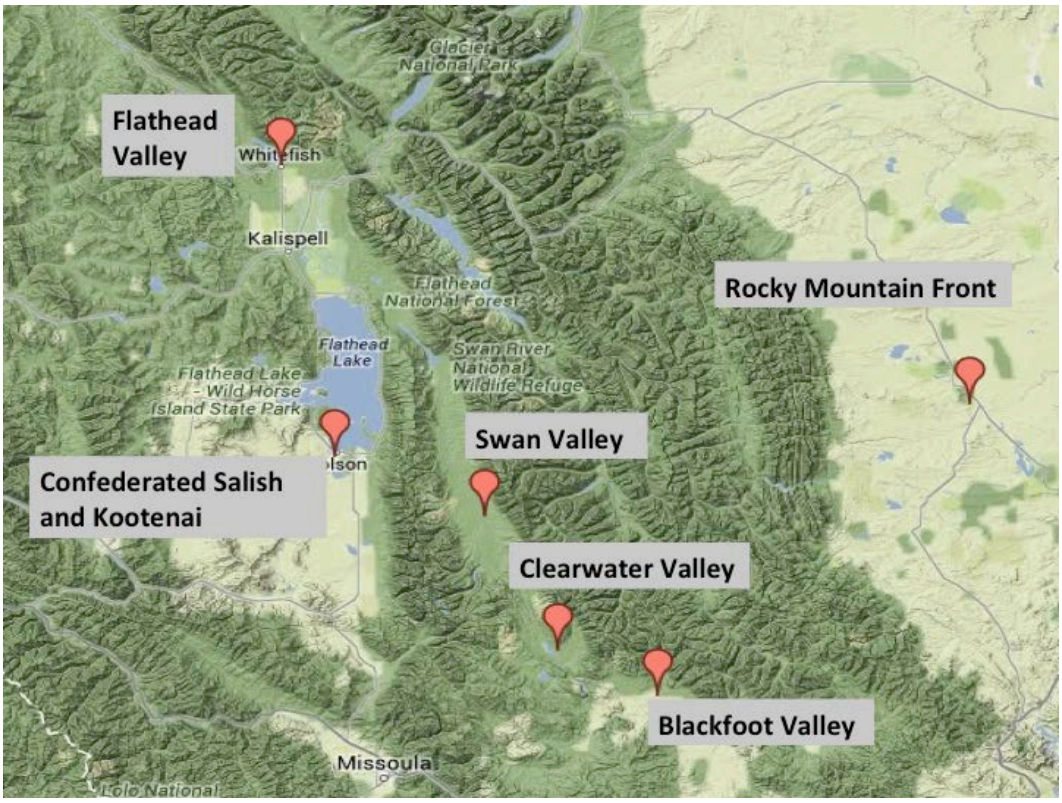


Figure 2.2. Map of Community-based Locations of Interview Participants

The data was analyzed using QSR N10 (NVivo) software. Analysis of the emerging concepts was done through an initial coding and recoding of the data, followed by a second set of codes that emphasized the emerging relationships between previously coded themes (Charmaz 2006; Strauss and Corbin 1998). The resulting codes ranged from the very substantive that pointed to information about specific topics of interest, such as “landscape conservation”, “invasive species”, “grizzly bear”, and “climate change”; but also more abstract concepts such as “trust”, “learning”, “uncertainty”, and “knowledge”. Some of the highest frequently coded nodes

included, “Collaboration/Network” (121), “Communication” (107), “Cross-scale” (85), “Coordination” (79), and “Barriers” (55). This analysis followed a grounded theory approach that through the coding and recoding looked for unifying themes and ‘rich’ underlying issues (Charmaz 2006; Strauss and Corbin 1998). The codes that emerged were grounded in the different literature bases on networks, network governance, landscape conservation, and adaptive co-management.

The participant observation included 17 days of events (workshops, retreats, meetings), twenty-three additional hours of meetings (board meetings, advisory team calls and webinars), and many more many hours of informal activities and in conversation with both landscape-level, regional workshops and leadership meetings as well as with local community members and community-based groups throughout the Crown of the Continent landscape. These informal interactions and associated activities provide a valuable social context for interpreting the content of the interviews, as well as additional data in the form of field notes. In many respects, the participant observation extends back to previous research with the Blackfoot Challenge starting in the summer of 2010.

In addition to the interview transcripts and field notes, supplemental documents (policy documents, press releases, internal and external reports) were analyzed to seek confirmatory or contradictory information relative to the emergent analytical themes found in the interviews. These reports and strategic conservation plans help triangulate the veracity of claims (Yin 2003).

Despite the "Crown of the Continent" landscape extending into parts of Alberta and British Columbia, interviews primarily focused on American stakeholders. This methodological decision was made for two reasons. One, budget constraints of this research prevented extensive travel beyond the home site located in Missoula, the southern end of the Crown of the Continent

landscape. Two, American policy and federal funding remains targeted at the US side only. For example, between 2014-2015, over $100M USD is being invested in the Crown of the Continent region through America's Great Outdoors initiative. Moreover, the Crown of the Continent region was selected as a Land and Water Conservation Fund (LWCF) landscape for collaborative funding. These funding mechanisms are contributing large sums of money into the region for conservation work. However, as American taxpayer money, these funds are explicitly designated for research, capacity building, land transactions, and on-the-ground restoration work only on the American side of the Crown region. Thus, there are high stakes in better understanding the dynamics of conservation efforts in the Crown landscape on the U.S. side.

2.2.2 Social Network Analysis

To capture the ties among stakeholders in the Crown of the Continent landscape, I developed and implemented an online social network survey. This survey was sent to all of the interview participants, as well as other leaders in community- and landscape- level conservation initiatives. In total, this survey was sent to 67 people. The social network survey asked respondents to report their ties across four substantive areas:

1. Natural resource management in general (e.g. "Please list up to ten individuals or organizations from whom you received or provided information, advice, or expertise related to natural resource conservation in the past year. These may include individuals from federal, state, or local agencies; foundations, non-governmental organizations, community-based groups, tribal nations, or private consultants. Please be as specific as possible")
2. Invasive species management (i.e. Please list up to ten individuals or organizations from whom you received or provided information, advice, or expertise related to terrestrial or

aquatic invasive species. When applicable, if individuals are listed please identify their organizational affiliation")

3. Climate Adaptation (i.e. "Please list up to ten individuals or organizations from whom you received or provided information, advice, or expertise related to climate adaption science or planning. When applicable, if individuals are listed please identify their organizational affiliation.")
4. Funding (i.e. "Please list up to ten individuals/organizations from whom you received funding related to natural resource conservation related work in the past year. These may include federal, state, or local agencies; foundations, non-governmental organizations, community-based groups. When applicable, if individuals are listed please identify their organizational affiliation.)

In network analysis, the respondent to the questions above is considered the "ego." The survey used a name generator to gather information on other nodes in the network (Marsden 1987; Knoke and Yang 2008). The ego-respondent was asked to name up to ten individuals and/or organizations with which the ego had direct contact. The ego-respondents answers are known as "alters." Alters are those who the respondent is directly connected (Knoke and Yang 2008). An ego network consists of focal actor (the respondent, the ego) and the actors to whom the ego is directly connected, the alter (Knoke and Yang 2008). See figure 2.3.

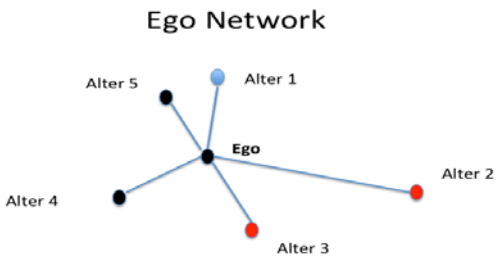


Figure 2.3. Hypothetical Ego Network

This information was collected for each respondent and structured into a network matrix (that follows the format in table 2.2 below).

Table 2.2. Ego-Alter Network Matrix

Egos		**Alters**		
Ego 1	Alter1	Alter 2	Alter 3	Alter…n

Additional data was also collected on the ego-respondent. As part of the survey, the respondents were asked to identify their "primary organizational affiliation", as well as how they identify the "type" of their organization across the following choices: community-based organization, science-based NGO, regional NGO, state agency, federal agency, other. Following Dillman (2007), I sent out three follow-up email messages to non-respondents. Of the 67 people contacted to complete the survey, a total of 39 people completed the survey resulting in a response rate of 58.2%. This response rate, 58%, is higher than comparable social network environmental governance research (see Romolini et al. 2013; Prell 2011). The respondent's distribution is below in Table 2.3.

Table 2.3. Distribution of Respondents Based on Organizational Type

Community-based Groups	10
Regional NGO	10
Science-based Organization	7
State Agency	3
Federal Agency	9
Total	**39**

Nodes in a network can be individuals, organizations, or groups and a methodological decision is made after considering the various roles of individuals, groups, and organizations in the research context (Cross et al. 2009). The network surveys asked respondents to name (as alters) individuals, while also asking respondents to list the individual's organizational

affiliation. In many cases, respondents listed only organizations without naming particular individuals, thus making it impossible to develop a complete network diagram of the individual connections. For example, when asked with whom they shared information about invasive species, a common response was the US Forest Service; however, in only 9 of 18 cases was a specific individual listed. Analyzing only a matrix of individuals would have reduced my data points by excluding key organizations and provided a less complete picture of the conservation network in the Crown of the Continent landscape. Therefore, I grouped individuals into their respective organizations for analysis, the process that is described below.

In order to retain the most robust data, I adjusted the analytical strategy. During the initial stages of the analysis, I used the ego-respondent's names (individuals) as the ego, and represented the alters as a mix of individuals and organizations, as directly reported by the survey respondents. This process resulted in a network matrix that was challenging to analyze and results that were difficult to interpret when grounded in the qualitative and case study knowledge. For example, in some cases respondents would list an individual (individual A) that works in organization (A). The next respondent didn't list individual names, but rather only organizations, and also reported a direct tie to organization A. This created a network with both individuals and organizations as nodes. However, based on my background knowledge of the study area as well as with organization A, I know that organization A only has 2 staff members, and based on the qualitative data I know that individual A is who the second respondent was referring. In order to reconcile this discrepancy where individual A would have an in-degree of 1 and organization A would have an in-degree of 1 (despite my knowledge of them being the same), I combined the individual with the organization, to only have organizations as nodes. In

this hypothetical case, organization A now has an in-degree of 2 which is a more accurate representation of the network than if the ties were split between individual A and organization A.

Translating all individuals to organizations as nodes did reduce the detail about individual actors in the network, but it has the benefit of more accurately mapping the relationship between organizations. After considering the roles of various individuals and organizations across the study area, organizations, rather than individuals, were selected to be the nodes of the network. To maintain consistency, I also combined the ego-respondents into their organizational affiliation. From a total of 39 respondents, this resulted in 32 egos (e.g., there were four Forest Service ego-respondents, that resulted in one Forest Service "ego"). The limitations of this approach with be discussed below.

Another methodological decision was made to use the name-generated data collected from each ego, and combine the ego-alter data to represent a whole network. The ego-alter data collected from each respondent was combined into one matrix to create a larger inter-organizational network matrix (see Table 2.4 below).

Table 2.4. Interorganizational Network Matrix

Egos	**Alters**			
Ego 1	Alter1	Alter 2	Alter 3	Alter…n
Ego 2	Alter1	Alter 2	Alter 3	Alter…n
Ego 3	Alter1	Alter 2	Alter 3	Alter…n
Ego…n	Alter1	Alter 2	Alter 3	Alter…n

There are some specific issues of methodological importance when discussing a "whole network" as defining the boundaries around populations within which social interactions of actors are to be measured and analyzed is in many cases non-trivial. Since everyone in some sense can be seen as connected to everyone else (via others), carefully defined system boundaries are necessary. In the cases discussed here, the population is not necessarily easily definable, as

not all individuals/organizations have been surveyed. The geographical and social space and organizational population is too large to get a complete network analysis. The network presented is a sample of the interorganizational "whole network." While this approach does allow for important network dynamics to be analyzed and discussed, particularly identifying specific node attributes such as organizations with high prestige and betweenness centrality, it is incomplete because some organizations that are in this network were left out of this representation of the network.

Since the name-generator network questions were open-ended, an ego-respondent could list up to ten alters. In some cases respondents did list other individuals or organizations that were also ego-respondents, however, in many cases the ego-respondents named a "unique" individual or organization that was not included in the survey population. When this was the case, those unique organizations were added to the original population to create an expanded network population of organizations. Table 2.6 and table 2.8 below display the network sample population for invasive species and climate adaptation, respectively.

Social Network Data for Chapter Four and Six

Chapter four on invasive species uses social network data collected from the online social network survey. Some participants omitted answering the invasive species question, which reduced the total number of respondents to 36. Since multiple individuals responded to the survey from the same organization, the 36 ego-respondents were reduced down to a total of 28 organizational egos. These egos became a part of the inter-organizational network matrix. 189 direct ties or links to alters were identified. From the total of 189 ties reported, a total of 86 organizational alters were generated. The organizational types of the egos and alters are listed below in table 2.5.

Table 2.5. Invasive Species Ego and Alter-Organization Types

Organization Types of Alters (Invasive Species)	**# of ORG Egos**	**# of ORG Alters**
Community-based Groups	8	40
Regional NGO	9	15
Science-based Organization	4	12
State Agency	2	9
Federal Agency	5	10
Total	**28**	**86**

These specific organizations are listed below in table 2.6 In addition to the organization's name, table 2.6 indicates if the organization was a respondent (ego), the out-degree of that ego, the total incoming ties (in-degree) of each organization, and how many of those were identified as specific individuals (in parenthesis). So, for example the first organization listed below, the Blackfoot Challenge, had one individual take the survey (ISM Ego = **1**), they have an out-degree of **8,** they were nominated by other respondents seven times – in-degree = **7** (3), and in three instances was a specific individual listed (Individuals = 7 (**3**). The bottom row of the table also indicates how many ego-respondents were combined into ego's (i.e., the 36 respondents resulted in to 28 egos), and how many total ties were reported (189) to the total number of alters (58) that were reported in addition to the surveyed organizations (a total of 86 nodes).

Chapter six on climate adaptation followed the same methodological process as described above for chapter four. The network data was collected from the online social network survey, and a total of 37 responded to the climate adaptation question. The 37 ego-respondents resulted in a total number of 30 organizational egos for the network matrix. Two hundred and twenty-two direct ties or links to alters were identified. From the total of 222 ties reported, a total of 67 organizational alters were generated. The organizational types of these alters are listed below in table 2.7.

Table 2.6. Climate Adaptation Ego and Alter-Organization Types

Organization Types of Alters (Climate Adaptation)	**# of Org Egos**	**# of Org Alters**
Community-based Groups	9	14
Regional NGO	8	18
Science-based Organization	6	34
State Agency	2	7
Federal Agency	5	7
Total	**30**	**80**

Each of the 80 organizations is listed below in table 2.8. Table 2.8 lists the organizations, indicates if the organization was a respondent (ego), how many incoming ties (in-degree) each organization had, and how many of those were identified as specific individuals (in parenthesis). The bottom row of the table also indicates that 38 respondents were combined into 30 organizational egos, there were 222 ties reported, and a total of 50 alter-organizations that were in addition to the surveyed organizations. While social networks analysis methods are widely used to evaluate the structure of inter-organizational networks, like any kind of data, the findings need to be interpreted in context with caution. Most of the rich volume of social network research has been conducted on relationships between individuals (Gulati et al. 2011), that is the node or actor is an individual and not an organization. However, for reasons discussed the analytical decision was made to use organizations as the nodal unit for the network analysis. The organizations are listed below in table 2.7 and 2.8.

Table 2.7. Organizations in the Invasive Species Network with Network Characteristics

Ego Organizations and In-degrees				Alter Organizations and In-degrees			
# of Egos	Out-deg	Organization	In-Degree (Individuals Named)	Alter Organization	In-Degree (Individuals Named)	Alter Organization (cont)	In-Degree (Ind Named)
1	8	Blackfoot Challenge	7 (3)	America's Great Outdoors	1	Missoula Fire Laboratory	1
2	10	BLM	2	Aquatic Nuisance Species Council	1	Montana State University	2
2	15	Center for Large Landscape Cons	1 (1)	BC Forest Lands and NR	1 (1)	Montana Watercourse	1
1	6	COTC Roundtable	1	Boat Education	1	MT Dept of Ag	1
1	10	CRC	6 (4)	Bonneville County	1	MT Dept. of Env Quality	1
1	10	Crown managers Partnership	17 (15)	Canfor	1 (1)	MT FWP	15 (8)
1	6	East Kootenay C.P.		CCCI	1 (1)	MT Weed Control Association	2
1	9	Flathead Basin Commission	9 (6)	Central Kootenay Plant Council	2 (1)	Nature Conserv of Canada	2 (1)
1	5	Friends of the Teton River	1 (1)	Clark Fork Coalition	1	North Pacific LCC	1 (1)
2	16	GNLCC		Community Food and Agriculture Coalition	1	Northwest Connections	1
1	13	Greater Yellowstone CC	2	Conserve Montana	1	NRCS	1
1	5	Heart of the Rockies		Cooperative Weed Management Association	1 (1)	Old Man Watershed	2 (2)
1	5	MT DNRC	5 (3)	CSKT	5 (2)	Park County Weed	1
1	10	National Parks Conservation		East Kootenay Invasive Plant Council	2 (2)	Ponderosa Snow Warriors	1
1	10	NPS	4 (1)	Five Valleys Land Trust	1	Powell County Weed Committee	1
1	3	Sun River Watershed Group	2 (2)	Flathead Lake Biological	2	Snake River Fund	1 (1)
2	10	Swan Ecosystem Center	1	Fremont County Weed	2	Swan Lakers	1
2	10	SWCC	1	Goat Mountain Ranch	1 (1)	Teton County Weed and Pest	1
1	8	Teton Regional Land Trust		Great Basin LCC	1 (1)	The Nature Conservancy	3 (1)
1	6	The Wilderness Society	2 (1)	Hold the Line	1	Trout Unlimited	3
1	10	U of Montana	3 (2)	Idaho Fish and Game	4 (3)	U of Wyoming	1
4	18	USFS	18 (9)	Inlands Forest Management	1	US Bureau of Reclamation	1
1	4	USFWS	1	International Joint Commission	1 (1)	US EPA	2 (1)
2	3	USGS	10 (5)	Invasive Species Action Network	2 (1)	WCS	5 (2)
1	1	Vital Ground		Jefferson County	1		
1	3	Water Matters	1 (1)	Kootenai River Network	1 (1)	Wildsight	1 (1)
1	2	Yellowstone Business Partnership		Madison County Weed	2	Working Dogs for Conservation	1 (1)
1	1	Yellowstone to Yukon		Mainstreams	1 (1)	Working Lands Council	1
				Missoula County Open Lands Committee	1	WY Fish and Game	1
				Missoula County Weed	6 (1)		

Total Egos: 28 — Total Alters: 58

Total Ego-respondents: 36 — **Total Linkages Reported: 189**

Total Nodes: 86 — **Total Edges: 162***

*** The difference between total linkages and total edges, where total linkages are reported and edges are ties between two organizations, multiple linkages to one organization makes a stronger tie.**

Table 2.8. Organizations in the Climate Adaptation Network with Network Characteristics

Ego Organizations and In-degrees				Alter Organizations and In-degrees			
# of Egos	Out-deg	Organization	In-Degree (Individuals Named)	Alter Organization	In-Degree (Individuals Named)	Alter Organization (cont)	In-Degree (Ind Named)
1	4	Blackfoot Challenge	1	350.org	1 (1)	MT Gov Drought	1
2	15	BLM	3	Alberta Biodiversity Monitoring	1	National Adaptation	1
2	16	Center for Large Landscape Cons	9 (8)	Alberta Gov	1	National FF	1
1	8	COTC Roundtable	3 (1)	Blackfeet Confederacy	1 (1)	National Wild Fed	1 (1)
1	3	CRC	1 (1)	Bonneville Env Foundation	1 (1)	Pew Foundation	1
1	10	Crown managers Partnership	4 (1)	Brainerd Foundation	1	Private Landowner	1 (1)
1	4	East Kootenay Cons Partnership		C3	1	Return on Insight	2 (1)
1	10	Flathead Basin Commission	1 (1)	California Academy of Sciences	1	The Nature Conservancy	2
1	7	Friends of the Teton River		CCCI	5 (4)	Wilderness Association	1
1	8	GNLCC	9 (5)	Clark Fork Coalition	2 (2)	Trout Unlimited	3 (2)
1	10	GYCC	4 (1)	Clark Fork Task Force	1	Trust for Public Land	1 (1)
1	7	Heart of the Rockies		Climate Action Reserve	1	U of Alaska	1 (1)
1	7	Miistakis Institute	1 (1)	Climate Science Centers	1	U of Alberta	1 (1)
1	3	MT DNRC	2	Columbia Basin Trust	1	Lethbridge U	2 (1)
1	10	National Parks Cons Association		CSKT	5 (3)	US Bureau Reclamation	1
1	10	NPS	7 (1)	EcoAdapt	3 (3)	US EPA	
1	3	Sun River Watershed Group		ECOS	1 (1)	Western Governors	1
2	2	Swan Ecosystem Center		Flathead Lake Biological Station	1 (1)	Wilburforce Foundation	1 (1)
2	7	SWCC	1	Forest Products Laboratory	1	Wildlands Network	1 (1)
1	3	Teton Regional Land Trust		Geos Institute	1	Word of Mouth	1 (1)
1	10	TWS	11 (9)	GreatYellowstone Coalition	4 (1)		
1	10	U of Montana	20 (7)	Headwaters Economics	3 (1)		
1	5	U of Washington	1	ICLEI	1		
4	16	USFS	13 (8)	Idaho Fish and Game	1		
1	1	USFWS	7	IPCC	1		
2	9	USGS	14 (10)	Kresge Foundation	1 (1)		
1	6	Water Matters		Mainstreams	1 (1)		
1	10	WCS	18 (12)	Montana Cons Voters	1 (1)		
1	4	Yellowstone Business Part		Montana State U	2		
1	1	Y2Y	7 (3)	MT FWP	4		

Total Egos: 30 Total Alters: 50

Total Ego-respondents: 37 **Total Linkages Reported: 217**

Total Nodes: 80 **Total Edges: 171***

*** The difference between total linkages and total edges, where total linkages are reported and edges are ties between two organizations, multiple linkages to one organization makes a stronger tie.**

Analysis of Data for Chapters Four and Six

Social network data was analyzed using the computer software Gephi, I examined the data in the invasive species and climate adaptation networks using the following network measures:

Density: the proportion of possible ties in a network that are actually present, and a network's density is commonly used to measure the extent to which all actors in a network are tied to one another (Wasserman and Faust 1994)

Centralization: A centralization score of 1 indicates that a maximum number of ties concentrated around one actor is present, and a score of 0 indicates a fully connected network, where all actors are directly connected to each other (Knoke and Yang 2008)

Betweenness Centrality: Refers to how many times an actor is positioned on a short path connecting two others who are themselves disconnected (Knoke and Yang 2008; Freeman 1971)

In-Degree Centrality: Refers to the extent to which a social actor in a network "receives" or "serves as the object" of relations sent by others in the network. This is an indication of important or prominent actors; an organization's prominence reflects its greater visibility to other actors (Knoke and Burt 1983).

Modularity: refers to the detection and characterization of community structure in networks, meaning the appearance of densely connected groups of vertices, with only sparser connections between groups (Wasserman and Faust 1994). Modularity detects communities based on the sociological concept of betweenness centrality, a measure of how many of the shortest paths from one actor to another actor pass through a particular relationship or actor (Freeman 1977).

Cores: refer to sets of successively enclosed substructures -- k-cores. The k-core is the largest subgraph where vertices have at least k interconnections (Wasserman and Faust 1994).

Network Limitations for Chapters Four and Six

As noted, I originally planned to do the analysis individual to individual but since half of the data was missing, resulting in a mixed matrix that significantly altered the structure of the network, the benefits of making the change to an interorganizational matrix were clear – a more precise and complete picture of the network. However, the limitation is the lost resolution of some detail because of compressing multiple ego-nodes into one ego (i.e., four Forest Service ego-respondents into one Forest Service ego), and multiple alter-nodes were compressed into one alter. Triangulating the network dynamics with the qualitative interviews and ethnographic fieldwork informs the analysis and clarifies the understanding of the inter-organizational dynamics in instances where individuals were originally listed as alters.

The second limitation to note here is the directionality (or non-directionality) of the network data. The wording of the survey questions asked respondents to generate names of individuals/organizations they *gave* or *received* information regarding invasive species/climate adaptation. This is non-directional data and only indicates with certainty that two organizations share information with each other, but does not specify the giver or receiver. In the network diagram maps used in chapter four and six, arrows of directionality are indicated on the maps. This illustrates where respondents identified alters (i.e., an arrow from the Forest Service to the Blackfoot Challenge indicates that the Forest Service nominated the Blackfoot Challenge). While this only indicates that information was shared between the two organizations, a non-directional tie, in many cases the qualitative data helps to verify the directionality of the link. Based on the qualitative understanding of the data, the working hypothesis of this analysis and discussion is that in most cases when an ego-respondent nominated an organization it does indicate that they receive information from that organization. However, given the limitations of the data the

discussion will mostly indicate that organizations shared information and not indicate directionality.

Finally, it is important to note that the survey is clearly biased towards those individuals and organizations that are "pro nature conservation" because I sent the survey to only those leaders of conservation organizations. The results that are presented then reveal a highly self-selected network of organizations that are engaged in natural resource conservation. Had a sent a random sample survey out, the network would likely be much different. Likewise, the network would be very different had I targeted private property rights activists or pro-commercial development groups.

Social Network Data for Chapter Five

Chapter five on grizzly bear conservation used a different strategy for collecting social network data. The network survey questions developed to collect data for the analysis in chapters four and six were asked prior to grizzly bear conservation emerging as a major issue of concern in my qualitative data. This is common in inductive and grounded theory approaches to research where particular issues emerge as relevant to the study (Charmaz 2006). In the analysis of the qualitative data I noticed some very interesting network dynamics around the issue of grizzly bear conservation. Interview participants were discussing weak and informal ties and information sharing, brokering organizations, and regional clusters. Although I didn't directly survey about information sharing around grizzly bear conservation, I did want to explore the network dynamics around this issue. Therefore, I coded the qualitative data for relational ties, as is commonly done by researchers who want to examine networks embedded in their narrative data (McKether et al. 2009). This process entails coding for network data while at the same time coding for larger themes embedded in the qualitative data. Through this coding, I identified

twelve participants that were engaged in grizzly conservation and described working with other organizations engaged in this dimensions of landscape conservation in the Crown landscape. These organizations (along with their organizational types) are listed in the table 2.9.

Table 2.9. Organizations and Organizational Types Discussed in Chapter Five

Organization Type	Organizations
Science-based Organizations	Interagency Grizzly Bear Committee (IGBC), Great Northern Landscape Conservation Cooperative
Community-based Organizations	The Nature Conservancy (working with communities in the High Divide), Teton Valley Land Trust, Swan Ecosystem Center, Confederated Salish and Kootenay, Clearwater Resource Council, and Blackfoot Challenge.
Regional NGOs or Agency Collaboratives	Greater Yellowstone Coordinating Committee, Crown Managers Partnership, Vital Ground, Heart of the Rockies.
Total Organizations	**12**

Network Limitations for Chapter Five

It is important to note that in the interview process I was not prompting interview participants to "generate" names of people they share information with and this type of specific information doesn't always spontaneously arise in the interview process. The sparseness of the network in chapter five should not be compared to the complexity of the networks in chapters four and six. The composition and structure of the network reflects the data collection strategy; had I known to ask about grizzly bear conservation in the network survey administered earlier in the research process, I would have had a more detailed network picture. Nonetheless, the qualitative data, while a bit sparser, did provide important analytical and theoretical insights.

2.3 The Connectivities: Overarching Analytical Framework

Through the grounded analysis of the qualitative and social network data, an overarching analytical framework emerged. Building on a fundamental premise of landscape conservation,

ecological connectivity, I develop three principle ideas that are applied across the empirical chapters 4-6. First, *social connectivity* is a necessary prerequisite for network governance and landscape-scale conservation. *Social connectivity* includes conceptual frameworks such as social capital and social networks and is concerned with how information flows between individuals and organizations. *Discourse connectivity* is that crucial next step that links the social and the ecological together. This is the process of framing a problem in a way that culturally resonates across stakeholders and how broader narratives shape information into usable knowledge and how these variables lead to coordination of land management across landscapes. Finally, I develop the idea of *assemblage connectivity*. The interest here is how the previous three concepts (ecological, social, and cultural) catalyze the conditions for cross-scale conservation outcomes that strengthen the role of community-based natural resource management. Each of these is summarized in table 2.10 and elaborated below.

Table 2.10. Analytical Framework

Analytical Framework			
Terms	**Concepts**	**Key Questions**	**Key Barriers**
Ecological Connectivity	Landscape-scale ecological dynamics Common pool resource	What constitutes this issue as a landscape-scale ecological problem? What constitutes this problem as a common pool resource problem?	Habitat fragmentation Altered ecosystem structure and function Collective action challenges
Social Connectivity	Social Capital (weak ties, bridging ties, structural holes) Social Networks (multi-level, strategic interdependence)	Who talks to whom about what?	Social barriers to opportunities for a relationship Mistrust Incompatibility of reciprocal needs
Discourse Connectivity	Problem Framing Narratives	How are problems being framed? What are broader narratives shaping problem frames?	Conflicting norms or values Incompatible worldviews or knowledge systems

Assemblage Connectivity	Environmental Governance Networks Landscape Conservation	How does ecological, social, and discourse connectivity assemble together in ways representative of a network of landscape governance?	Inaccessibility (or lack for relevance) delivering knowledge to action Lack of learning mechanisms Conflict over 'scale' Power dynamics

2.3.1 Ecological Connectivity

The section on ecological connectivity will present the ecological characteristics that constitute the problem as a 'landscape-scale' issue as well as discussing the common-pool nature of each ecological challenge. While this section will briefly address literature from ecological science that constitutes 'the problem,' ecological connectivity more generally is representative of a social science perspective to these ecological problems. The literature on common pool resources and common property has grown swiftly in the last three decades (see reviews in Agrawal 2003; Ostrom et al. 2002).

Common pool resource governance emerged in large part as a reaction to 'the Tragedy of the Commons" that represented local actor's exploitation of common pool resources as 'tragic' (Hardin 1968). The tragedy posits that a shared pasture open for livestock grazing to everyone, without control through private ownership or government regulation, is doomed to overexploitation through this open access, with accompanying losses in pasture quality and declining benefits for all involved. Since this paper was published in Science in 1968, numerous researchers have noted that although open access commons may be doomed, many resources (e.g. fisheries, forests, oceans, grazing and irrigation systems, wildlife, and the atmosphere) and property held in common, but not open access, may be managed and used sustainably, depending on how the resource users and those they interact with are organized in ways that promote

sustainable resource use (Dietz et al. 2003; Ostrom, 1990, 2005; Ostrom et al., 1999). This narrative has been instrumental in promoting the idea that natural resources, without the state or the market to regulate, would inevitably be degraded (Hess and Ostrom, 2007; Ostrom et al. 1999). Moreover, this view gained ascendancy in institutional theory where common pool resources were characterized by inefficient institutional arrangements where the 'free rider' over-exploited resources causing environmental degradation. Although many authors have noted Hardin was describing was a tragedy of 'open access regimes' and not a tragedy of the 'commons', this paper was nonetheless influential in legitimizing the view that common pool resources required either the state or the market to avoid tragedy (see Bryant and Bailey 1997; Ostrom 1990).

Great strides have been made in better articulating the institutions that facilitate governance of common pool resources, especially at the community level (Agrawal 2003). As a rather large body of research indicates, the management of common pool resources can be viewed as a problem of collective action and analyzed in terms of the costs and benefits of cooperation, institutional development, and monitoring according to variables such as group size, composition, relationship with external powers, and resource characteristics (Ostrom 2009, 2007). Successful case studies of community management of coastal fisheries, forests, pastures, irrigation, and groundwater are now commonplace in the literature. However, the nature and challenges of ecological problems that are multi-scalar in process present new challenges to the lessons learned from successful community-based case studies. Ostrom's (2009) social-ecological system (SES) framework provides a mechanism to systematically parse a system composed of actors (resource users), a governance structure, and a resource system into its component parts for the purposes of studying that system. The ecological connectivity section of

each chapter will focus on describing the resource and what characteristics constitute it as a common pool resource problem.

The chapter subsections on ecological connectivity will consider these different factors of ecological connectivity and what constitutes these as social-ecological problems. In chapter four, I will discuss the problem of aquatic and terrestrial invasive species in the Crown of the Continent, and the common-pool problem that the invasion of noxious weeds presents to native grasses and plants. In chapter five, I will discuss how the concept of connectivity conservation emerged from early studies of grizzly bear habitat connectivity and discuss grizzly bear habitat as a common-pool resource. In chapter six, climate adaptation, I will discuss the ecological consequences of changing temperature and precipitation patterns for landscapes and how climate represents a common-pool problem.

2.3.2 Social Connectivity

This analytical section is based on applying the analytical construct of social capital that is grounded in the assumptions that networks are an important dimension of social life. Having an existing basis for communication, i.e. a network, is a key component of social connectivity. Across various social science literatures there is widespread agreement on the significance of networks at all scales and levels of organization. Moreover, literature on social capital heavily emphasizes social networks as a key component of social capital. It is theorized that social networks are the fabric of social capital and social capital is an important precursor to arriving at conservation outcomes as it begets new relationships, new relationships lead to greater trust, and trust leads to more effective collective action and both individual and social benefits (Rohe 2004). Social capital refers to the shared knowledge, norms, rules, and networks that facilitate collective experience within network (Coleman 1988, Ostrom 1999, Pretty 2003). Norris et al.

(2008:137) writes, “The basic idea of social capital is that individuals invest, access, and use resources embedded in social networks to gain returns. It can also be defined as the aggregate of the actual or potential resources that are linked to possession of a durable network of relationships.”

Social Capital

Social capital is a group-level phenomenon, often explained in terms of reciprocity and mutual trust built by strengthening relationships and communication on a community wide basis (Flora and Flora 2004). It is also considered those networks and norms that facilitate collective action (Putnam 2005), and it captures the idea that social bonds and norms are increasingly important for sustainability (Mulvihill et al 2006). Social capital is interactive and created partly through social interactions among stakeholders, individual and group reflection on what is being learned, as well as iterative attempts to apply what is being learned to the issues (Stringer et al. 2006). According to Pretty and Ward (2001), social capital includes the following four features:

- Relations of Trust - relations of trust facilitate cooperation and thus reduce transaction costs between people. Building trust takes time.
- Reciprocity and Exchanges - reciprocity increases trust, and refers to simultaneous exchanges of goods and knowledge of roughly equal value, or continuing relations over time. Reciprocity also contributes to the development of long-term obligations between people, which helps in achieving positive social and ecological outcomes. Reciprocity often hinges on actions being reciprocated by others (Axelrod 1984).
- Common Rules and Norms - common rules and norms are the mutually agreed upon drivers of behavior that ensure group interests are complementary with those of individuals. Results in confidence to invest in the collective good.

- Connectedness in Networks and Groups - connectedness refers to the bonding capital that links people with similar objectives into local groups and the bridging capacity to link groups together. This connectedness describes the ability of groups to engage with external agencies, either to influence their policies or to draw on useful resources.

Social Networks

A primary feature of social capital is social networks. Networks have been evoked as both an explanatory tool and as an outcome of a broad spectrum of social processes and have been described as an essential feature of human connection and organization (Grannoveter 1973; Marsden 1990; White 1992). Networks have been used to describe a 'post-bureaucratic' world we live in (Heydebrand 1989), social formations that emerge where formal social institutions do not exist (Powell 1990), and situations where people self-organize to solve problems where both bureaucracies and existing institutions are lacking (Rycroft 2003). Networks have proven essential for describing basic patterns of human connection as well as particular formations that have emerged as a result of increasingly electronically defined and linked societies (Castells 1996).

There has been several theoretical paradigms emerge that draw on a relational philosophy grounded in this notion of networks, such as Deleuze's description of a rhizome that is "open and connectable in all of its dimensions" and Bruno Latour's actor-network theory (Latour 1993, 2004). Latour offers this notion of a network: "more supple than the notion of system, more historical than the notion of structure, more empirical than the notion of complexity, the idea of network is the Ariadne's thread of these interwoven stories" (Latour 1993: 3). Latour's actor-networks are inherently dynamic with constantly changing relationships of humans, other species, technologies, and institutions. The network, Latour argues, at once embraces the

political, the discursive, and the material (Latour 2004). Although these theoretical notions of networks inform 'social connectivity', perhaps more important for this immediate discussion is the literature of networks in environmental governance (Bodin and Prell 2011; Ramirez-Sanchez and Pinkerton 2009; Ernston et al. 2008; Janssen et al. 2006; Bodin et al. 2006; Crona and Bodin 2006). This dimension of networks will be elaborated in the next chapter in the discussion on network governance.

The network perspective assumes that: (1) relationships among actors are important; (2) actors are interdependent rather than autonomous; (3) a relationship between two actors represents a flow of material or nonmaterial resources; and (4) network structures enhance or inhibit actors' ability to act (Wasserman and Faust 1994). Network theory draws insight from overlapping discussions in political science, organization theory, public administration, and sociology (Gilchrist 2004). The sociological literature contends inter-organizational networks are characterized by repetitive exchanges among semi-autonomous organizations that rely on trust and embedded social relationships to protect transactions and reduce their costs (Borgatti and Foster 2003; Gulati and Garguilo 1999; Powell 1990). Networks create value (Buchel and Raub 2002) and accumulate vital resources and power (Pfeffer and Salancik 1978) needed to carry out shared tasks. Networks are viewed as a positive alternative to other implementing structures because of their capacity to transmit information across a wide range of participants. Further, certain network characteristics are also argued to influence an organizations ability to recognize and respond to environmental threats or changes (Kraatz 1998).

Social network analysis is based on network theory and the premise that a network's structure can provide insights into how a network functions, including facilitation or hindering of knowledge sharing. Network analysis can identify the informal positions held by various actors

within a network, as well as connections between various networks or 'sub-groups' across space and levels of organization. It helps to identify which actors or organizations are connectors (i.e. boundary spanners or bridging organizations), which actors or organizations are isolated, where there are clusters and which actors are in those clusters. It can also assess whether there is a core within the network and if so, which organizations are in that core and which are on the periphery (Borgatti and Everett 2000; Scott 2000; Wasserman and Faust 1994). Mapping who talks to whom, where information is obtained and traded, and who seeks advice from whom opens up the possibility of explaining the role of more lateral and information links underpinning innovation, learning, and governance (Considine and Lewis 2007).

While social capital and social networks are closely linked, there are some important caveats to note. The presence of network structures through which network members can build and sustain their efforts, and incorporate learning, is foundational to social capital. However, ties between organizations, while illustrative of social capital, is not enough to say with certainty social capital exists and the causality link between social capital and social networks can be tautological. Nonetheless, social network analysis can help unravel the links between social capital and social networks, and especially if network analysis is conducted over time, the network evolution may be indicative of changes in social capital as well as dynamics involving effectiveness, legitimacy, and responsiveness.

Social connectivity, then, considers these variables related to social capital and social networks across the empirical cases. Specifically, chapter four on invasive species will explore different aspects of networks, such as 'prestige' (as indicated by in-degree centrality), 'community structure', and core structures and the implications of that on information flows and the privileging of certain types of knowledge. Chapter five on grizzly bear conservation will

focus on weak ties and structural holes; and, chapter six on climate change will discuss fundamental aspects of relationship building and the role of boundary spanners in building trust.

2.3.3 Discourse connectivity

The chapter subsections on discourse connectivity focus on the role of problem framing and narratives in the context of environmental governance. This employs analytical techniques attuned to discourse and narrative analysis and focusing on the role of language and narratives in definitions of ecological ‘problems’ and their so-called ‘solutions’ (Fischer 2003). Discourse, simply understood as a rhetoric or manner of speaking, has been developed as an analytical tool to assess entire systems of thought and knowledge governed by (often unspoken or unrecognized) rules about what constitutive boundaries of what can be thought and claimed (Foucault 1969). Discourse establishes what is and what is not, or what can be accepted and what cannot, and a narrative is a coherent unity or sequence linking specific sets of events and actors within discourse (Lejano et al. 2013). Attention to narratives puts the analytical spotlight on "the constructed and constructive nature of language" (Shotter and Gergen 1989: 207) in relation to the social context in which it is used. This calls attention to the stories that are told about environmental issues, highlighting the embeddedness of environmental issues in broader power relations, histories, and contextual issues (Fischer 2003). This includes two very similar and related, but distinguishable, parts: (1) the role of problem framing, and (2) the broader role of narratives.

Problem Framing

One interpretive approach that adheres to these insights and is regularly used in such studies is frame analysis. Frame analysis has been developed in sociology and policy analysis as a way of depicting and engaging in the array of arguments and counter arguments that surround

complex social issues (Creed et al. 2002; Schon and Rein 1994). Framing means that people make sense of the world in different ways in that they cannot and do not consider all detail and information on a certain situation but select the elements of their interest and concern (Isendahl et al. 2010).

Frame analysis has at its roots the sociology of Erving Goffman. According to Goffman (1974), frame analysis is concerned with the structure of experience individuals have at any moment in their lives. Frames are principles of organization that govern social events and our subjective involvement in them. They are the basic background assumptions that enable us to understand what is going on in any encounter or situation. We use frames to pick out certain elements in a situation to pay attention to and others to ignore. Frames tell us not only what to see but also how to be involved actively and emotionally in any occasion. The frames within which individuals organize experience are cultural constructs, prefabricated by society or social group. They buttress real life to confirm a frame-relevant view of the working world and provide the means to comprehend the motives, intentions, and desires of others.

This perspective has been elaborated in the social movement literature as strategic frames, or frames for collective action. Framing theory states that collective action is guided by socially constructed interpretation frames aimed at explaining the world and what needs to be done, while mobilizing yet other actors to join collective action (Benford and Snow 2000). In an environmental governance context, framing comes in one step before the actual decision-making process. According to Dewulf et al. (2005: 117) “The framing concept draws the attention to the concrete interactions where actors bring in their conceptions of problems and possible solutions, and how they affect each other’s frames in and through a developing relationship.” Thus, the concept of framing comprises a dynamic and interactive process taking into account different

conceptions of a problem and its solutions. This is an important aspect of framing because it indicates that problem frames may be changed through social interactions; the very notion of social learning.

Although frame analysis refers to a number of interrelated methods for the analysis of discourse, rather than a full-fledged theoretical paradigm or a coherent methodological approach, there have been a number of approaches to analytically consider frame analysis. Frames are generally described as operating at two broad levels, although different authors define them slightly differently. The broadest level is often called a master-frame (Benford and Snow 2000) or a meta-frame (Schon and Rein 1994). The second level can be described as the diagnostic and prognostic frames (Benford and Snow 2000) or the framings of 'what's wrong and what needs fixing' (Schon and Rein 1994). Diagnostic framing represents problem orientation regarding the current situation, how it differs from an ideal state, and the underlying causes or driver of the problem. Prognostic framing then is what needs to be done to achieve that ideal, what solutions are deemed necessary, valid, or appropriate and *whose* solutions are considered valid and appropriate. The master-frame, then, points to the broader role of narratives in environmental governance.

Narratives

Narratives are a relational explanation for the way embodied actors in an environment make sense of the world, constituting a psychological, social, and linguistic framework often worked out through social interaction (Gergen 1994). Here, a focus on narratives reveals how science is used to translate things into an authoritative knowledge that is disembedded, and reveals important social and cultural dimensions of the environment and environmental problems. Analyzing narratives from diverse stakeholders allows the piecing together of

storylines that imply causality, and can often be linked to larger global environmental discourses (e.g. Adger et al. 2001). Narrative storylines interpret or frame events in particular ways that forge bonds, creating a 'glue' that binds (Hajer 1995). Moreover, as Lejano et al. (2013: 20) note further characteristics of the role of narratives:

- Narrative is the means by which members become part of the network
- Members become and maintain their membership in the group by joining in the act or narration
- Narratives serve a 'social memory' function of the network, the knowledge that the group seeks to save is stored in narrative
- Narratives can be told in multiple and varying ways that include heterogeneous motivations while also being aligned towards a shared vision.

Analysis of narratives illustrates a more nuanced account of the interconnections and interactions between the scientific and the social, the economic and the political. For a narrative to resonate, it is generally considered to have two dimensions: empirical credibility and experiential resonance (Hajer 1995).

Problem framing and narratives are critical to facilitating and prompting communication across organizational or group boundaries. The problem frame in chapter four illustrates a good case of a clear 'other' - the noxious weed 'invaders.' It also illustrates how the narrative around invasive species is 'grounded.' Chapter five illustrates the broader context of the narrative of grizzly conservation and how the concept of 'umbrella species' has influenced what constitutes a healthy landscape. In the climate adaptation chapter, I illustrate the challenges that scale presents in shaping a narrative that is inclusive of communities.

2.3.4 Assemblage Connectivity: Assembling Governance Networks of Landscape Conservation

The analytical framework of *assemblage connectivity* is concerned with the integration of the three elements discussed: ecological, social, and discourse connectivity. Moreover, how do these pieces ‘assemble’ together in ways representative of a network of landscape governance? The concept of assemblage connectivity draws upon an emerging 'assemblage theory' in the social sciences indebted to the relational philosophy of Donna Haraway (Haraway 2008), Bruno Latour (Latour 1993, 2004), and Gilles Delueuze and Felix Guattari (Deleuze and Guattari 1987). While distinct, this scholarship shares an approach that sees life as a process that unfolds through changing assemblages of humans, other species, technologies and institutions (Ogden et al. 2013). It recognizes that a 'landscape' of interest is open-ended, mobile, networked, and actor-centered 'geographic becoming' (Jones 2009) that both influences and is influenced by the governance process. In their philosophical treatise on this type of networked relationality, Deleuze and Guattari (1987: xiv) write: “a plateau is reached when circumstances combine to bring an activity to a pitch of intensity that is not automatically dissipated in a climax. The heightening of energies is sustained long enough to leave a kind of afterimage of its dynamism that can be reactivated or injected into other activities, creating a fabric of intensive states between which any number of connecting routes could exist.” In many ways, this is the sweet spot for both network governance and landscape conservation. Once relationship building, trust, intermediate outcomes, learning, etc. are enacted it leaves an “afterimage of its dynamism that can be reactivated or injected into other activities.” Therefore, the last section on assemblage connectivity will discuss the assemblage of the various elements into networks of landscape governance, with particular attention to power and political ecology.

The analysis of ‘assemblage connectivity’ will combine the ecological, social, and cultural, as well as illustrate how non-human actors and technologies assemble together. The discourse connectivity analysis helps tease apart the themes that make up the problem frames and narratives, whereas social network analysis can illuminate the patterns of interaction that can guide interpretation on who is most influential in the network. This perspective allows us to view landscape conservation as a relational, networked and negotiated process where actors strive to influence how the governance process should be performed. Emergent properties of these relationships, including where and how the networks intersect and the mechanisms that connect the multiple levels of governance will be discussed in assemblage connectivity.

The type of 'integration' across ecological, economic, and social domains is the essence of landscape conservation, and this will be discussed in this section. Across the empirical issue case studies, the pattern of relations between agents, organizations, and institutions is different, and these differences have real consequences for how the problem is framed and delivering conservation action. The interrelationships that make up the heterogeneous networks of human, nonhuman, animate, and inanimate actors are also imbued with histories and power relationships. These relationships exclude some stakeholders, privilege certain types of information and knowledge over others, and are generally embedded in broader social and political contexts that favor some outcomes over others. These are questions of political ecology and will be addressed in this section. What emerges in the three issue case studies are networks of ‘landscape conservation’, however differentiated across the cases.

2.4 Summary and Moving Forward

These four elements developed here: ecological connectivity, social connectivity, Discourse Connectivity, and assemblage connectivity, while being an innovative framework for

this analysis, draw from elements of similar frameworks established in the literature. For example, Berkes et al. (2010) produces a model of "links between devolution of responsibility and co-management of natural resources." His model has three spheres that interact with each other, including: communicative action, self-organization, and joint or collaborative action. Elsewhere, Hill and Engle (2013) assess adaptive capacity by focusing on a number of 'network indicators', including: connectivity between groups and stakeholders that allow common and integrated solutions to be negotiated; accessible, expedient and effective conflict resolution mechanisms; and integration across sectors and stakeholders into a coherent legislative, policy and decision making framework.

As the next chapter will illustrate, there is a broad body of literature that informs the construction of the analytical framework presented above. The next chapter will present a literature review of the various bodies of scholarship I draw from for this dissertation, followed by empirical chapters applying this framework to issue case-studies of invasive species, grizzly bear conservation, and climate adaptation.

CHAPTER THREE: LANDSCAPE CONSERVATION AND THE EMERGENCE OF CROSS-SCALE NETWORKS OF ENVIRONMENTAL GOVERNANCE

The foundation upon which discussions of landscape conservation and network governance are built is eclectic, diverse, cuts across a number of disciplines, is itself interdisciplinary, and is not defined by a clear pathway or a single scholarly tradition. In the previous chapter, I discussed important literatures and frameworks that make up the overarching conceptual framework from its constituent 'connectivity' parts. This chapter deals with the foundation of literatures that inform my understandings of the ways that network governance intersects with landscape conservation as a mode of environmental governance. My intent is to present the landscapes of literatures that contribute to the state of knowledge regarding network governance and landscape conservation, the two points of focus in the concluding section, assemblage connectivity, of the empirical chapters. Figure 3.1 presents a flow diagram conceptualizing the particular relationships between these bodies of literature. The diagram references in what section the discussion for each of the mentioned literatures can be found in this dissertation.

Figure 3.1. Conceptual Map of Literature

3.1 From Natural Resource Management to Environmental Governance

The shift from natural resource management or government to governance highlights the multi-actor and multi-purpose natural resource reality of today (Newell et al. 2012; Lemos and Agrawal 2006). In traditional western natural resource management or government settings, a single actor, typically a state or federal bureaucratic agency is designated to manage resources in accordance with the prevailing biophysical centric perspective favored by the agency. In these settings, the administrative boundaries within which decision-making authority is granted are often clearly defined. In contrast to government, governance implies that the management process is less formalized, more difficult to control, and involves a diverse set of actors. In an annual review, Lemos and Agrawal (2006: 298) define environmental governance as "the set of regulatory processes, mechanisms and organizations through which political actors influence environmental actions and outcomes."

A critical and defining characteristic of environmental governance is that it is multi-actor, and that the sources of governance themselves are co-produced through the involvement of this range of actors in their formulation and implementation for reasons of capacity, resources, or reach (Newell et al. 2012). A single authority of government, in this definition of governance, has not become irrelevant and neither has the forces of the market and private sector, however, multi-stakeholder governance arrangements have been increasing in scope. The expansion from natural resource management (by government) to environmental governance in policy discourse and academic debate denotes perceived, as well as actual, shifts if power and authority such that modes of governing have broadened and evolved to increase their ability to tackle a range of ecological challenges they were set up to address. Traditional modes of state-based governance such as statute and regulation have come to be seen as limited in their reach, effectiveness,

authority, or legitimacy such that tackling complex environmental problems requires the engagement and participation of a range of non-state actors including business, civil society organizations, and local governments (Adger and Jordan 2009). These actors advance legitimacy, and influence how power is exercised and how public decisions are made (Reed and Bruyneel, 2010).

The scholarship and inquiry into this shift from government to governance has many dimensions, and it is important to note some caveats. The broader literature suggests that this shift towards governance is a result of the 'hollowing out of the state' by a neoliberal bias against the state (Jessop 2004). This neoliberal bias embodies assumptions that key services such as water, health, education, and environmental management can be more efficiently provided by the private sector (Newell et al. 2012). Many scholars have looked into the ways that 'market-based' environmental governance occurs through different mechanisms such as 'forest-stewardship council' and 'fair-trade certifications', among others. Others have noted that the weakening of central government institutions (Sonenfel and Mol 2002), and more general neoliberalization of the environment has led to the decentralization of environmental governance to local institutions (McCarthy 2005). This shift towards local level institutions of environmental management, whether a consequence of neoliberal policies or driven by other factors, is a critical departure point for this study.

3.2 Community-based Natural Resource Management

Community-based Natural Resource Management (CBNRM) has emerged from a concern for livelihoods, poverty reduction, and equitable access to participatory processes for natural resource decision-making. It is an alternative option along a continuum of centralized to decentralized control of natural resources, emphasizing decentralization – the transfer of powers

from central authorities to lower levels in a political-administrative and territorial hierarchy (Larson and Soto 2008: 216), and devolution – a more disperse distribution of power transfer to local groups, organizations, and local-level governments (Berkes 2010). In large part it is a response to a paradigm of 'fences and fines' conservation where, in an attempt to preserve wildlife and biodiversity, global public and private interests began establishing parks and reserves around the world at the exclusion of local peoples that traditionally lived in and around those resources. These exclusionary modes of environmental governance were backed by scientific narratives that represented natural resources as threatened by the activities of local actors in proximity to these resources. This was in large part strengthened by the narrative of 'the Tragedy of the Commons" that represented local actor's exploitation of common pool resources as 'tragic' (Hardin 1968).

As discussed in chapter two, the tragedy of the commons has led to a productive field of inquiry in common-pool resources that has had significant influence on contemporary community-based natural resource discussions and dialogue. Studies from institutional theorists such as Ostrom (1990, 1999) and many development sociologists have offered mounting and indisputable evidence on the inherent capacity of local actors to act collectively in order to solve environmental problems and illustrated the social injustice that a fences and fines approach to conservation enacts (Western and Wright 1994). This led to a strong push for participatory and community-based approaches towards conservation in both developing and developed countries (Bixler et al. in review). Decentralization occurs in a number of different forms and 'fields' and the terminology varies across geopolitical contexts. Different labels include community forestry, community-based conservation, collaborative conservation, wildlife conservancies, participatory conservation, joint forest management, co-management, and watershed councils among others.

In the U.S., a growing number of scholars and practitioners are increasingly using the term: community-based natural resource management (CBNRM) (Bixler and Taylor 2012; Wagner and Fernandez-Gimenez 2009; Weber 2000). Instead of a system premised on hierarchy and top-down formulation of natural resource management objectives, CBNRM devolves significant authority to local, place-based alliances (networks) of affected stakeholders from the community, and relevant federal, state, and local agencies (Weber 2000). Regardless of the terminology used for these types of institutional arrangements, they typically share similar characteristics (in theory), including: shared decision-making authority among local stakeholders, including agencies, public officials, private interests and citizens (Clark et al. 2005; Pretty 2003; Agranoff and McGuire 2003; Weber 2000); transparency, accountability, and equitable distribution of resources and empowerment of marginalized actors (Barry et al. 2010; Ribot 2002).

Many collaborative community-based efforts are self-organized by stakeholders and aim to be long term, self-sustaining organizations with their own mission, goals, budget, and staff (Leach et al. 2001). Many variables, including the size and productivity of the resource system, leadership, norms and social capital, as well as the importance of the resource to users and collective-choice rules help determine when and where local users will self-organize to manage common resources (Ostrom 2009; 1990). CBNRM groups are presumed to regulate the local use of resources, serve as a forum for conflict mitigation and facilitate collaboration, and represent stakeholders inside and outside the watershed (Clark et al. 2005; Bidwell and Ryan 2006; Hardy and Koontz 2009), and often face critical structural decision points about if and how to proceed as internal and external contexts and structures evolve (Taylor and Cheng 2012).

"Participation" is a central tenet of CBNRM (Bixler et al. *in review*; Reed 2008; Ribot 2002). Participation by those who are affected or can affect a decision can increase public trust in decisions and provide organizational legitimacy if participatory processes are considered to be transparent and consider conflicting claims and views (Reed 2008). Participation, however, is a very multi-faceted, normatively and ideologically loaded, and complex term that is far from an easily implementable concept and takes different forms across social-, economic-, political-, and ecological contexts (Bixler et al. *in review*). Many different typologies exist to delimit the type and kinds of participation, including: the degree to which stakeholders are engaged such as a 'ladder of participation' (Hobbly 1996; Arnstein 1969). One of the most widely used is Bigg's (1989), who described the level of engagement as a relationship that can be ''contractual'', ''consultative'', ''collaborative'' and ''collegiate''. Lawrence (2006) built on this, proposing ''transformative'' participation as an alternative top rung of the ladder, and emphasizing the idea that empowerment should lead to the transformation of the communities who are involved. The hierarchical nature of the ladder metaphor implies higher rungs are preferred, however, different levels of engagement are likely to be appropriate in different contexts. This seems particularly true for network governance.

Other participation typologies focus on the nature, rather than the degree, of engagement (Rowe and Frewer 2000) where information dissemination to passive participants represents 'communication', gathering information from participants is 'consultation', and 'participation is conceptualized as a two-way flow of communication. Other typologies distinguish between a participation that is pragmatic and/or normative. Habermass' (1984) communicative action theory suggests participation should be "fair", representing a full range of relevant stakeholders and equalizing power between participants. This conceptualizes participation as a means to an

end that delivers higher quality decisions. Elsewhere, participatory governance is discussed as leading to unjust and illegitimate exercise of power in ways that are tyrannical (Cooke and Kothari 2001). Participatory forms of natural resource management are often delimited to defined projects, have trouble influencing traditional hierarchical and bureaucratic governance structures, and require appropriate training, expertise, and experience to get to implementation (Johnson 2009; Cooke and Kothari 2001)

However, there has been ample CBNRM scholarship that has identified many barriers to participatory governance and transparent and accountable institutions that incorporate community interests and livelihood concerns while also managing resources sustainably. CBNRM literature relies heavily on normative rather than empirical conceptualizations and empirical studies often show that actual devolution and power-sharing from governments to community institutions is limited and, in some cases, non-existent despite the policy intent and rhetoric. The role of the state is still central in natural resource conservation and management, much to the chagrin of CBNRM proponents.

Nonetheless, many current natural resource management policies and programs seek to scale up this collaborative process and apply it across a broader landscape, despite the nature of collaboration and the meaning of participation being ill-defined moving from a local to a broader, regional or landscape scale (Bixler 2014; Wyborn and Bixler 2013). Research in these 'social' or 'human' dimensions of landscape conservation is increasing, however empirical studies are still few and often not critical of these processes. Conrad et al. (2011) indicate that participation and capacity building are two of the most important innovations for landscape science and policy (the others being scope, context and scale). Keough and Blahna (2006) identify eight factors for success: integrated and balanced goals, inclusive public involvement,

stakeholder influence, consensus group approach, collaborative stewardship, monitoring and adaptive management, multidisciplinary data, and economic incentives. As these studies indicate, collaborative processes are foundational to landscape approaches to conservation.

3.3 Collaborative and Adaptive Approaches to Environmental Governance

Accommodating multi-actor pluralism that characterizes the shift to environmental resource governance requires novel institutional designs that move from political administrative hierarchies to various types of collaborative structures (Kickert et al. 1997; Koppenjan and Klijn, 2004; Olsson et al. 2004; Wondolleck and Yaffee 2000). There is a plethora of 'collaborative' and 'adaptive' approaches to environmental governance and a rich social sciences literature defines and draws distinctions among collaborative processes, collaborative governance, collaborative conservation, adaptive governance, polycentric governance, adaptive co-governance, adaptive co-management, and other similar models. These emerge from the more general recognition that society has limited capacity to understand the biophysical environment and inherent uncertainties associated with complex systems, which leads to conflict over environmental problem definition and appropriate action towards problem resolution (Folke 2006). These challenges require that ecological and social scientists look beyond disciplinary boundaries and technical approaches and engage a variety of stakeholders in order to find acceptable solutions to complex problems (Bodin and Prell 2011; Dietz et al. 2003; Wondellock and Yaffee 2000; Ostrom 1990). For pragmatic purposes, it is not necessary to dwell on the different definitions of each, but rather to identify similar and different characteristics and inherent tensions that will help clarify the place and role of network governance among this class of models.

Similar to CBNRM, collaborative governance is a related concept that comes from the public administration literature and has been defined as "a governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, deliberative and that aims to make or implement public policy or manage public programs or assets (Ansell and Gash 2008: 544). Collaborative governance, as does CBNRM, builds upon broader underpinnings of collaboration that occurs "when a group of autonomous stakeholders in a problem domain engage in an interactive process, using shared rules, norms, and structures to act or decide on issues related to that domain" (Wood and Gray 1991: 146). Whereas collaborative conservation tends to have a focus on non-governmental actors (Snow 2001; Wyborn and Bixler 2013), collaborative governance includes government actors as a key component, especially as a means for achieving direction, control, and cooperation of collective action between government agencies and nonpublic groups and organizations (Lynn et al. 2000). Through the lens of the public administration literature, collaborative governance occurs in the context of public management when stakeholders work together with government to create new policies or to address public problems. This has variously been referred to as cross-sector collaboration (Bryson et al. 2006), new governance (Bingham et al. 2005), and collaborative public management (O'Leary and Bingham 2007).

Environmental governance draws from this rich literature on collaborative governance (without always giving due recognition), while also incorporating literature that developed along a parallel track in resource management focusing on being adaptive. Over three decades ago, the concept of adaptive management appeared in the writings of C. S. Holling (1973) and its evolution from concept to practice accelerated in the 1990s and 2000s (Scarlett 2013). Definitions of adaptive management vary, but generally invoke a common paradigm that

includes: systematic processes for improving management practices through ongoing learning with a focus on outcomes assessed through monitoring and evaluation (Folke et al. 2005). Adaptive co-management is another term that followed that emphasizes the importance of involving stakeholders in an adaptive management process with an iterative learning dimension and the linkage dimension of collaborative governance in which rights and responsibilities are jointly shared (Plummer et al. 2012; Olsson et al. 2004; Dietz et al. 2003). Adaptive co-management incorporates a complex systems view conceptualizing feedback loops and coupled social-ecological systems that shapes management strategies oriented towards system resilience and sustainability (Olsson et al. 2004). Collaborative adaptive management is another term used that merges science, collaboration, and a focus on outcomes. Scarlett (2013: 29) notes this is characterized by:

> "(1): a high degree of uncertainty; (2) complexity resulting from multiple variables, nonlinear interactions, and diverse human values; (3) interconnectedness - among issues, across landscapes, and between people and place; and (4) persistent, possibly dramatic, changes to ecosystems and land uses. In this context, many resource management decisions present information challenges, coordination challenges, action challenges, and challenges of understanding and measuring results."

Dietz et al. (2003) used the term adaptive governance as an umbrella phrase for collaborative, participatory alternatives to top-down decision-making. This term typically is characterized by continual generation and integration of knowledge, social learning and refinement of approach based on new information; flexible institutions and multi-level governance to foster shared responsibility and collaboration within a social network; and development of adaptive capacity to address uncertainty and change (Folke et al. 2005; Jacobson and Robertson 2012).

Collaborative conservation is another rather large umbrella term that seeks to bundle these collaborative and adaptive approaches to environmental governance. Although collaborative conservation is applied to many conservation efforts at different scales of engagement, it generally emphasizes local participation, sustainable natural and human communities and voluntary consent and compliance over enforcement by legal and regulatory frameworks (Wyborn and Bixler 2013; Snow 2001). These approaches also have a focus on the role of information and knowledge in environmental decision-making as well as an understanding that science should go beyond providing neutral, credible, and legitimate support for decision making to incorporate other kinds of knowledge and different ways of knowing (Kirchoff et al. 2013).

The Nature of Knowledge, Knowing, and Learning

One common characteristic in the collaborative and adaptive forms of governance is the role that knowledge, knowing, and learning plays in being 'collaborative' and 'adaptive.' The production and legitimatization of 'objective' knowledge vis-à-vis science has become a topic of increasing scholarly interest. "Science," notes Jansonff,

> "wrenches phenomena out of their specific contexts, makes parts meaningful independently of wholes, and recombines segments in ways that transgress boundaries…" (2010: 235).

Scientific knowledge focuses on relationships and phenomena that do not vary across space and time, is reductionist and looks at relationships between specific variables. To effectively do so, the production of science tends to erase specificity and transcend the subjective and contingent circumstances of the local. In this way, 'facts' may float freely and carry legitimacy through objectivity (Latour 1990). Science and technology studies continue to illustrate the nuanced nature of Truth (or truth of Nature), especially painting a grey area around the science-policy

interface. The broader social and political context of scientific knowledge creation is increasingly being put under a critical lens. The "complex interface of science and decision making in which science is 'co-produced' by various sectors of society, and separation of 'facts' and 'values' cannot be achieved" (Pielke 2004: 407) is an increasingly popular topic of academic inquiry.

Some of this research concerns the ways in which human societies establish and maintain boundaries between scientific and other forms of authority – legal, political, religious, and social (Jasonoff 1999). Gieryn (1999) points out that drawing boundaries around social groups and biophysical entities – and their interactions at specific temporal and spatial scales – is a process which frames 'legitimate' science and policy. Actors problematize a situation in ways that they wish to see adopted as the standard explanation and/or solution. Variations in the framing of the 'root cause' of an environmental problem can lead to widely various policy outcomes. When policy prescriptions assume that the boundaries between the scientific, technological, and social are given and unchangeable, a premature narrowing in both the framing and solution of perceived problems can occur. Jasonoff notes, "Scientific knowledge, in particular, is not a transcendent mirror of reality. It both embeds and is embedded in social practices, identities, norms, conventions, discourses, instruments, and institutions – in short, in all the building blocks of what we term the social" (2004: 3, emphasis original). This point seems particularly salient in ecological sciences like landscape ecology, where social practices shape ecosystem dynamics under scientific investigation and conservation policy prescriptions often aim to restrict social practices deemed problematic.

Environmental governance takes place in complex situations, scenarios where uncertainty and conflict are the norm (Funtowicz and Ravetz 1993). Far from the 'linear model' where, if we

get the science 'right' the best decision will follow, the "linear formulation leading from 'more science' to 'less uncertainty' to 'political action' [is] inherently flawed" (Sarewitz 2004). It follows from scientific uncertainty, which so often occupies a central place in environmental controversies, that facts can be understood not as a lack of scientific understanding but as a lack of coherence among competing scientific understandings, amplified by the various political, cultural, and institutional contexts within which science is carried out.

The box enclosing this push and pull of legitimate knowledge and the appropriate way to do science has been 'opened up,' argues some, in the discussions of post-normal science (Funtowicz and Ravetz 1992), trans-science (Weinberg 1972) and the democratization of science (Carolan 2006). Pielke (2004) provides a good starting point for this discussion by drawing nuanced distinctions between policy, politics and scientific justification. He illustrates that science can be of assistance in policy by providing a range of available policy alternatives, but when used in politics it is a resource in the process of bargaining, negotiation, and compromise for desired needs (*ibid*). But science is an inherently political undertaking, as "the appropriate standard for judging science in neither proof, nor certainty, not unanimity, but a broad and firm consensus of the relevant experts in the field" (Oreskes 2004: 372). Yet, expertise is a rather subjective and political undertaking and there are different forms of expertise in environmental governance (Carolan 2006). Indigenous and local knowledge is increasingly being recognized as one form of expertise.

Local Knowledge

The integration of local knowledge into scientific knowledge regarding ecosystem dynamics is an increasingly popular topic within the environmental management literature. Recent discussions of social-ecological systems (Berkes and Folke 2003), polycentric

governance (Bixler 2014; Ostrom 2010, McGinnis 1999), co-management (Berkes 2009), and community-based natural resource management (Larson and Soto 2008) purport the importance of this objective. The justification to engage local people and their knowledge in resource governance is simple: any intervention that is inattentive to historical and geographical specificities, local conditions, and local knowledge will likely fail.

As Oreskes (2004) notes, producing logically indisputable proofs about the natural world (that meet these criteria) is inherently problematic. One response to these challenges is the increasing recognition of the validity of local ecological knowledge. Local Ecological Knowledge (LEK) is defined as knowledge, practices, and beliefs regarding ecological relationships that are gained through extensive personal observation of and interaction with local ecosystems, and shared among local resource users (Charnley et al. 2008). Local ecological knowledge refers to the local expertise of people who, different from indigenous peoples, may not have a long-term relationship (i.e. hundreds or thousands of years) with the local environment, but nevertheless have local wisdom, experience, and practices adapted to local ecosystems (Ballard et al. 2008). This knowledge is held by users of a resource system and is informal, lay, personal and often implicit or tacit, but also can often be considered expert (Raymond et al. 2010; Carolan 2006). A similar discussion to local ecological knowledge is narratives of local environmental change (Bixler 2013). Environmental narratives have been described as

> "stories that are bounded by narrator's particular experiences, observations, and attachment to place. They include anecdotal information, oral environmental history, local knowledge, and are analogous to traditional indigenous knowledge" (Robertson et al. 2000: 120).

There are many different perspectives on what constitutes knowledge or how someone comes to know something. As local ecological knowledge becomes more legitimate, the

boundaries defining 'truth' and 'validity' become more permeable. The embrace of a variety of epistemological perspectives in environmental knowledge is becoming more socially, politically, and ecologically acceptable.

Yet, this is not without complications. An increasing body of literature in sustainability science (Clark and Dickson 2003) and boundary organizations (Guston 2001) seek to resolve the tensions inherent in knowledge system integration, yet a general and well tested model of integrating different knowledge systems has not yet been developed (Cash et al. 2003). And even if a successful 'user-oriented' scientific framework is developed, one where local knowledge is considered alongside scientific knowledge, there is still the challenge of integrating this into policy and decision-making frameworks. "Once we begin to move from questions of what "is" to "what should be done" (e.g. policy and regulation) – two questions that are often inseparably intertwined in the ecological sciences" Carolan notes,

> "- an expertise is required that goes beyond merely possessing knowledge that contributes to the cognitive base of the field being analyzed. What is also required is a gauge of public sentiments and values" (2006: 665).

Tensions arise when impersonal and apolitical science comes into conflict with the subjective, situated, and normative individuals interacting with nature (Jasanoff 2010). How does a local knowledge system embedded in 'public sentiments and values' inform conservation science and policy? When individuals interact with the ecological phenomena being described by scientific investigation it adds a 'subjective, situated, and normative' dimension to the way science is internalized and conditions the acceptability of the conclusions that are drawn. Understanding how social positions and practices shape the validity of conservation science is critical for successful implementation of conservation practices.

Social Learning

Much emphasis has been placed on the importance of learning to support collaborative environmental governance and achieve goals of resilience and adaptability under conditions of social-ecological change. Building the capacity of individuals, organizations and societies to collaboratively learn through change and uncertainty is fundamental to adaptive co-management, and learning provides the basis for joint action required to respond to social-ecological feedback. Keen et al. (2005: 4) define social learning as "the collective action and reflection that takes place amongst both individuals and groups when they work to improve the management of the interrelationships between social and ecological systems." Social learning occurs when stakeholders and the wider community in which they live learn from each other through the development of new relationships, building on existing relationships and transforming adversarial relationships as individuals learn about each others' trustworthiness and learn to appreciate the legitimacy of each other's views (Stringer et al. 2006). Social learning has also been defined as "learning that occurs when people engage one another, sharing diverse perspectives and experiences to develop a common framework of understanding and basis for joint action" (Schusler et al. 2003: 311).

Social learning is seen as the key to remaining adaptive and addressing complexity and uncertainty inherent natural resource governance. This can be described on several different levels – learning from the consequences of specific actions (single-loop learning); learning about the assumptions underlying our actions (double-loop learning); to learning that challenges the values and norms that underpin our assumptions and actions (triple-loop learning) (Keen et al. 2005). Armitage et al. (2008) illustrate the intervention points of different types of learning in the chain of governance-intention-action-outcome with learning feeding back into the system. This

emphasis on higher-order learning is more than just stakeholder participation, but rather involves understanding the limitations of existing institutions and mechanisms of governance (Fernandez-Gimenez et al. 2008). Further, understanding those limitations and fostering learning through networks of relations may be fundamental to successful establishment of communities of innovation and the facilitation of community-based conservation efforts (Bixler and Taylor 2012).

Yet, as Armitage et al. (2008: 86) note "on-going struggles to learn from experience and respond to complex social-ecological conditions reflect an emerging paradox." There is no consensus on the definition of learning (Crona and Parker 2012; Armitage et al. 2008; Muro and Jeffery 2008), a poor understanding of how social interactions influence learning (Crona and Parker 2012; Muro and Jeffery 2008), and an uncritical appreciation of how power and conflict shape learning processes and outcomes (Armitage et al. 2008; Muro and Jeffrey 2008). There are considerable asymmetries of power that need to be recognized and addressed when bringing together different actors and knowledge systems (van Kerkhoff and Lebel 2006). As such, social learning may mean something more than just being situated or embedded in communities of practice (Keen 2005), but should demonstrate a change or understanding that goes beyond just the existence of relationships.

3.4 Network Governance - Collaboratives + Adaptives + a focus on *Network* aspects

As chapter two explained, networks have been invoked in a broad array of discussions that intersect domains of the state, market, and civil society. It is no surprise that there is increasing interest in networks in environmental governance (Bodin and Cronin 2009; Armitage et al. 2009; Carlsson and Sandstrom 2008; Carlsson and Berkes 2005). Network governance incorporates dimensions of collaborative governance and adaptive management as outlined

above, while also providing a framework for thinking about the relationships between multiple levels of governance, cross-scale linkages and collaboration across multiple and overlapping but separate issue sets. It is theoretically useful when thinking about collaborative process across larger spatial areas, as are many ecological challenges, that present governance and coordination challenges that often outstrip capacities, structures, and decision-making processes of the individuals, single organizations, or place-based collaborative networks. It involves a framework for analyzing a governance scheme involving communication and coordinated action by many federal, state, and local agencies working with industries, private landowners, and nonprofit organizations. These governance issues are not new per se, and numerous formal and informal models of what is increasingly referred to as "network governance" exist, with varying purposes and degrees of complexity in both public and private sector contexts (see reviews by Borgatti and Foster 2003; Brass et al. 2004; Isett et al. 2011; Provan, Fish, and Sydow 2007).

Rather than framing this as consensus-based collaboration, networks draw attention to how governance institutions should be designed, and implies that the managing process is less formalized and focused on adaptability (Newig et al. 2010; Bodin and Cronin 2009; Carlsson and Berkes 2005). Institutional arrangements should incorporate different actors from different areas of society, incorporating diverse and multi-faceted knowledge systems with a focus on continuous learning (Crona and Parker 2012; Newig et al. 2010; Armitage et al. 2009; Isaac et al. 2007; Keen et al. 2005; Dietz et al. 2003; Brown and Duguid 1991). In addition to learning, the flows of resources and information are increasingly the focus of environmental governance research placing the spotlight on the networked nature of governance and policy making (Lewis 2011; Robins et al. 2011; Bodin and Crona 2009; Bodin et al. 2006; Borgatti and Foster 2003). The environmental governance literature is increasingly recognizing these inter-agency and inter-

organizational networks as important structural characteristics of adaptive natural resource governance that fosters cross-scale adaptive capacity (Bodin and Prell 2011; Prell 2011; Bodin and Crona 2009; Bodin et al. 2006).

Environmental governance arrangements often incorporate an implicit and sometimes explicit assumption about the establishment of social networks, based upon a different logic than political-administrative hierarchy (Carlsson and Sandstrom 2008). Researchers working in this domain have found a variety of network structures, and note that it is likely that no single network structure is optimum for all circumstances (Bodin et al. 2006; Bodin and Crona 2009). However, network structural characteristics that are hypothesized to contribute to sustainable natural resources include:

- Densely connected groups of people that share specific knowledge and work together productively (Sandstrom and Rova 2010; Bodin et al. 2006; Bodin and Crona 2009);
- Creating trust and a shared commitment to specific environmental management efforts (Dietz, Ostrom, and Stern 2003);
- A heterogeneous set of groups within the network as a whole, contributing expertise in a variety of knowledge areas (Sandstrom and Rova 2010; Bodin and Crona 2009; Ernston et al. 2008; Bodin et al. 2006);
- Generating and sharing different types of knowledge (Bodin and Crona 2009);
- Bridging relationships between groups that facilitate the sharing of expert knowledge in response to emerging challenges (Sandstrom and Rova 2010; Bodin and Crona 2009; Ernston et al. 2008; Bodin et al. 2006);

- Ties to a periphery of diverse actors that provide specialized knowledge, skills, and other resources over time as changing circumstances require (Bodin and Crona 2009; Ernston et al. 2008);
- Playing an important coordinating function (Berardo and Scholz 2010);
- Mobilizing resources to accomplish goals (Cash et al. 2003);

Networked governance is a process that engages stakeholders through multiple levels of decision-making and in different centers of authority (Bixler 2014), and facilitates the formation and strengthening of relationships among stakeholders for mutual learning (Stringer et al. 2006). Networks provide the basis for linkages that exist across scales, both vertically and horizontally and brings together many discussions in environmental governance, namely that social-ecological systems can benefit from relevant individuals engaging with one another, learning from one another, and hence enabling adaptive capacity to manage complex environments (Folke et al. 2005). Networks connections also bring attention to the 'multiple-levels' of governance. Cross-scale linkages are defined as "social, institutional, or ecological connections among individuals or organizations. Such connections may be horizontal (e.g. across geographical space) or vertical (e.g. across different levels of organization)" (Armitage et al. 2009: 96). According to Berkes (2002: 293), cross-scale interactions refer

> "to linking institutions both horizontally (across space) and vertically (across levels of organization). Cross scale institutional linkages mean something more than management at several scales, isolated from one another. Issues need to be considered simultaneously at several scales when there is coupling or interaction between scales."

The literature contends that cross-scale linkages that link multiple levels (e.g. community institutions with other levels of organization) are critical for adaptive governance (Carlsson and Sanderson 2008), however, the substances of these linkages remains empirically and theoretically unclear.

Given the mule-dimensional nature of networks and network governance, and the possibilities of conceiving of networks operating across geographical and ecological space, conceptualizing 'network governance' in large-scale ecological restoration and management has become increasingly salient among natural resource managers, scientists, and practitioners. Designing and implementing networked institutions at a broader regional or landscape scale offers the promise of a more inclusive and 'institutionally fit' approach to solving interrelated, landscape scale ecological problems. Defining and understanding those landscape-scale ecological problems has been the domain of landscape ecology.

3.5 Non-equilibrium and Landscape Ecology

Landscape Ecology, in some ways, is a response to the 'tragedy of the commons' paradigm of conservation as noted above but from a different perspective. In particular, equilibrium thinking in ecological theory was instrumental in forging a conservation approach that favored exclusive control of natural resources by state experts (Forsyth 2003; Hurley et al. 2002). Landscape ecology was a response to the steady-state ecosystem assumptions, and borne from a more informed understanding of evolutionary genetics and theorizing about how these processes take place over a landscape scale. Theories of island biogeography (how populations of species can become isolated in 'islands' of habitat), edge dynamics (what happens at the edge of habitat), and large-scale patterns and processes became the field of inquiry for conservation biologists and ecologists interested in landscape ecology.

Landscape ecology focuses on large spatial extents (i.e. Interacting mosaics of ecosystems), spatial heterogeneity, and the influence of humans on landscape composition, structure, and function (Lindenmayer and Hobbs 2007; Wu and Hobbs 2002). One driver of the growth of landscape ecology is the replacement of an equilibrium understanding of ecosystems

to a more nuanced non-equilibrium model (Holling and Meffe 1996; Holling 1973). Non-equilibrium ecology highlights the inherent dynamism and complexity of ecosystems with a focus on the diverse factors operating at multiple spatial and temporal scales and the significant effects of those factors on ecosystem characteristics (Mori 2011). Landscape ecologists focus on how ecological processes (disturbance regimes) interact with heterogeneous biotic and abiotic conditions (e.g. hierarchical patch dynamics) in unique and complex, and sometimes contingent ways (Bennett et al. 2009).

Importantly, anthropogenic influences (historically, contemporarily, and into the future) often alter these processes through, for example, loss of top predators, spread of invasive species, livestock grazing patterns, habitat fragmentation and degradation, water pollution, and climatic changes (Fischer and Lindenmayer 2007; IPCC 2007). Many leading conservation biologists now argue that 'humans have touched everything' and that we live in a new geological era of earth history titled the 'anthropocene' (Caro et al. 2011; Crutzen and Stoermer 2000). Philosophical debate aside, anthropogenic stressors compound the inherent dynamism and complexity of ecosystems and can lead to cascading effects on competition dynamics, community structure, and species distribution at the landscape scale (Lavergene et al. 2010). These factors have led landscape ecologists to increasingly focus on advocating for landscape integrity (maintaining structure and function within a historical range of variability) and landscape resilience (the ability to handle stress without experiencing a fundamental loss of ecosystem character or state change) (Mori 2011). Ecosystems are now understood to follow stochastic, threshold-dominated trajectories where ecological outcomes are less predictable.

Landscape ecology has brought complexity and uncertainty to the forefront of our understanding of ecology, which subsequently has raised important questions about the need for

environmental governance institutions that incorporate decision making at spatial scales that transcend jurisdictional boundaries, integrate issues across agency domains, and include public, private, and nonprofit participants in direct decision roles.

3.6 Network Engagement in Landscape Conservation

The broader context of this research explores the intersection of two prevalent trends in natural resource management and policy: network governance and landscape ecology to bring us to this place of "landscape conservation." Surprisingly little academic scholarship has investigated "landscape conservation" through this lens to date, although inquiry is definitely on the rise (Pirani et al. 2012; McKinney et al. 2010; Jacobson and Robertson 2012). As mentioned above, I will argue that *Large Landscape Conservation* is emerging out of the convergence of two streams of thought: landscape ecology and collaborative community-based natural resource management as it seeks to integrate large-scale ecological processes with social and participatory processes. One such policy report defines Large Landscape Conservation as conservation that is multijurisdictional, i.e. the issues addressed cut across political, social, and jurisdictional boundaries; is multi-purpose addressing a mix of issues including environment, economy, and community; and, includes relevant stakeholders including private, public, and non-governmental actors (McKinney et al. 2010). Another conceptual framework from the grey literature defines landscape conservation initiatives as "focused efforts by organizations to partner with others to protect resources and landscape-scale processes across borders, generally to protect habitat, water, agricultural and forest production, and cultural and recreational resources" (Pirani et al. 2012: 4).

Landscape conservation is focused on large-scale resource management and restoration, the nature of which crosses many traditional administrative, jurisdictional, and natural resource

boundaries. There is increasing political traction for planning resource management through this lens as indicated by a federal resource management 'interagency headquarters-level' roundtable discussion that took place on June 26th-27th, 2013. Organized by the Landscape Conservation Cooperatives National Coordination Office, this roundtable established principles for "landscape conservation design" a generic term coined to cover a variety of planning approaches that are collaborative, partnership-driven, science-based, and technologically supported (Campellone 2013). They note that the approaches "share the goal of collaboratively developing a shared understanding of issues and opportunities at a landscape-scale—across the many jurisdictions and individuals within that landscape—and sharing that collaboratively developed understanding with all those who live or work within it" (Campellone 2013: 1).

Several events and approaches, primarily drawing on a conservation biology informed notion of connectivity conservation, precipitated this recent focus on landscape conservation. In 2005, Congress required each state to develop and regularly revise their state wildlife action plans as a condition for receipt of federal funds (Lacher and Wilkerson 2014). Many plans identified connectivity as a major concern and indicated that revised plans would include connectivity maps. Also in 2005, each state's transportation agency was required to coordinate its planning with that state's wildlife agency (Public Law 109–59). In 2008 governors of 19 western states called for connectivity maps to help reduce the undesirable effects of energy development, urbanization, and highway projects (Western Governors' Association 2008). Governors of six northeastern states similarly called for statewide maps as a "foundation for regional work on habitat connectivity" (Barringer et al. 2009).

There is also increased interest in connectivity maps that transcend state or national boundaries, such as the Yellowstone to Yukon initiative launched in 1998 (Y2Y 2004). The

Freedom to Roam initiative, launched in 2009, encourages businesses and citizens to support corridors for wild plants and animals in North America. In 2009, the U.S. Department of the Interior inaugurated its Landscape Conservation Cooperative program to integrate management actions to address climate change and other landscape stressors and build scientific and technical expertise to do so (Salazar 2009; USFWS 2010). In 2011, the USDA passed the collaborative forest landscape restoration act (CFLRP) prioritizing funding to landscape scale initiatives (Schultz et al. 2012).

Indeed, it does appear that the word "landscape conservation" is increasingly penetrating policy, science, and practitioner circles and becoming common vernacular for a number of prominent initiatives throughout the U.S. Organizations and networks such as "The Practitioners Network for Large Landscape Conservation," the "Center for Large Landscape Conservation," "Landscape Conservation Cooperatives," "Collaborative Forest Landscape Restoration Program" are a few agency and non-agency initiatives that have adopted the terminology. In some ways, these initiatives are second-generation initiatives that follow other collaborative, large-scale management and restoration efforts such as CALFED Bay-Delta Conservation Plan, the Tahoe Regional Planning Agency, and the Everglades Restoration Program (see Booher and Innes 2010; Imperial and Kauneckies 2003, Kauneckies et al. 2000; and Garvoille 2013, respectively for more information about these initiatives). Some landscape conservation initiatives are emerging and self-organizing more organically from the ground-up, however, others are still mandated from the top-down such as those just noted.

A small body of work on "National Heritage Areas" assesses some of these dynamics of landscape-scale conservation and collaborative processes (Alliance of National Heritage Areas 2013; Laven 2013, 2010). National Heritage Areas (NHAs) are congressionally designated

places where natural, cultural, and historic resources combine to form a cohesive, nationally important landscape. Following the tenets of landscape conservation, NHAs exhibit diverse landownership patterns, vary greatly in terms of their size, local community dynamics, and heritage resources, and seek to link economic and community development objectives across multiple sites within a defined landscape or region (National Park Systems Advisory Board 2006). Studies into NHAs emphasize the importance of three factors: 1) use of heritage as a public engagement strategy, 2) collaborative approaches to management, and 3) development of intersectional networks (Laven et al. 2013).

Elsewhere, research on similar landscape-scale collaborative planning efforts have been documented in British Columbia. In many ways, British Columbia (BC) has been innovators of collaborative planning and conservation through the 1990s and 2000s with the implementation of their community forest tenure (Bixler 2014), as well as efforts at large-scale collaborative planning (Cullen et al. 2010; Frame et al. 2004). As noted elsewhere (Bixler 2014), this largely stems from intense conflict between environmentalists and forest-based industry through the 1980s, coined the "war in the woods" that resulted from lack of public engagement for non-timber forest values in BC. One landscape conservation effort in BC is the Great Bear Rainforest (GBRF) initiative that explicitly employed a two-tiered planning effort that included First Nations and communities interests at the first 'table' whose recommendations were sent to 'table 2' for government to government negotiations between First Nations government representatives and BC provincial agencies. Cullen et al. (2010) note four advantages of this collaborative planning model: 1) it provides a forum to negotiate interests and resolve conflicts, thereby making win/win options possible; 2) support for an agreement is increased if all stakeholders are involved in the process increasing the likelihood of implementation; 3) increases dialogue and

diversity of knowledge bases and experiences which leads to higher quality results; and, 4) generates social capital through improved stakeholder relations, new communication skills, and better information. Nonetheless, the authors note that issues of power, settling for vague solutions in order to reach agreement, and fundamental ideological and value differences may prevent landscape level decision making from occurring (Cullen et al. 2010).

Efforts to assess landscape-level conservation in the U.S. are on the rise too as the number of initiatives increase. Studies on the Landscape Conservation Cooperatives (LCCs) (Jacobson and Robertson 2012; McDowell 2012) and Collaborative Forest Landscape Restoration Program (CFLRP) (Schultz and Jedd 2012) have recently been published. Yet, more systematic investigation of these different initiatives is necessary to build a knowledge base useful to the policy refinement and practice of landscape level conservation. These analyses do point to many barriers, including institutional barriers that make it difficult to maintain functional and adaptive partnerships (Jacobson and Robertson 2012), unequal representation and organizational stratification (McDowel 2012; Bixler 2012), and the need to focus on community concerns and strategic partnerships for restoration and conservation (Schultz et al. 2012). Those critical of the emergence of this new paradigm argue that landscape conservation is nothing new and analogous to traditional protectionist paradigms that exclude local interests and livelihoods (Dramstad and Fjellstad 2011; Olwig 2002). Across multiple levels, however, there is an increasing awareness that successful conservation efforts must include and be responsive to multi-stakeholder perspectives and collaborative institutional arrangements (Wondellock and Yaffee 2000) and many scholars and practitioners recognize that the implementation of landscape-scale conservation will require new strategies and innovative collaboration across disciplines and political and ecological boundaries (Laven 2005).

Yet, despite the general increased policy and practitioner focus on landscape-scale management, guidance is scant and large landscape conservation efforts are relatively undocumented in the academic literature, especially in the US. Moreover, a precise definition or single paradigm of landscape conservation does not exist. The terms large landscape conservation, landscape-scale conservation, large-scale restoration and management are often used interchangeably. Clark et al. (2010) found the terminology can simultaneously refer to spatial scales (landscape-level), ecological criteria (biodiversity hotspots) and political dimensions (trans-boundary protected areas and peace parks).

Throughout the duration of this research, I found that landscape conservation is a malleable tool that practitioners, scientists, managers, policy makers and foundations wield to define problems and shape certain outcomes. In some cases, this is done with attention to power imbalances, livelihood considerations, and general attention paid to the social dimensions of conservation. In other cases, landscape conservation is used as a tool that excludes those broader social concerns. Nonetheless, most participants of this research saw 'landscape conservation' as adding value to their own conservation efforts. The next three chapters will focus on three issue-case studies - invasive species, grizzly bear conservation, and climate adaptation - to provide an in-depth and grounded analysis of network governance and landscape conservation.

CHAPETER FOUR: INVASIVE SPECIES MANAGEMENT

4.1 Introduction

In this first empirical chapter, I will discuss invasive species management in the Crown of the Continent landscape. Invasive species management, primarily noxious weed control, is not a flashy attention grabber like carnivorous and charismatic mega-fauna (see grizzly bear conservation, chapter five). However, invasive species management is an issue with widespread salience and relevance across a spectrum of individuals and organization types, across multiple levels of social organization, and was discussed in interviews by a large majority of research participants. In this chapter, I will highlight certain variables across the "connectivities" that illustrate important factors that contribute to multiple-level network alignment with a clear problem frame that has at its core enhancing community-based conservation.

As will be discussed, invasive species presents a classic common-pool resource collective action problem, however, both governmental and non-governmental organizations have 'stitched' together to make overlapping and complementary contributions towards invasive species management in the Crown of the Continent landscape. Rather than being fused together in a seamless web, the network is assembled in ways to allow for complex interactions providing a capacity to interact with other entities. Specifically, I will discuss the strategies of community-based organizations including, the Clearwater Resource Council, the Blackfoot Challenge and the Rocky Mountain Front Weed Roundtable. Several regional NGOs are also important in the organizational field of invasive species management, primarily the Crown Managers Partnership and the Flathead Basin Commission. Additionally, I will talk about the efforts of local community-based networks in the Swan Valley, the Blackfoot Valley, and the Rocky Mountain Front to join together in the formation of the Working Lands Council.

As this chapter will illustrate, certain network characteristics are noteworthy, such as community-based groups being at the 'core' of the broader network and regional initiatives hold key positions 'bridging' different network groups. The problem of invasive species as it is framed, as "invaders" and "economic threats/opportunities," helps explain how the network orients itself towards particular outcomes. Moreover, the network organizes itself against a very distinct "other", invasive species. These factors contribute to a unique assemblage of stakeholders, non-human objects, and governance arrangements that make up this network of landscape governance. Compared to grizzly bear conservation (chapter five) and climate change adaptation (chapter six), invasive species management represents an integrated, governance network where attention is paid to direction, control, and coordination of collective action between government agencies and non-governmental organizations, including government funded initiatives or contracts (Ansell and Gash 2008). As one landowner remarked, "Everyone needs water and everybody hates weeds. So we can learn from that."

4.2 Ecological Connectivity: The Problem of Invasive Species

Invasive species are recent introductions of nonnative, exotic, or nonindigenous species that are (or have the potential to become) successfully established or naturalized, spreading into new localized natural habitats or ecoregions with the potential to cause economic or environmental harm (Lodge 2006). The USDA defines invasive, or non-native species, as those organisms, plants and animals whose introductions into new ecosystems cause, or are likely to cause, economic, environmental, or human health-related harms (USDA 2011). These plants, animals or microbes often create negative impacts on the environment, and the impacts can be either ecological or economic and are most commonly both. Invasive species are a major cause of modern global extinctions for species of birds (50%), fish (48%) and mammals (48%)

(Clavero et al. 2005). Non-native species are often difficult and costly to eradicate (Myers et al. 2000, Pimentel et al. 2005, Hulme 2006), particularly in the case of invasive plants (Genovesi 2005).

Invasive species can also lead to the decline of native species through competition (Gurevitch and Padilla 2004). In Yellowstone National Park and surrounding areas, the invasive plant *Linaria Vulgaris* has dramatically reduced the cover of native plants (Pauchard et al. 2003). Large tracks of undeveloped land can limit the spread of nonnative plants, however the ability of undeveloped land to buffer against invasive species is limited because waterways, roads, and other disturbances (natural and un-natural) allow invasive plants to spread more easily (Foxcroft et al. 2011). Recreation can also contribute to the spread of invasive plants (Pickering et al. 2011), as can the expansion of invaders' potential ranges due to climate change (Hulme 2006). In general, human density is also a major driver of invasions of both plant and animals species (Spear et al. 2013). As global temperature and human population increases, invasive species will become an increasing challenge to manage across large landscapes.

Although humans have always moved organisms from one place to another as we travel, the interest and attention to "biological invasions" has increased substantially, being characterized as a leading cause of biodiversity loss and one of the most dangerous and least visible forms of environmental decline (Bright 2001). Two major issues in the Crown of the Continent landscape are aquatic invasive species (AIS) and noxious invasive plants. On terrestrial landscapes, weedy invasive species become a landscape issue for a number of reasons, including being a proximate result of forest fragmentation - habitat fragmentation is increasing the relative length of the "edges" that surround an interior forest. The microenvironment in edges changes more rapidly than the historical ecotones surrounding the forest interior and this creates

new selection pressures that are unfavorable to many native species. Exotic species may be adapted to edge microenvironment, and fragmentation facilitates invasion (Murphy 2005). In worse case scenarios, the exotics tend to dominate, suppressing or even extirpating most native competitors, and alter the ecosystem structure and functions, e.g., gradually eliminating larger trees and shrubs by preventing recruitment, suppress or change *mycorrhizae* and other microflora and microfauna, and alter PH, cation-exchange capacity, and nutrient cycling (Crooks 2002). Invasive weedy species like spotted knapweed, leafy spurge, yellow and Dalmation toadflax, houndstongue, sulfer cinquefoil and orange and meadow hawkweed pose a threat to landowners working to maintain native range and grasslands in the Crown of the Continent region.

Terrestrial invasive species are a threat to the classic common-pool resource problem of pasture (see Hardin 1968). The 'invasion' of noxious weeds threatens the viability of native plants and grasses, which are valuable resources that support the types of ranching livelihoods found in many parts of the Crown of the Continent landscape. On the one hand, invasive species management represents the classic common-pool resource "tragedy" of the pasture. However, in contrast to the traditional open access pasture these grasslands have clearly demarcated property boundaries, which presents a variation on the classic problem of organizing for collective action. Noxious species indiscriminately disperse across property boundaries affecting the entire landscape, yet individual actions (or inaction) to remedy the problem occur on a individual parcel, ranch, or forestland, or managed area. The collective action problem therein lies in coordinating the myriad of actors that manage the landscape. The next section, social connectivity will discuss the 'costs and benefits of cooperation' and discuss the ways that local actors organize to communicate and coordinate their invasive species management strategies.

4.3 Social Connectivity: Scaling for Increasing Returns

There are many different organizations ranging from local community-based groups to regional landscape initiatives concerned with invasive species management across the Crown of the Continent. For example, at the community-based level the Rocky Mountain Front Weed Roundtable (RMFWR), the Blackfoot Challenge weed committee, the Confederated Salish and Kootenai weed committee, the East Kootenai Conservation program are all explicitly interested in noxious weed management and learning from each other. At the national as well as regional-landscape level, American's Great Outdoor initiative (national), the Crown Managers partnership (landscape), and the Roundtable on the Crown of the Continent (landscape) have all identified invasive species as a major threat and they are working to mobilize resources, connect different groups, and coordinate policy and action around invasive species management. This social-organizational context introduces the challenges and opportunities of multi-level governance as these groups, on the one hand, develop local networks to engage in local action, while on the other hand recognize that local networks are embedded within larger social and ecological systems in ways that affect the success at both levels. In this sense, community-based groups recognize a strategic interdependence that can be achieved in stitching together local efforts at invasive species management. Below, I will assess both the local level community-based conservation networks as well as the multiple-level networks of invasive species management.

4.3.1 Local Community-based Networks of Invasive Species Management

Invasive species represent an interesting case of social connectivity because there are distinct local and community-based networks organized around invasive species management. For example, the Rocky Mountain Front Weed Roundtable, which has garnered national attention for their coordinated local efforts, is itself a distinct and local network that includes the

Blackfeet Nation, county extension and weed districts, several Montana state agencies, local watershed groups, federal agencies, and national ENGOs. In fact, there are many community-based networks that realize the importance of coordinated efforts at weed management and organize cross-boundary management accordingly. One example of this is the Clearwater Resource Council's 'coordinated invasive weed strategy'.

Located on the Clearwater tributary of the Blackfoot Watershed in the Southwestern portion of the Crown of the Continent, The Clearwater Resources Council has a similar mission to its southern neighbor the Blackfoot Challenge. The Clearwater Resource Council (CRC) works to engage the community and facilitate efforts that will enhance, conserve, sustain, and protect the natural resources and rural lifestyle of the Clearwater Watershed for present and future generations. CRC was established in 2003 and in the beginning "there was a lot of tension about certain turf wars, corners, and I think a lot of ill will," notes one board member, referencing community-based groups to the north and south (Swan Ecosystem Center and Blackfoot Challenge, respectively). Moreover, the organization lacked legitimacy locally and was "thought of as environmentalists to make sure bull trout survive and no big trees get cut down" and that was "a threat to the community".

However, engaging in a community-based process of developing a coordinated weed strategy helped build support and legitimacy for the organization, a legitimacy based on those intermediate outcomes that were relevant to community members. Weed management exemplifies the point of intermediate outcomes, that is collaboration is more likely to continue when the possible purposes and advantages of collaboration are relatively concrete and when "small wins" from collaboration are possible (Bixler and Taylor 2012; Ansell and Gash 2008). This particular "win" was a collaborative mapping project and coordination of partners,

including: the Missoula County weed district, the U.S Forest Service, private landowners including Plum Creek Timber Company (the largest landowner in the Clearwater Valley as well as Montana), The Nature Conservancy and other partners. One board member of the Clearwater Resources Council remarks,

> We developed a weed strategy and weed conservation plan through the valley. There is a lot of good weed work going on, but it wasn't coordinated so we established a local weed committee and developed a strategy around that. Instead of just going after weeds everywhere, we try to be more strategic about how we go about tackling that.

The outcome, CRCs weed management plan, included establishing (1) high priority weed free areas, (2) weed control areas, (3) and widespread invader infested areas. In the high priority areas, for example, resources are spent to aggressively and immediately eradicate 'invaders' from delineated weed free areas, and infested areas are designated non-priority given resource constraints (although individual control efforts of landowners and agencies are still encouraged in those areas). Through this project, the CRC was able to build a strong network of local level actors working in a coordinated effort against weeds.

As figure 4.1 below illustrates, the Clearwater Resource Council is connected to other actors operating in geographical proximity (Blackfoot Challenge and Swan Ecosystem being notable), and other local actors such as the Missoula County Weed District, Five Valley Land Trust, Missoula County Open Lands Committee, to note a few. (CRC node is in the top-center of the network map below). The Clearwater Resource Council was not alone in playing an important structural role as a hub, or connector, in the invasive species network. Particularly interesting aspect of this network is the relative importance of community-based groups throughout the network as a whole (see figure 4.1 below).

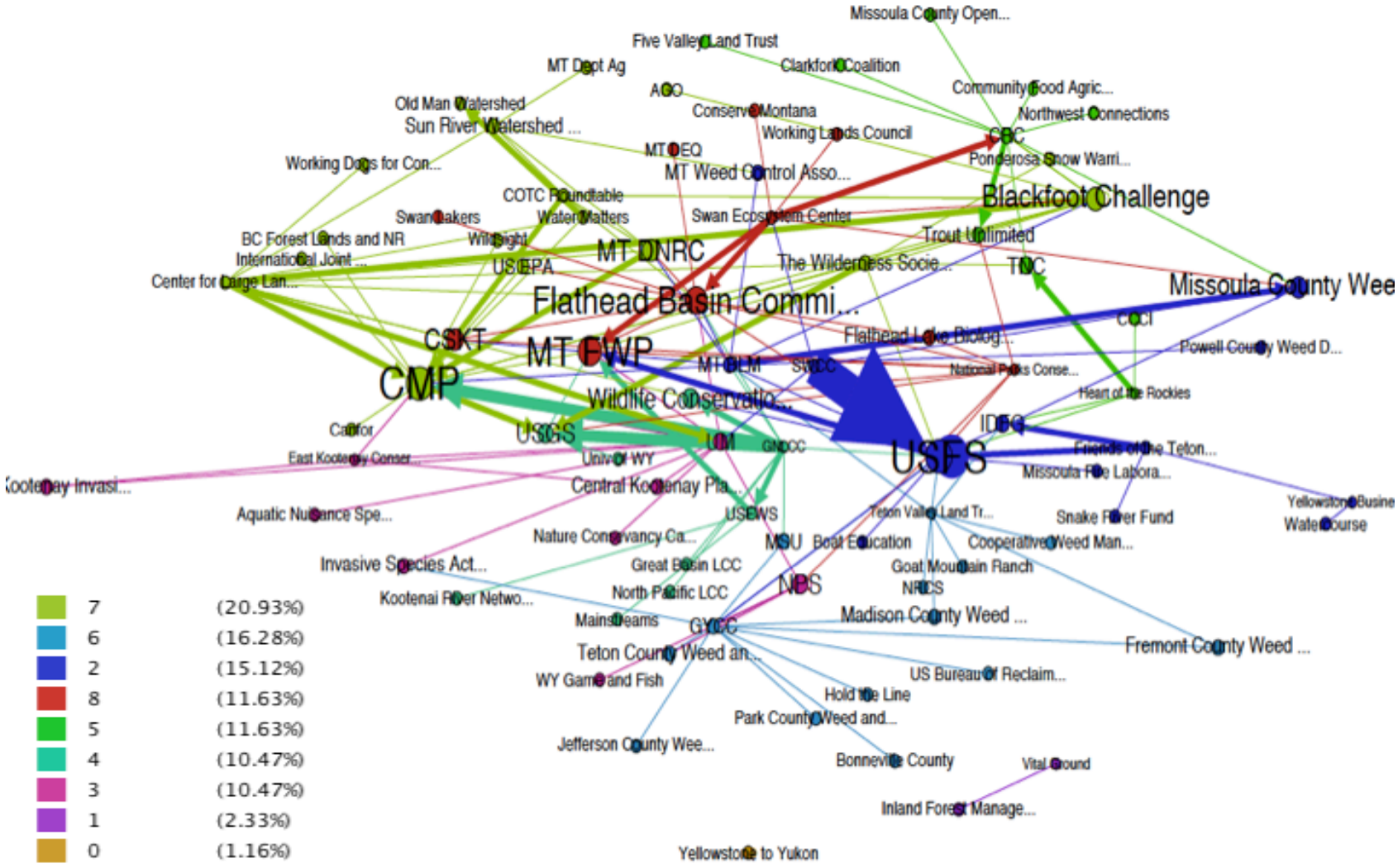


Figure 4.1. Complete Invasive Species Network Map
*Nodal Size indicates indegree, edge thickness indicates tie strength, color groupings indicate modularity or network community groups, edge color represents the network group from which the tie originates

The network map above (figure 4.1) is the full network map of organizations that responded to the question, "who do you seek advice from regarding invasive species management." The size of the nodes in the map above represents the relative “in-degree” of each organization (the nodes larger in size have a larger in-degree than those that are smaller in size). “In-degree” is a measure of how many ties are received by a node and is an indication of a node’s prestige (Wasserman and Faust 1994). The color of the node represents the network module that groups the nodes together by their “likeliness to interact” (Newman 2006). As briefly discussed in chapter two, modularity refers to the detection and characterization of community structure in networks, meaning the appearance of densely connected groups of vertices, with only sparser connections between groups (Wasserman and Faust 1994). Modularity detects communities based on the sociological concept of betweenness centrality, a measure of how many of the shortest paths from one actor to another actor pass through a particular relationship or actor (Freeman 1977).

As figure 4.1 displays, there are nine groups that exist in the network, with many edges or ties between the organizations in the same group and a smaller number of edges between different groups. The edges are colored according the source organization, so when one colored arrow leads to a node of a different color node, then “cross-group” sharing is occurring. The largest distinguishable sub-group contains 20% of the overall network and is represented by the green nodes. This group includes community-based organizations such as the Blackfoot Challenge, Old Man Watershed Group, and the Sun River Watershed Group, regional NGOs such as the Crown Managers Partnership and COTC Roundtable, and science-based organizations like the Wilderness Society and the Center for Large Landscape Conservation.

This group includes a diversity of organizational types and the majority of these groups focus their work in the Crown of the Continent region.

Interestingly, the second largest group as a percentage of the whole network is group 6, with 16.28% of the network. The vast majority of these organizations are place-based organizations that work in the Greater Yellowstone region. The third largest group, group 2, includes the US Forest Service, the Southwestern Crown Collaborative, and Montana BLM. The Southwestern Crown Collaborative is part of the CFLR program, a Forest Service initiative, so the strong tie to the USFS is not surprising. Given that close agency tie, this is a somewhat homogenous group with close ties to agencies. Group 4 is largely centered on the GNLCC, and connects to other LCCs and science-based organizations. It is also important to note that Vital Ground and Inland Forest Management make up on isolated cluster, and the Yellowstone to Yukon initiative is an isolate in this network.

An important point for discussion in this network is the connection between in-degree and prestige. Prestige is defined as the extent to which a social actor in a network "receives" or "serves as the object" of relations sent by others in the network. Prestige increases when the actor becomes the object of more ties, but not necessarily when the actor itself initiates the ties. The sender-receiver or source-target distinction strongly emphasizes inequality in control over resources, as well as authority and deference accompanying such inequalities (Knoke and Burt 1983).

As the size of the nodes above indicates, several organizations were more frequently sought out for information regarding invasive species management, those include: the Crown Managers Partnership (8); the Flathead Basin Commission (6); Montana Fish, Wildlife and Parks (6); the USFS (6); the Confederated Salish and Kootenai (5); Missoula County Weed

District (5); and, the Blackfoot Challenge (5). This is important, because it represents the heterogeneity in organizations and organization types that are sought for information regarding invasive species (and its contrast to the climate adaptation network, as will be discussed in chapter six, is noteworthy). This can be more clearly represented by visualizing a network map of just the "core" organizations in the network. These organizations are more central to the network, or more 'core like.' See figure 4.2 below.

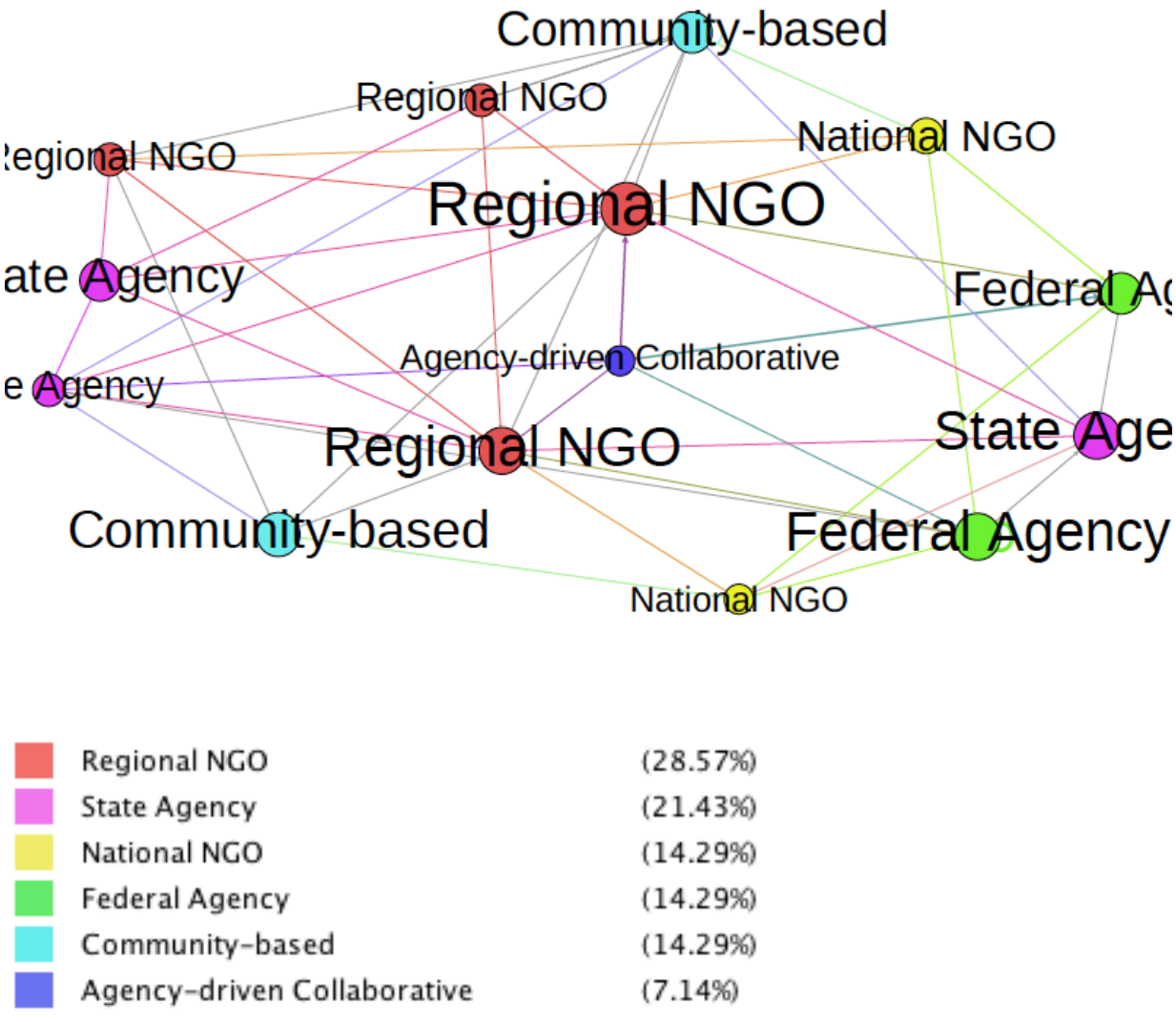


Figure 4.2. Core of Invasive Species Network and relative in-degree of organizations identified by organizational type.

As the core network map above illustrates, there are several community-based organizations (14 percent of total core organizations) and regional NGOs (almost 30 percent of the core organizations) in the invasive species network. Many participants talked about "being grounded", of being on the ground and interacting with the landscape on a daily basis. A local weed management business owner reflects on the annual Blackfoot Challenge weed meeting,

> When you say grounded, I think it revolves around your sense of place. I think I'm pretty grounded. I'm on it all the time; I see that stuff every day. If you just show up to a meeting once a year, not so much.

He reflects, "It is interesting for me to go and hear what everyone is doing, what everyone is planning." Noxious weed management opens up the door for many informal ways of interacting and sharing. Weed organizations often plan community events that bring together community members to 'pull weeds.' Teton Watershed Council interviewees talked about organizing a day where they get volunteers to go and collect biological weed controls from another location and bring them back into the Teton watershed on the Rocky Mountain Front. This is an important point because these events are the venues for social interaction as well as spaces of local knowledge.

There are interesting implications of this related to the local nature of knowledge with invasive species management. There exist highly contextual meanings associated with noxious weeds that often emerge from local places that include local knowledge and everyday ways of doing things. Interestingly, invasive species management practices leading to meaningful advice may be derived from these groups, at both local levels and regional levels. If we follow the 'direction' of the links we find that the Regional NGOs, such as the Flathead Basin Commission, the Crown Managers Partnership, and the Crown of the Continent Roundtable have ties extending out to community-based nodes (indicating they share information from the

community-level). In turn, many of the science-based organizations, such as the Great Northern LCC, and management organization, such as the Montana BLM, report sharing information with the regional NGOs. The community-based to regional NGO to state and federal agency "sharing" linkage in this network is a noteworthy finding. (Important to note that this *is* non-directional data so it is difficult to know the "sender" and "receiver" with certainty, all we can say with certainty is that they share information. Nonetheless, based on the qualitative interviews, there is a high probability that the agencies and science-based organizations are getting information from the community-based groups.)

In the case of noxious weed management, there is a sense of getting conservation done 'on-the-ground.' As one senior level representative from the Flathead Basin Commission notes, "How do you translate that to money on-the-ground to protect the resource. They never seem to get there. We need action. We need something on-the-ground." This is an important point; it is not just having a network for network's sake. Yet, this point also illustrates the nature of multiple-level networks that can connect the policy and resources at a higher level to 'action on-the-ground.'

4.3.2 Multiple-level Networks of Invasive Species Governance

Invasive species management makes an important cross-scale case for a number of reasons. The way local groups are organized illustrates the importance of this topic for those 'on-the-ground.' The Blackfoot Challenge has a weed committee that focuses on invasive species management; the Confederated Salish and Kootenai have invested many resources in both terrestrial and aquatic species; the Rocky Mountain Front has a weed Roundtable that has garnered national attention for their 'cooperative efforts.' Moreover, the highest level of Department of Interior officials has also emphasized invasive species coordination and

alignment of technical information in the Crown of the Continent through the America's Great Outdoors demonstration landscape project. Other regional NGOs, such as the Roundtable on the Crown of the Continent, selected "coordination of weed management" as one of their four focus areas for 2013. Momentum to focus on invasive species management is occurring at many different levels with a strong emphasis on its cross-scale nature.

In many cases it is a strategic, utilitarian, and functional concern behind the motivation to participate in this network. These reasons are articulated in the theories of resource dependency and strategic interdependence (O'Toole 1997; Powell 1990). Finding and articulating 'cross-scale' linkages is a persistent challenge as is articulating benefits to such linkages. However, when linkages are able to provide value-added benefits to work that are already taking place, the value of those linkages becomes more definable.

A qualitative example portrays this and provides some basis for the ways in which the Blackfoot Challenge, one of the core organizations above, is communicating with the landscape level-connecting organizations as well as with other community-based organizations. After participating in the two-day Roundtable of the Crown of the Continent leadership team meeting, a senior staff at the Blackfoot Challenge remarks,

> You're starting to find the dots [referring to the Roundtable on the Crown of the Continent]. Now find more dots and make them connected. Nobody is doing that in the Crown. The invasive species stuff, you start knitting that together. Just yesterday the North Fork called and I said you're one of the folks I can reach to. In the next round of grants we should include you. So now we are doing weed work in the Blackfoot, Swan, Front, and then the North Fork. We are starting to get a larger landscape focus to some similarities. Maybe we can stop the invaders. We are beginning to have a landscape level effect based on local modules of local people with their partners getting stuff done…

This quote articulates, surprisingly in network terms (i.e. the use of the terms "find the dots" and "local module"), how different place-based networks link together to have a landscape level effect. Through available channels of communication, or being socially

connected, community-based groups are linking together to coordinate action to have a larger effect in noxious weed management. Community-based conservation groups ‘get’ the vision of how their actions impact the ecology at the landscape level, and there are incentives for their participation. There is an “increasing returns of conservation” in their strategic interdependence. Urry (2011) discusses this process in terms of innovation, where "extraordinary benefits flow through the network as a consequence of increasing returns…[that] involves exponential increases in output (and rewards or wealth) that spread throughout a network of relationships between many different enterprises" (*ibid:* 126). Increasing returns is an example of a positive feedback mechanism, where improved coordination between organizations, and from the processes of social learning, spread non-linear gains and benefits.

Specifically, in this context, the local costs of weed mitigation go down as the scale of coordinated cross-boundary noxious weed management increases. If it is possible to "push out the boundaries" of the invaders (terrestrial weeds) or keep the 'invaders' from entering in the first place (aquatic invasives) then there is value-added for local level efforts by 'scaling' the efforts outward. Important dimensions in this include the heterogeneity in the network as well as the role of regional NGOs that play a connector role. Again, focusing on the 'core' network of the large invasive species network we see both heterogeneity as well as some key regional 'brokers.'

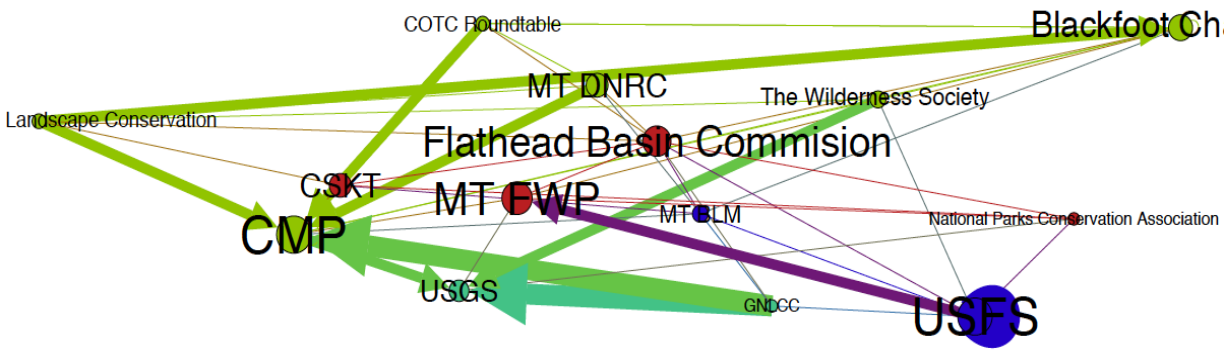


Figure 4.3. Map of Core Invasive Species Network

The core seems to represent a relatively heterogeneous distribution between state and federal agencies, science-based NGOs, regional landscape initiatives, and community-based organizations (as figure 4.2 indicated). In figure 4.3, the color of the nodes is representing the network group as defined by modularity analysis. Here, too, we see a relatively heterogeneous mix of network groups in the core of the network. Various studies have illustrated that network heterogeneity has been related to the function of resource mobilization and performance in terms of innovation (Carlsson and Sandstrom 2008; Reagan and Zuckerman 2001), and heterogeneous networks provide diverse knowledge systems that facilitate problem solving and adaptiveness (Prell et al. 2009; Rodin and Galunic 2004). The heterogeneity of the organizations in the core indicates the propensity of being able to share important information that originates at the center of the network throughout the entire network.

The challenge of conceptualizing 'vertical and horizontal interplay' (Young 2006, 2002) is illustrated in the discussion above, where community-based networks find value in "connecting the dots." In order to connect the dots there must be a sense of reciprocity that a collaborative interdependence of horizontally linked groups would be strategic. That is, there is no value-added linkage between the Blackfoot Challenge and the Clearwater Resources Council

to work together on noxious weed management if one or the other does not reciprocate efforts. Building that local legitimacy and a basis for reciprocating efforts is important. A board member of the CRC notes,

> What do we do recognizing each of our organizations have their own area, but a lot of issues span the broader Southwestern Crown. How do we move together and address some of the broader questions?

As the next section will discuss, perhaps the best way to connect networks across multiple-levels is through an effective narrative.

4.4 Discourse Connectivity: Invasive Species as the Ultimate "Other"

Much of the social network analysis literature focuses on the structure of networks (informal and formal), as I did in the previous section. While I outlined important features of actor positions in the network, it is not enough to just 'link' one actor to another. This leaves out qualities of the relationships between and across actors. These qualities determine the strength of the network, the meaning actors find in it, and the kinds of actions that the network engages in. These are important questions about how actors relate to each other and why. This is an interest in how those ties came to be, how they are maintained over time, and how they represent an added dimension to the network. If we want to understand what makes the network hold, what knowledge the network has, and what the network means to those involved, it is not so much the structure of the network that matters but the narrative. These are questions of 'Discourse Connectivity.'

The successful construction of any environmental issue as a problem requires the construction of an effective collective action frame. These collective action frames are a primary organizing factor for mobilizing networks towards particular ends and bundling heterogeneous motivations towards a common vision (Benford and Snow 2000). In the Crown

of the Continent landscape, there is a relatively robust network of individuals and organizations representing heterogeneous interests that work across a range of ecological scales and are focused on invasive species. As this section will discuss, the problem frame and narrative that binds the actors together, and together against an “other”, is an important dimension of connectivity.

4.4.1 The "Problem" of Invasives as "Invaders" and an "Economic Threat"

Invasive species management has provided a platform for organizations to build 'strategically interdependent' networks that stitch together local-level efforts. In many ways, this is because invasive species have been ‘framed’ in a way that has mobilized certain organizational partnerships and enabled those actors to build coalitions to take action. The problem of invasive species, writ large, provides a very classic case of problem framing. The establishment of what is ‘invasive’ and what is ‘native’ is an ongoing political and social process that is often very contested. In this case, the framing of what is problematic is a function of the intended purpose of the land. One contractor that does weed management work for several properties’ the Nature Conservancy owns remarks,

> What is your value of the land? I might want a beautiful pristine Palouse prairie. Somebody else might want an awesome hay meadow. Protecting or restoring either of those is different cost and different value. Especially around here on private land it is a touchy subject to go up to someone and say, well, this place is nice but it would be way better if this happened. And that is where people tell you to [expletive] yourself.

Whether the land is a pristine Palouse prairie of native grasses, a hay meadow, or forested is a prescription of what ‘should’ and ‘should not’ be on the land. This knowledge or wisdom often ‘sits in place’ (Basso 1996).

A new rural property owner from urban California might enjoy the yellow blooms of the Yellow Starthistle without realizing it outcompetes native grasses that local ranchers view as

valuable. When asked if newcomers know about weeds, a local native restoration worker who primarily works in the Blackfoot Valley says, “If they don’t, their neighbor will come over and tell them that they should. That is the way it works around here and throughout Montana.” As Wenger (2000) notes, competence is historically and socially defined and that knowing is a matter of displaying competency as defined in social communities. Knowing invasives from non-invasives is a competency in rural and conservation-minded landscapes such as the Crown of the Continent. Actors, via a process of socialization, internalize the historically situated knowledge of invasive species identification within this landscape. This socialization process, an interaction of competence and experience, defines parameters that frame invasive species as “a problem.”

Invasive Species as an Economic Issue

The ways that noxious weeds are framed as a problem is important for defining knowledge about invasives as a competency. In an interview in the summer of 2010, a member of the Blackfoot Challenge noted that the Blackfoot Valley has three resources that were important to steward: water, wildlife, and grass. Invasive weedy species directly impact native grasses as a resource, posing a direct threat to the local economy and livelihoods of local people. Some stakeholders in the invasive species world were very forthcoming about framing invasive species as an economic issue. A senior staff from one of the regional NGOs in the above ‘core’ network above notes, “We made a decision early on that this would not be an environmental issue. When I go to the legislature and talk about it, you won’t even hear environment come up in my discussion. It is an economic issue.” Invasive species, as an economic livelihood issue, is a diagnostic frame that quickly identifies the problem as one that is relevant across a wide range of stakeholders.

Invasive species management has also been framed as an economic opportunity. When talking about weed management, many research participants spoke about receiving grants from both foundations and public agencies. A director of one of the regional NGO's remarks,

> The invasive species stuff has been a common currency that has dealt with this, I think the southwest crown initiative was a good start, you had that initial problem…it was really focused on public lands and not the private lands, those were disconnected. I've seen how money from the [Crown of the Continent] Roundtable through Kresge [Foundation] and money through Great Northern [LCC] has been able to bring those two realms of public and private together.

As this quote illustrates, invasive species was not only an issue that generate economic activity for work in communities and 'on-the-ground,' but also 'brought public and private together.' The social organization of invasive species management on the Rocky Mountain Front garnered similar support.

The Rocky Mountain Front Weed Roundtable formed in 2010, and implemented a cost-effective, broad-scale, integrated weed management model. The project's goal was to change weed management from less effective treatment of established weed patches to cost-effective, integrated weed management using all appropriate techniques. In addition to "enhancing the ecological health" of the landscape, maintaining "economic opportunities" of the Rocky Mountain Front was a clear objective of the initiative (Duncan 2012). According to their website, in 2012, the RMFWR achieved:

- The collection of 300,000 leafy spurge flea beetles from field insectaries
- Distributed 25,000 biological control insects for knapweed across 4 counties
- Hosted nine cooperative events for pulling and learning about weeds, and
- Hosted a "Sun Canyon Weed Whacker Rodeo" where over 500 pounds of knapweed were pulled.

The driving problem frame catalyzing this weed coordination and organization was cost-effectiveness. Through communication and coordination, weed management became more cost-effective. Moreover, this initiative and every other invasive species initiative I studied were not only engaged in treatment, but also prevention. Prevention strategies were very frequently found in local literature and likewise discussed when individuals talked about invasive species management.

Invasive Species as "the Other": Invaders

Preventing invasive species is a core strategy across every local and regional invasive species management effort I investigated in this research. As noted earlier, the CRC mapped and designated weed free zones that were a top priority. After an extensive survey and developing a tool (TELSA, Tool for Exploratory Landscape Scenario Analysis), the RMFWR developed weed prevention areas. The language of 'prevention' is an effective prognostic frame, with a clear goal to stop the invaders. In order to prevent something, there must be something out there as the focus of the prevention.

Many participants spoke of invasive species as 'invaders.' The quote in the previous section (about connecting the dots) said, "maybe we can stop the invaders." The Blackfoot Challenge's website declares a 'war on weeds', and the Rocky Mountain Front notes "Hundreds of *weed fighters* gather each year to spray, pull, collect biological agents, and learn about noxious weeds within eight major drainages along the RMF" (Duncan 2012, emphasis added). Within this problem frame, very clear lines have been drawn between "us" and "them". In narrative terms this is the alterity, the other, and identity is often constructed against the other (Fludernik 2007). In this case, the network exists in defiance to 'the other' and that creates

motivations to build the 'strategic interdependence' discussed previously. As one member of the weed committee in the Blackfoot notes,

> If we can get connected further, we can push the boundaries of where these invaders are coming in further back. Now we see the relevancy of this and helping us see the larger picture of addressing this at a larger landscape. It really is very tangible.

The ways that invasive species is framed, both as an economic threat/opportunity and as an invader, provides for a narrative that is both grounded and tangible, but also connecting – horizontally from place to place as well as vertically to other institutions.

4.4.2 A Narrative that Connects

Noxious weeds and aquatic invasive species are literally 'grounded.' Rather than being epistemologically distant and measurable only through the scientific processes, network participants can rely on anecdotes from previous experience, stories they have heard from trusted sources, and traditional ways of knowing and dealing with invasive species. An operator of a native restoration business speaks to this,

> When I first started this business it was a lot of trial and error. I would get the best information I could from the distributor, but I would also take it out in the field and use it. Weed management is hard, it is not always successful…I've had some success and some failure…I like to work with someone that wants to start a weed business, then I hire them as a contractor and train them for a few years.

This is contrary to many other types of environmental issues where talk is homogenized by consistent scientific categories and measurements (think climate change). As mentioned earlier, where different individuals and organizations seek information is informative and certain organizations may need to 'translate' information across stakeholders. In the social network graph above (figure 4.3), one of the key regional NGOs was the Crown Managers Partnership. A senior staff at another regional NGO remarks about the CMP:

> What they are really doing is taking on two issues, the issue front and center on this meeting was invasive species. They are coordinating with all of these different entities to

> address the same problem across the boundary. There is great value in that in what you do adjacently and how invasives move across the landscape and knowing what the other person is doing so you know what you do is synergistic with the effort of your neighbor. Then a smaller scale, the Southwestern Crown Continent is a subset of the Crown of the Continent. You have three ranger districts working on similar ecological issues but now they are working on them collaboratively with a group of people that bring not just interest but also knowledge to the table. There is a great opportunity for synergy to help you actually design better projects on the ground.

The 'need' to do weed management emerges from the ground up, as does a good proportion of the knowledge and information regarding management. It is an inclusive narrative that, while incorporating different motivations, provides connectivity for a broader network of coordination. One research participant talks about the nature of ‘nesting’ the approach to invasive species management.

> The writing on the wall became apparent very quickly. How can we protect these two counties and what is extremely evident with AIS, even more than terrestrial, is that you can’t work on county by county or even basin by basin. You have to work bigger than that if you want to be successful. So we started working with a large piece of western Montana. We started working on a plan that would look at protecting western Montana. So that was our smallest unit. However, we recognize if you keep it to a four county area we won’t be successful. So through our different partnerships, I view it as nesting. The Flathead is the smallest then the next circle out from that would be the work with the Crown Managers Partnership.

Clearly, in order to function effectively at scales from the local community or watershed to a regional level, different networks or partnerships must intersect. In many cases, invasive species management has provided a platform to provide that ‘connective tissue’ to scale efforts.

For example, it was a “grounded” issue that helped springboard the ‘stitching together’ of four watersheds in the Southern Crown of the Continent to form the “Working Lands Council” (WLC). The Working Lands Council is an unincorporated collective of private landowners representing the Southern Crown, including the Rocky Mountain Front, the Blackfoot, Clearwater, and Swan Valleys. According to the declaration of partnership, the working lands council is focused on community driven working lands conservation delivered on

a landscape scale working in partnership with the US Department of Interior and the US Department of Agriculture with the intent to establish transparent and regular communications between working landowner interests and USDA and DOI leadership. The plan for this partnership was to have two meetings every year - one in the Crown of the Continent and one in Washington DC - to discuss important landowner issues in the region. This partnership followed the momentum of the America's Great Outdoor Initiative having its kickoff event at a ranch in the Blackfoot Valley.

In many ways, this is a clear example of a 'cross-scale' linkage. The coordinator for the working lands council notes,

> Right now, people in the Rocky Mountain Front, the Blackfoot, and the Swan have been working together to talk about more of the southern part of the Crown and whether and what they can work on that makes sense across this landscape…Just getting them talking and having those conversations is valuable. That is an attempt to scale up. You have to find that balance, what is a crown-wide issue that can really be worked on and solved versus just getting people together to have more political power.

Despite these local differences, a compelling narrative around invasive species management has led for these Crown groups to intersect. Not only have local and community-based efforts have intersected at a larger regional level, but also at that level of organization the Working Lands Council has now established a direct linkage to high level policy officials in Washington, DC. This illustrates the power (political and practical) that occurs when a narrative and network align in a particular assemblage of landscape governance.

4.5 Assemblage Connectivity: Assembling an Invasive Species Networks for Landscape Governance

Invasive species management makes an interesting first case study of the assemblage of individuals, groups, actors, organizations, practices, artifacts and institutional structures that fix (or transform) networks and narratives. The historically situated knowledge within this

landscape is internalized by the actors via socialization processes, and is then reproduced (and occasionally transformed) through the use of language (economic threat/opportunity, invaders), expanding ‘out’ collaborative efforts, and on-the-ground practices. It is, perhaps, these practices that really ‘assemble’ this network of landscape governance. In environmental governance, collaborative stakeholders learn about ecological issues, but as a part of this actors also learn a way of living and being. Practices carry that knowledge: skills, instruments, and an educated eye that displays competence. Through interactive practices, this information is shared between neighbors, communities, watersheds, and coordinated at ecological levels that deliver an increasing return to collaboration. In a case of invasive species management, there are complex assemblages of institutions, actors, and non-human actors that ‘integrate’ together to form networks of landscape conservation.

Competence as Practice in Polycentricity

The network and narrative of invasive species management connects different groups to each other, facilitating a cross-scale form of social capital that strengthens the role of community-based natural resource management because of the ways that information and knowledge are created and acted upon. There is a particular competency to 'knowing' about weeds, identifying and implementing the appropriate management practices for weeds. These types of 'competencies’, as discussed above, have been explained as entry and affiliation into 'communities of practice' (Wenger 1998). Wenger writes of “knowledge in practice” and states that “as a regime of competence every practice is in some sense a form of knowledge, and knowing is participating in that practice” (1998: 141). With invasive species, it is knowledge gleaned in practice that also has value in being shared. For example, one forest service employee involved with the Southwestern Crown Collaborative remarks,

> Having that flow of ideas and thoughts and interaction. Maybe you can consolidate around one type of thing and benefit that on a larger scale, but not everything at the same time. Even the thought of the invasive. If you could take one thing you want to help across boundaries that would be much more feasible, practical. I think that networking would be valuable. Sharing ideas about it.

As she indicates, sharing ideas about that one thing, invasives, across boundaries, adds value to conservation efforts. In many ways, the way that this network assembles is representative of a polycentric governance network. Across the Crown of the Continent, and on both sides of the U.S. and Canadian border, there are semi-autonomous nodes of knowledge and decision-making authority loosely coupled, sharing information, and learning from one another.

Theoretically, in polycentric networks, there are multiple centers of authority that create opportunities for local institutions to evolve with monitoring and feedback loops with institutional incentives that improve the fit between knowledge and action (Bixler 2014; Berkes 2010; Folke et al. 2005; Berkes et al. 2003). The core network map presented above (figure 4.3) illustrates several 'centers of authority', operating at multiple and often nested scales, with overlapping authorities and capabilities. One of the 'core' regional NGOs participants speaks directly to this element,

> If you think about me, I'm in a bunch of different groups and they are not concentric circles they are overlapping circles. I'm on the Flathead Basin Commission dealing with AIS. That came up at the Crown Managers Partnership, she works for the state government, I work for the federal government. So you start to see a lot of similar players in different organized environments working on the same issue. We are making strides working on AIS in Montana and across the country. There are 80 different groups and there is overlap of these groups. That is where your networking comes into play.

Thinking in terms of polycentric or network governance with invasive species, it becomes clear that the term 'network' is not synonymous with consensus-based collaboration, but rather it focuses attention on the multiple relationships existing (or not existing) among

multiple individuals or organizations. Staff for a national NGO based in Whitefish, Montana identifies this aspect of networks,

> So you have all of these partnerships, some are formal and some are not. And it is really needs based. You can dip into it when you need to and back out. Then you start to tie collectives together.

This is how a multi-level governance network becomes ‘assembled’, by fostering community-based networks grounded in place that can “dip into” broader networks when a particular need arises. Maintaining connections with different sources within and beyond a community is a form of information and knowledge gathering, enabling people to gain access to advice, services, and resources they might not otherwise know about or be able to influence (Gilchrist 2004).

The invasive species, as a particular “object”, is also an important part of this assembled network. The weeds themselves are a visible marker on the land, something that is 'other' and juxtaposed what the landscape 'should be.' These are the motivations that underpin why these local actors keep to the task, and what special meanings the landscape and its ecology has for them. It is a contextualized logic of meaning, that is differentiated from broader rationalities of science, bureaucracy, and regulation that has traditionally been associated with 'conservation.' So, in this case, the invasive species is a catalyst that brings people together. One Crown of the Continent Roundtable staff noted about landscape conservation,

> It is a multiplicity of things, but it hangs together in some way. So it is not defined by drawing a circle on a map and calling it a landscape. There has to be some catalytic reason to bring those people together and they work together and figuring out who needs to be part of the picture across jurisdictions to pull it off. Some landscapes don’t have that. If I look at federal initiatives it seems like they are drawing circles on a map and then trying to make it fit. It seems like those issues and conversations are much more challenging.

This point highlights the important role that the 'landscape' itself plays in landscape conservation and 'assembling' different actors, institutions, and knowledge's into networks of

governance. These assemblages can't be forced, and rarely successfully mandated (as chapter six will discuss). As illustrated next, the way that 'landscapes' are constructed is imbued with power relations defining who is actually in a position to be a part of the network of the landscape.

Power and equity issues in Assembling the Invasive Species Network

In many ways, the invasive species management network is assembled from the grassroots. What constitutes competent "knowledge" and "practices" around invasive species management is "grounded" in the landscape, especially as compared to the next two issue cases, grizzly bear conservation and climate adaptation. The grounded nature of this is empirically represented in both the core network map and the network positions that community-based NGOs and Regional NGOs have in the network, and also in the narrative of invasives as something that poses 'a threat' to local livelihoods.

However, while analytically assessing how this network is 'assembled', inequitable distribution of resources and displays of bureaucratic power also become apparent. Specifically, two cases illustrate this - the Confederated Salish and Kootenai tribe fighting for a voice and access to resources from the designation of the "Crown of the Continent" as an America's Great Outdoors priority landscape, and the rigidity of bonding ties in the Working Lands Council.

Anthropologist George Bird Grinnell first coined the term, the Crown of the Continent, in 1901. However, the concept of the Crown as a landscape didn't really gain traction until National Geographic magazine published a map of the Crown in 2008. Since then, it has undergone a process of transformation, negotiation, and reification of what and who belongs in the Crown. One Nature Conservancy staff working in the Rocky Mountain Front remarks,

> So it started to become cache to work on and talk about the areas like the crown, these whole systems…In Montana, it is the crown and because of that a lot of these

> collaborative efforts were born around five years ago. There are at least 600 groups that work collectively, collaboratively around the crown. Some of them go into Canada some of them don't, some focus on science, some on funding. They are tweaked just a little differently.

And further, she goes on:

> The focus on large landscapes and whole systems really wasn't a priority until the last 6 years or so. It has really ramped up and of course the efforts like the Americas Great Outdoors (AGO) that brought the public sector on board to this newer vision. Prior to that everybody was more interested in their individual landscapes, like the Blackfoot, the Rocky Mountain Front, the Swan – those as separate. Now the conversation is about whole systems as the key work. That being, in our area, the Crown. That is the whole system here. Everybody wants to be in a whole system right now because it is a priority and it is where we see resources being the most beneficial and valuable but the fact of the matter is that not every landscape is in a whole system because we degraded our resources to a point where not all systems are longer whole.

Interestingly, it is not only the contested process of creating a 'landscape,' but it is also illustrating the ways that this landscape is very active in assembling this overall network. The Crown of the Continent has become 'cache' and that is "where we see resources being the most beneficial", but who and how these collaborative groups become part of the larger 'network' is a contested process. This was particularly salient in my discussions with the Confederated Salish and Kootenai tribe and their engagement with America's Great Outdoor Initiative. A senior tribal member remarks,

> This particular project is the collaboration of AGO and all of these agencies working with private landowners and NGOs. Not once did they talk about working with the tribes and how they can create these projects to demonstrate their relevance. Now all of the sudden, the Crown of the Continent, which didn't exist until a few years ago and is just a concept, has become sort of this priority demonstration landscape area for them [referring to America's Great Outdoors]. If they can demonstrate how they can work together to address weeds, that is one of the working groups, and get a collaborative budget submitted…they are banking on that [weeds] being such a high priority that money will help them in their survival [against shrinking budgets].

As his point illustrates, that through the re-casting of the Crown of the Continent landscape, politics and power fundamentally shapes who benefits from the network. He goes on to say,

> That is what they are doing. So when we jump in and say where do we fit in? They say sorry that was an oversight and we don't have an answer. But in the meantime they are developing new plans and developing budgets and where do we fit in?

This exemplifies the point that networks aren't neutral, they are not always grassroots driven, and they are not always value added. Rather, if not carefully managed and guided, they can work towards excluding certain people and interests.

Another example of this is the Working Lands Council, as mentioned previously, a collection of private landowner interests in the Southern Crown of the Continent. As this group works to effectively 'link' itself to Washington D.C. and high level DOI and USDA officials, they are also setting boundaries around whose voice is represented, says a WLC support staff:

> What if other working lands groups want to join or what if you don't want a group to join – how do you do that? There was some real consternation because of the working lands folks didn't want to just say, ya'll come. Because then it gets beyond the scope of their interests.

Assembling the network of landscape governance is an important process to examine. In many ways, the network of invasive species management represents an integrated network of landscape governance that incorporates local knowledge and practices with mechanisms to share 'innovative' approaches throughout the network. However, in other ways certain social groups are excluded from the resources that being 'cache' brings into the landscape. Nonetheless, important characteristics including having community-based conservation organizations in the core and having an effective problem frame and narrative that includes local communities are important analytical take-away to carry forward to the next chapter, grizzly bear conservation.

4.6 Conclusion

The analytical chapters began with this analysis of invasive species management for a number of reasons. In contrast to grizzly bear conservation and climate adaptation, invasive species provides a very tangible problem definition and action set. Simply stated, invasive species management is about preventing a "bad" that everyone agrees is bad. Network actors have a shared understanding of what the problem is and see value in coordinating land management to make progress on the problem. Action is limited to a number of well-defined options, with all of the options end-goal being to eradicate or prevent "the invaders." In many ways, since invasive species management is about keeping out a "bad," the network of invasive species is held together through normative glue. Rather than being grounded in technical or scientific information (note: there is a plethora of biological and ecological research on invasive species, it is just not an organizing principle of this network), a collective understanding and value orientation motivates this network towards action. A motivating factor of this network is that invasive species are not an "acceptable" assemblage of the landscape, a value-oriented frame. A significant resource to flow through this network is funding, with the majority of the community-based groups part of this study having received significant financial resources for their invasive species management work. Although equity issues exist in how these resources are distributed throughout the network (and defining the boundaries of the network), many of these resources do make it onto private lands to help offset management and restoration costs on private lands. This, in turn, helps create and maintain community support for the network efforts at invasive species management.

CHAPTER FIVE: GRIZZLY BEAR CONSERVATION AND THE TRANSFORMATION OF NETWORKS AND NARRATIVES

5.1 Introduction

Chapter five presents the next issue case study, grizzly bear conservation. The word "grizzly" or "bear" appeared almost as much in the interview data as any other word. So in many ways, this dissertation is about the grizzly bear and the very notion of connectivity this dissertation sets out to explain. The ecological connectivity section will explain the foundation of 'connectivity conservation' as it applies to grizzly bear habitat. It will also unpack the 'problem' of grizzly bear conservation as a common-pool resource issue.

This chapter will add to the conversation on social connectivity by highlighting the role of weak ties that bridge structural holes. In the previous chapter on invasive species the role of building cross-scale linkages was highlighted. This chapter takes those insights one-step further by illustrating how some linkages strategically 'bridge structural information holes.' This chapter highlights the role of weak ties in doing that bridging, and the flow of that information as actionable knowledge being applied on the ground.

However, these network structures don't exist *a priori* nor do ties exist in a vacuum without context. On the contrary, it is precisely the context that creates and sustains network ties. Building on the previous chapter's discussion on problem framing, this chapter will discuss these dynamics by illustrating the effect of changing social contexts on narratives. As stories and narrative change, so to does the social and geographical space of common ground the network operates. Grizzly bear conservation and the notion of landscape or habitat connectivity are ecological issues that resonate socially and culturally across many stakeholder groups in the Northern Rockies where grizzly bears co-habituate. That wasn't always the case, and

highlighting those different narratives and where they originate helps explain the evolution of this network.

In the last section of this chapter, I will discuss the role that technology and innovation play in the broader network, and the role of boundary organizations that 'translate' science, funding, and planning on-the-ground conservation action. However, data and information are not always compatible and power relationships are negotiated over 'whose' information is the 'right' information.

Many organizations working across a variety of levels of governance are engaged in grizzly bear conservation and will be discussed in this chapter. Primarily, I will draw on some regional NGOs that work on land conservation and grizzly bear connectivity, primarily Vital Ground (based in Missoula, MT) and the Heart of the Rockies (based in Driggs, ID), an umbrella organization for local land trusts working in the Northern Rockies. A couple of primary organizations drive the science of grizzly bear conservation in the region, the Interagency Grizzly Bear Committee and the Great Northern Landscape Conservation Cooperative and they will be discussed. Finally, at the local level I will draw heavily from two place-based groups, the Teton Valley Land Trust based in Driggs, Idaho and the Blackfoot Challenge, in the Blackfoot Valley of Montana.

5.2 Ecological Connectivity: Grizzly Habitat as a Landscape Problem

Grizzly bears are the quintessence of ecological connectivity and connectivity conservation. Ecological connectivity (the ability to support animal movement, gene flow, range shifts, and other ecological and evolutionary processes that require large areas), is a driver of this push to think at the landscape scale (Beier et al. 2011). Habitat corridors that link 'islands' are valuable and necessary conservation tools, and scientists are increasingly looking to identify land

that connects big wild areas, keeping in mind where species are expected to move and persist as the climate changes.

Grizzlies once inhabited the entire north-south trajectory of the continent, from Alaska to Mexico, and from the West Coast to nearly the center of the North American continent. The North American range of grizzly bears has contracted in the past century and a half because of human-caused mortality, habitat loss, and population fragmentation (Servheen 1999; Mattson and Merrill 2002). In the conterminous United States, 98% of their range has been lost, and grizzly bears in the Yellowstone region have been isolated from northern populations for close to a century (Mattson and Merrill 2002). Grizzly bears are a key umbrella species – if you protect habitat in a way that grizzly populations persist, you've protected almost every other species (Roberge and Angelstam 2004). The science of connectivity conservation more or less started with grizzly bears. In 1978, Mark Shaffer wrote a doctoral dissertation titled "Determining Minimum Viable Population Sizes: A Case Study of the Grizzly Bear (Ursus arctos L.)." The take away from this dissertation was an emphasis on 'biological bridges' between 'islands' of grizzly bear populations. The science of grizzly bear connectivity is still very active in the Northern Rockies, for example a multi-year study was recently published in Wildlife Monographs titled, "Population fragmentation and inter-ecosystem movements of grizzly bears in Western Canada and northern United States" (Proctor et al. 2012).

Grizzly bears, and in the context of this research, grizzly bear habitat can be represented as a common-pool resource problem. Grizzly bears are a mobile species, moving across the landscape that includes multiple ownerships, and across those varying ownerships are varying attitudes and behaviors towards wildlife. Movement is an important process in population ecology (Clobert et al. 2001), allowing species to meet their ecological needs and helping them

persist during dramatic ecological changes such as those brought on by residential development and climate change (Nathan et al. 2008). However, this mobility is particularly problematic where the focal wildlife species has many social values (hunting, viewing, protecting) or particularly with grizzly bears when these animals move out of parks and public lands into adjacent ranches and communities, damaging property and crops or threatening human lives, and as a result face increasing risk of anthropogenic mortality. Often, private lands in valley bottoms and foothills adjacent to public lands are problematic zones, especially when available bear attractants coincide with occupied grizzly bear habitat. Specifically, in the Crown of the Continent, conflicts or incidents include bears killing livestock, destroying beehives, foraging for garbage close to homes, or, in rare cases, threatening human safety (Wilson 2006). Repeated incidents typically lead to more severe conflict, habituation, and eventually to removal of the bear through trapping, relocation or killing.

Though the lens of common-pool resources, grizzly bear habitat is a common-pool resource where it is difficult to exclude users (whether they be tourists, local people or hunters, game management officials, ranchers, land developers) and their habitat is subtractable (exploitation by one user reduces the availability of the resource to others). This typifies common pool resources in that “these two characteristics - difficulty of exclusion and subtractability - create potential CPR dilemmas in which people following their own short-term interests produce outcomes that are not in anyone’s long-term interest” (Ostrom et al. 1999: 1). In particular, extensive habitat fragmentation, often caused by ex-urban residential development, and major highways fragment grizzly populations and interrupt movement. Landscape fragmentation exacerbates concerns about movement and population viability, and when linear residential developments separate regions of grizzly habitat, they create extended areas of

interface between bears and humans, exacerbating the problem of anthropogenic mortality (Woodroffe and Ginsberg 1998). If development cannot be excluded, then threats such as crowding and habitat depletion to sustainable populations of grizzly bears are highly likely (Proctor 2012). Both development pressures and grizzly bear population are expected to increase in the Crown of the Continent (Kendall et al. 2009). This situation raises serious challenges to the landscape governance for the resilience of both grizzly bears and rural communities.

5.3 Social Connectivity: Bridging Ties and Structural Holes in Conservation

Grizzly bears (like invasive species in the previous chapter) don't recognize the human demarcated boundaries that we, as societies, have constructed. The political (counties, municipalities), administrative and managerial (USFS, BLM, NPS, etc) and the institutional boundaries that shape our actions socially are not recognizable to a grizzly. They move across the landscape in search of suitable habitat in spite of these boundaries. By doing so, grizzly bears serve as a social catalyst for networks of actors to communicate with each other across complex socially constructed boundaries. Grizzly bear conservation connects specific projects to a broader sense of the landscape. That is, local level action and habitat conservation is linked to landscape-scale science assessment and conservation planning. Grizzly bear conservation also illustrates the role of weak and bridging ties, structural 'informational' holes that those ties cross, and bridging organizations that help establish and maintain those ties. In their original formulation, the concepts of weak ties and structural holes were used to explain individual career mobility on the one hand and industry profitability on the other. Little research exists that has considered these theories in environmental conservation. However, the causal mechanisms underlying these theories are equally applicable to environmental governance, where organizational action results from information search.

Background on Bridging Ties as Network Resources

A large body of organizational and network literature suggest informational advantages associated with a firm or organization's network of ties (Gulati 1999). This is premised on the understanding that in order to sustain a competitive advantage firms must constantly seek out new opportunities for upgrading or renewing their capabilities and that firms benefit from having a network of knowledgeable contacts that provide a reliable source of information about options for enhancing competitive capabilities (McEvily and Zaheer 1999). Not all organizations possess comparable levels of network resources, and the variation in network resources across organizations influences their individual ability to discover and exploit useful information. Specifically, an organization's network varies in terms of structure, or the pattern of ties, and the nodal heterogeneity, or the variation in the mix of contacts in organizations network. This section argues that network structures rich in (1) bridging ties and linkages to (2) regional institutions offers informational advantages and enables 'scale-dependent collaborative advantages' (see Wyborn and Bixler 2013).

In the context of this research, bridging ties are those that link a focal organization to contacts in science, policy, and practitioner circles not otherwise accessible to the organization. Bridging ties involve ties between individuals or organizations that are generally instrumental - that is, single purpose - and rarely involve an exchange of emotion or affect (Flora and Flora 2004). Research in business management on 'innovation clusters' note, "in geographical clusters, firms that act as connectors between subclusters maintain bridging ties" (McEvily and Zaheer 1999). The term "brokerage" generally refers to the position that bridges, and the brokerage position can facilitate access to novel information, or resources, facilitate transfer of knowledge, and coordinate effort across the network (Burt 2002; Long et al. 2013).

The concept of bridging ties has its basis in theories of social networks, which argue that new information is obtained through 'weak ties' (Granovetter 1973) and 'structural holes' (Burt 2002, 2004). Granovetter's strength of weak ties (SWT) argument "asserts that our acquaintances (weak ties) are less likely to be socially involved with one another than are our close friends (strong ties)" (1983: 201). In network terms, the SWT theory translates to say that people tend to be homophilous, meaning they tend to have stronger ties with people who are similar to themselves (McPherson et al. 2001). Strong ties characterize a dense cluster of actors who are all mutually connected to each other. Since this subcluster of strongly connected actors is likely to interact frequently, much of the information circulating in this social system is redundant. Conversely, weak ties are characterized by the relative infrequency of interaction between focal organization and contacts and enable the discovery of opportunities because they serve as bridges to potential sources of novel ideas and innovation (Grannovetter 1973, 1983; Borgatti and Halgin 2011). The connecting medium of bridging weak ties lubricates the exchange of ideas and innovation by connecting cohesive subgroups that are not too cohesive to be entirely closed off (Crona and Hubacek 2010). Weak ties are less redundant and more flexible than strong ties and can bridge longer distances within a network, and thus, provide new information and knowledge for the network.

Burt (2002) extends the strength of weak ties argument by asserting that it is not so much the strength or weakness of a tie that determines its information potential, but rather whether a structural hole exists between a focal organization's strong tie contacts. Burt claims that individuals near the 'holes' in a social structure have a higher likelihood of good ideas because people that connect across groups are exposed to alternative ways of thinking which gives them more options to select from and synthesize (Burt 2002, 2004, 2005). Being positioned between

structural holes presents the opportunity to receive more nonredundant information at any given time, which is the key to good ideas and social capital (*ibid*). Individuals can exploit structural holes to act as brokers and connect otherwise disconnected groups and thus promote innovation and learning, providing opportunities for emergent leadership and collaborative innovation (Crona and Parker 2012). Burt's structural hole theory of social capital (2002, 2004, 2005) provides insights into structural network characteristics that enable collaborative and adaptive governance institutions.

Organizations that play a brokerage role do so by maintaining weak ties, and many of those ties connect groups at different levels. Much evidence has emerged from the network literature about the role of brokers, and this chapter highlights the role of the brokers, sometimes referred to as boundary spanners, bridging organizations, or intermediaries that help connect individuals/organizations across boundaries (see Sternlieb et al. 2013). Boundary spanners (or leaders) are those actors who try to connect or link science and policy (White et al. 2008; White et al. 2010), whereas bridging organizations are positioned in a way to function as conduit between social networks to link diverse nodes of expertise for collective action (Berkes 2009; Biggs et al. 2010; Crona and Parker 2012).

The bridging organization, as a formal, third party entity distinct from the individuals or organizations it connects, provides "an arena for knowledge co-production, trust building, sense making, learning, vertical and horizontal collaboration and conflict resolution" (Berkes 2009, p.1695). They might assist collaborative initiatives by gathering and interpreting technical information or providing legal, financial, or simply moral support (Schultz 2009). In these capacities, such organizations are thought to lower the transaction costs associated with multiparty collaboration and provide social incentives to modify behavior or enhance

participation in resource governance (Hahn et al. 2006). In a structural sense, they might provide a stabilizing role in social networks, buffering disturbances such as changes in leadership (Olsson et al. 2007), or they could serve as catalysts for multiple ad hoc collaborations that arise in response to specific issues, with varying degrees of betweenness-centrality for each (Hahn et al. 2006). Brokers need to be able to understand the science, communicate with policy and decision makers, and incorporate community values into practice.

5.3.1 Local Networks of Grizzly Bear Conservation

In the following two sections, I will illustrate the role of weak ties and the types of 'informational' advantages of those weak ties in both local networks and then the ways that local networks bridge structural holes across multiple levels. The actual 'doing' of grizzly bear habitat conservation is a local and place-based practice. As discussed above in ecological connectivity, conservation of grizzly bear habitat is critical for 'ecological connectivity' for the species to move across the landscape. Critical habitat is often on private lands, and one of the primary tools to conserve private lands is a conservation easement. The role of land trusts and conservation easements are foundational to grizzly bear habitat conservation. An important organization engaged in this research, Vital Ground, notes on their website:

> Vital Ground has to be both selective and strategic to effectively carry out its primary goal of reconnecting isolated fragments of wildlands that are important for grizzly recovery and biodiversity. As such, Vital Ground uses its financial resources and real estate expertise to identify and protect those parcels of private land crucial to survival of the grizzly. (Vital Ground 2013)

However, 'identifying' and 'protecting' private parcels of land is often a contested and conflict ridden proposition in the West, a place where private property rights are held in high regard.

I personally was witness to a very tense meeting in Greenough, a small rural community in the Blackfoot Valley, during the summer of 2010. Missoula County Rural Initiatives was in

the middle of designing an interactive web-based conservation and community web atlas, the PLACE project. The PLACE project (practical landscape assessment for conservation and enhancement) was in the process of holding community meetings in Missoula County to receive feedback about the type of data to be collected for their maps. Prior to the meeting, some local landowners sent letters to every P.O Box in the zip code denouncing the project as a 'state-led' and socialist take-over of private land and encouraged disruptive participation at the meeting. Approximately 40 individuals were present for that meeting and largely disrupted the formal presentation and any chance for a constructive dialogue. While this is an outlier of the type of meetings I've observed in the region, this is also an important example of how explosive of an issue private land conservation can be.

This raises critical questions about the role of local networks in issues like grizzly bear conservation, where unlike invasive species management, most of the scientific assessment, planning, and information is derived from supra-local places. Importantly, this highlights the importance of 'bridging organizations' that can build rapport in local community networks. A leader in the Vital Ground organization referenced above discusses an example of this,

> What you want to do in the community is get people to think of you as an individual and not just an organization. The first meeting I took our [employee] to was a meeting in Bonners Ferry, ID. We own quite a bit of land in Boundary County, ID. There was a meeting of local landowners talking about common concerns with the state wildlife management area which we all border… So I told [employee] to wear his wranglers and packer boots and a cap that has something to do with guns or shooting on it. Because that is the community we were in. We are both hunters and outdoors people. You don't want to walk into a rural community with loafers and a blue blazer and a white turtleneck with a gold chain. That wouldn't have gone over. We had a good meeting, got to know some of the landowners…When it was all over one of the most conservative of the group came over and said, I didn't know what to think about meeting with you tonight but when you walked into the room and you were wearing caps that said Remington country on it I figured you couldn't be all bad. That is what it is about when it comes to building those relationships. We try to make it personal.

This is a good example of the cultural boundaries that are crossed in building local networks for grizzly conservation. Crossing these boundaries and building these relationships are necessary to bridge structural 'informational' holes that will be discussed in the next section. These dynamics of relationship building emerged several times in my data, another example was provided by a conservationist in the Greater Yellowstone Area,

> I used to say it takes five cups of coffee and five meetings in person for them to every understand what a conservation easement is. If you try to do it by phone you should just forget it. I'm in the business of bad coffee and uncomfortable couches.

Being in the business of bad coffee and uncomfortable couches means building those relationships with individuals and communities.

Community-based conservation organizations, and the networks of those community-based groups, play an important role in the broader social connectivity of the grizzly bear conservation network. One research participant in the Clearwater valley notes, "Local groups like the [Blackfoot] Challenge and Clearwater Resource Council are certainly important parts to that by being the interface between the science and the community." In contrast to the invasive species management network, scientific information plays a larger role with grizzly bear conservation. Data is often collected and compiled in the scientific community, but applied in local communities. A newer resident of the Teton-Jackson Hole area in the Greater Yellowstone and employee of the Teton Valley Land trust in Driggs, ID shares a story that helps explain this connection:

> The more data that is shared the better. We have 14 grizzly bears collared up in island park. I like to think it is a big meadow surrounded by lodgepole pine. Up 30 miles to the east is Hayden Valley in Yellowstone park. A big wide open meadow surrounded by lodgepole pine. There is not much difference between the two, fortunately. This summer we had a sow grizzly with a collar on her..[go] back and forth four times. The heart of Yellowstone National Park and Island Park. For a sow they look almost identical. There happens to be a straight line between the national park and private land. That bear couldn't

> care about that line and couldn't care less about those meadows. From a planning perspective, one of those is about to be erased. That kind of data speaks volumes.

The 'data' he is referencing illustrates the habitat value of that private land in Island Park that the sow grizzly is occupying, and that it is 'about to be erased' by ex-urban development. The empirical significance of this example is not that the data exists, but how it is 'socially connected' into communities and community-based land trusts that have established relationships with the community and are able to translate that information into 'on-the-ground conservation.' This is representative of multiple-level networks.

5.3.2 Multiple-level Networks

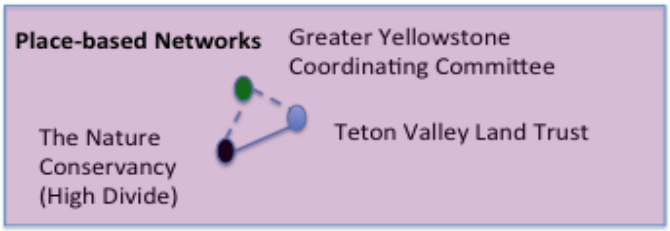
Grizzly bear conservation provides an interesting case of multiple-level networks. In the previous chapter, I discussed the role of regional NGOs in playing a broker role connecting different community-based groups. There are similar examples in grizzly bear conservation, however, given the data-driven and scientific nature of grizzly bear conservation there is an additional element to this network - the science-based organizations. During my fieldwork, I interviewed two science organizations that are driving much of the grizzly bear research in the Crown of the Continent landscape, the Interagency Grizzly Bear Committee and the Great Northern LCC. See figure 5.1 below.

Figure 5.1. Grizzly Bear Science Organizations Interviewed for this Study

In recent years, the Great Northern LCC has funded several connectivity conservation research projects of the Interagency Grizzly Bear Committee (IGBC), and the GNLCC helps the IGBC communicate that science and associated habitat maps to a broader audience. As previously stated, this science needs to be 'usable' to community-based organizations. The local Teton Valley Land Trust employee noted above continues his story that helps to articulate this point:

> We get better and better data on bears, primarily from the Inter-agency grizzly bear…the advent of geospatial technology, either from collaring animals or GIS platforms for depicting that information has made it publicly consumable…

An important part of this multiple-level network is those science-based organizations. The conservation of grizzly bear habitat has been transformed from a 'buckshot approach' to one that is more strategic because of the data generated by organizations such as the Interagency Grizzly Bear Committee. At another level, community-based conservation organizations also play a critical role. I interviewed place-based networks in both the Crown of the Continent and the Greater Yellowstone Area (see Figure 5.2 below).



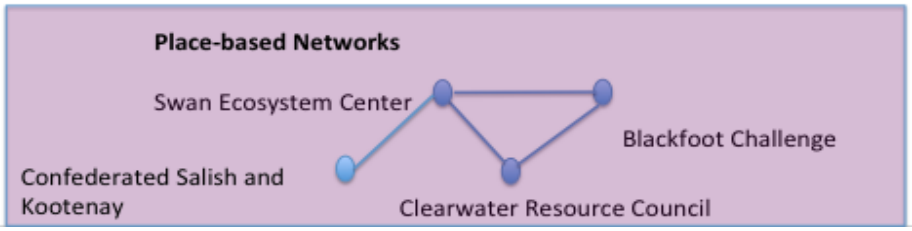


Figure 5.2. Place-based Organizations Interviewed for this Study

Through the course of the interviews, I did uncover a couple of references to direct ties between the science based organizations and the local community-based networks, but for the most part a 'structural hole' existed between the science-based organizations and the place-based networks (see figure 5.3 below).

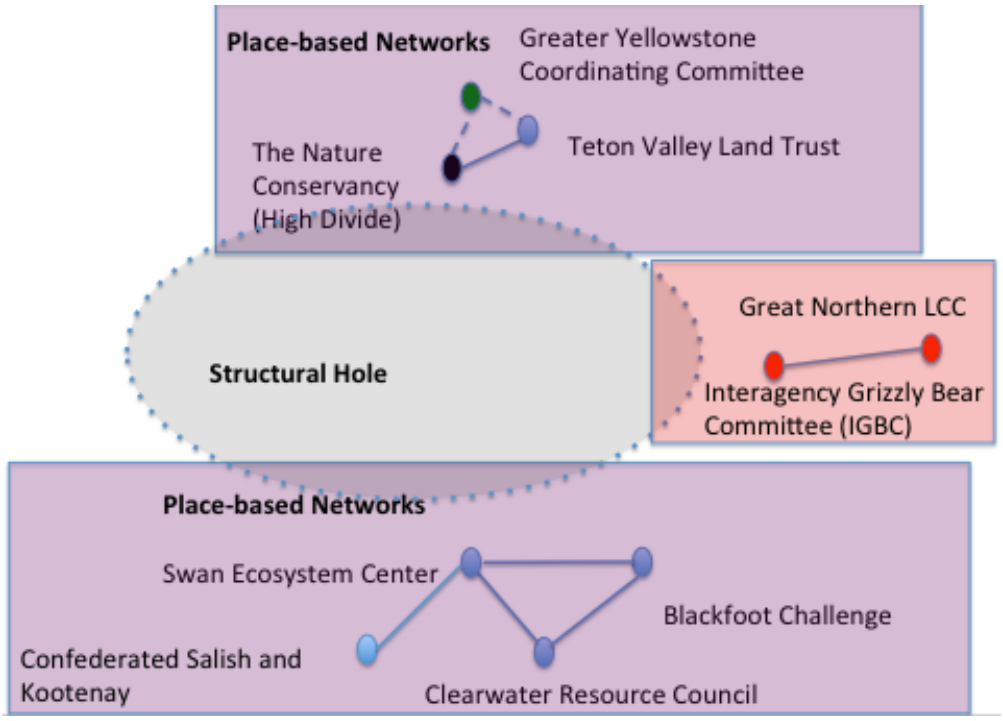


Figure 5.3. Structural 'Informational' Hole between Science and Community-based Organizations

As illustrated below, through the course of the interviews I was able to identify some organizations that bridged that structural hole and established relationships to both the science organizations and the community organizations, namely the Heart of the Rockies (HOR), Vital Ground, and the Crown Managers Partnership (CMP).

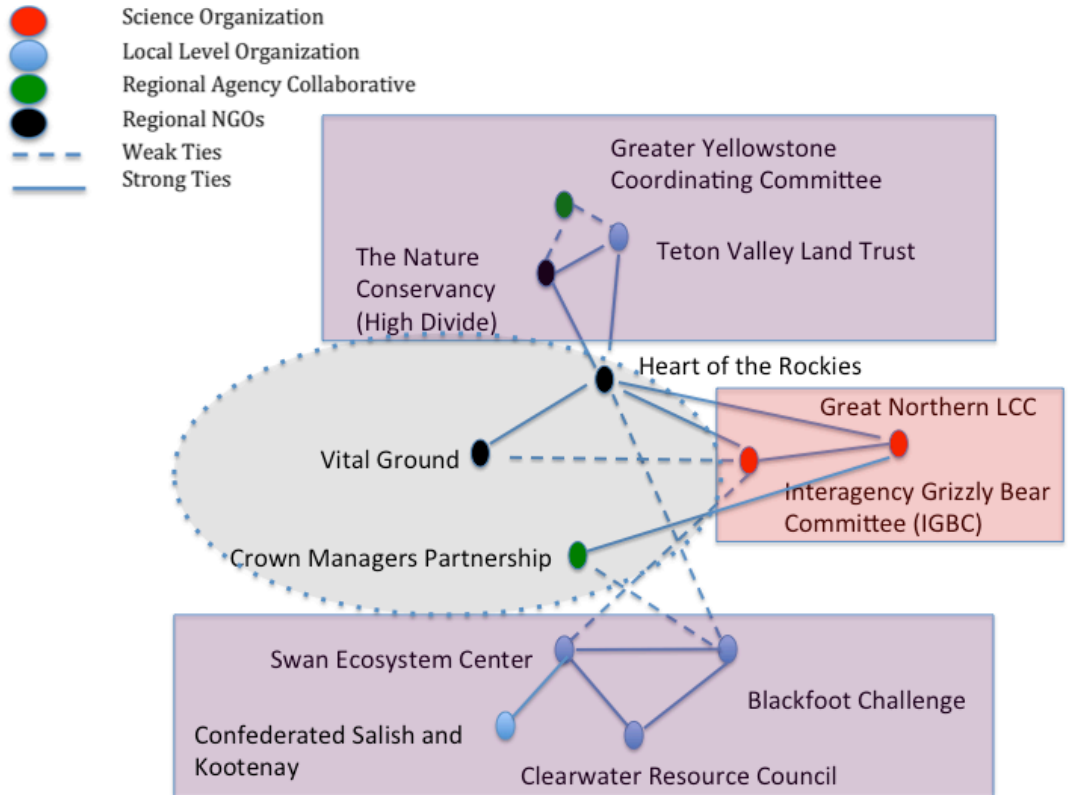


Figure 5.4. Multiple Level Network of Grizzly Bear Conservation in the Northern Rockies

As figure 5.4 above illustrates, there are certain organizations that bridge those structural holes and in doing so acquire informational advantages they use to advance conservation. In network terms, these ties are often weak as indicated by the dotted lines in the figure 5.4 above. Through informal networks and weak ties, information of grizzly bear habitat conservation flows from organization to organization. For example, staff from Vital Ground notes:

> You are the experts, is this something that really fits in as being important for grizzly bear conservation in the swan valley? If we only have $300K to spend in the swan this year, is this where we should spend it? That is an informal network. I'm not going through Fish, Wildlife, and Parks; but I'm going straight to the biologist who is collecting the radio collar data and I ask him to tell me if this is an important piece of land. I call that informal collaboration.

In this statement, he is directly making reference to connecting the science and data, on the one hand, with the community where this conservation will be delivered. Having this type of partnership is about 'information benefits' (McEvily and Zaheer 1999), but also about receiving a

valuable piece of information and knowing how to use it (Burt 2002). Organizations differ in their capacity to access and use information through their networks, and these differences are a key source of variation in organizations 'collaborative advantages.' When an organization utilizes information, it "can speak volumes."

This type of informal tie and information exchange was echoed elsewhere. Staff from the Teton Valley Land Trust remarks,

> I encourage all of the biologists, not to lie to me, not to tell me something they don't believe, but I want a hunch. I don't want five years of data collection and two years of writing a PhD before you tell me it is important. Development speed is definitely outpacing research speed. If you identified it in the first year when ten sows crossed the road or private property…I could have done something about that…Their hunches are better than my guesses and if they are willing to share we all have a chance to do something…the more data that is shared, the better.

This was also recognized by one of the grizzly bear scientists researching grizzly bears, a senior scientist with the U.S. Fish and Wildlife Service and the Interagency Grizzly Bear Committee remarks,

> To be applicable on-the-ground, it doesn't mean it has to be this ivory tower type thing like we would like grizzly bears to be everywhere and need to be all over the place. There is a balance between the needs of people and the needs of grizzly bears. What we try to do is work in that zone.

The social connectivity that connects the science and assessment of habitat conservation to the needs of 'people' suggests the presence of weak ties that bridge those structural holes and connect community and outside institutions. This empirical contexts suggests that connections to those external sources increases the flow of information and fosters collaborative work 'in that zone.' Collaborating organizations engaged with how to sustain that balance of grizzly bears and people that is shaping a more connecting narrative.

5.4 Discourse Connectivity: Changing Social Contexts and a Good Vision

Grizzly bear conservation in the Crown of the Continent illustrates the transformation of a problem frame. As the quote just previously above illustrates, there is an alignment between scientific organizations and community-based organizations to find a 'zone of agreement' where both the needs of grizzlies and people exist. This emergent narrative has framed collective action, and demonstrated to participants and external supporters and funders, as well as traditional antagonists such as national environmental NGOs, that their action was part of a larger struggle to protect not only an 'umbrella species' but also a cultural history unique to the region. Local innovation changed the social context of the problem in turn changing the perceptions, perceptions based on assumptions, experience, and understandings that underlie the definition of the problem. Perceptions can undergo a change, as can the 'long-term' interest of 'the commons' and the overall narrative that guides engagement in an issue.

The stories that motivate people with a vision and pulls them together into network ties provide insight into the reasons that networks emerge, specific concerns people have, how networks attract members, and how they persist. In order to understand the network, it is necessary to pay attention to the stories told by people about their connections: how they came to be and how they are maintained. This is illustrated in the examples in the previous sections on weak ties and structural holes and bringing the different knowledges and experiences into the network. Networks need stories to make sense, as they create the glue that binds people together in networks, providing them with a sense of history, common ground, and future vision, thus enabling them to persist through disturbance. This perspective helps explain the ways that networks around grizzly bear conservation in the Northern Rockies have transformed. Grizzly bears, as typical of large carnivore conservation in North America, are historically not well

tolerated outside of protected areas (Mattson et al. 1996). However, through effective problem framing, collaborative efforts have substantially reduced conflicts for both bears and people and helped shaped the narrative of grizzlies and people on the landscape that "glues" the network together.

5.4.1 Problem Framing Grounded in Local Context and Practices

As noted in the ecological connectivity section, a significant threat to grizzly bear population viability is anthropogenic mortality. One study tracked 388 radio-collared grizzly bears and found that people killed 77-85% of the 99 grizzly bears known or suspected to have died while radio-collared (McLellan et al. 1999). Half of those 99 grizzly bears were killed for being too close to human habitation (while the other half was permitted hunting and legal harvesting). Because of their reputation as dangerous carnivores, grizzly bears often experience higher rates of anthropogenic mortality in human-dominated landscapes than can be sustained by their low reproductive rate (Garshelis et al. 2005).

As grizzly bears re-expand their range onto private lands in the Crown of the Continent (the State of Montana suggests grizzly bear populations have grown at approximately 3 percent per year since population trend monitoring began in 2004, Wilson et al *forthcoming*), the chances for conflicts or incidents and anthropogenic mortality of grizzlies increases significantly. Recognizing this, the Blackfoot Challenge brought together the rural landowners, wildlife agencies, and conservation groups to determine exactly what the problem was and how best to address it. Not surprisingly, there were multiple perspectives or definitions of what was the "problem". As Wilson et al (*forthcoming*) reflect, some people felt that there were simply too many bears, some celebrated new grizzly bear activity, some defined the problem as primarily one of risk to human safety, and some linked the increased grizzly activity to an erosion of

personal rights and freedoms exacerbated by the regulatory burdens the Endangered Species Act. As this situation indicated, the ideas, ideologies, and beliefs brought to bear on a problem definition by different stakeholders can substantially influence problem perception.

Through a process of authentically engaging key stakeholders, a process that officially began in 2002, the Blackfoot Challenge implemented a participatory GIS mapping program that mapped land use practices, bear attractants and other relevant features and took that information back to the community to collectively re-frame the problem. Recognizing that the traditional practice of dumping dead livestock carcasses in "bone yards" was attracting bears onto ranches and driving much of the human-grizzly conflict, the Blackfoot Challenge started a carcass removal program. In the past three years, an average of 633 carcasses per year were removed, and the program now covers 70-80 ranches over 607,000 ha (Wilson 2011). In the Blackfoot watershed from 2003 to 2009, grizzly bear-human conflicts decreased 93 percent (Blackfoot Challenge 2013).

By 'grounding' the diagnostic frame of this problem, community-based conservation groups are increasing their 'social connectivity' across the landscape. The carcass removal program in the Blackfoot has helped stimulate efforts in Alberta, Wyoming, and other places in Montana (Bixler and Taylor 2012: 236), and now conservation practitioners are talking about it in the High Divide region around Salmon, Idaho. Staff for the Nature Conservancy in Montana who works to catalyze collaborative efforts in the High Divide region of Idaho/Montana notes that the local ranchers in that area are:

> Thinking on the more practical level about bone piles and how people lose livestock and that is that a problem for them, they would like to reduce that. I think the science people don't necessarily see that. The people on the ground are saying, here is where the community is and what their concerns are. Can we provide some tools to help them answer some of those concerns and hopefully some of those align with our conservation?

This quote illustrates the tension that exists between the 'science people' and the local community concerns. As the social connectivity section illustrated, certain bridging organizations are effectively bridging structural holes and engaging in a process of translating those often competing forms of information, science and local. How the problem is framed can lead to a 'cultural connection' of goals and vision.

5.4.2 The Larger Vision of Grizzly Bear Conservation

The vision of grizzly bear conservation is big, very big. The vision of 'grizzlies' on the landscape is a powerful narrative of a desired, healthy, ecological landscape. This is representative of the concept of the umbrella species used in conservation biology (Roberge and Angelstam 2004). The umbrella species is a conservation tool that is meant to serve as a 'shortcut' to guide ecosystem management in ways where management efforts of the most exigent species is likely to address the ecological requirements of the many co-inhabitants (people excluded) that use the same habitat. This umbrella metaphor is powerful, as it invokes images of 'protection' to other species. Several interview respondents invoked this type of imagery. For example, a senior associate at the grizzly conservation organization, Vital Ground, remarks, "The grizzly is our icon. Where the grizzly can walk the earth is healthy. We have the grizzly as our icon and our compass." The grizzly bear is clearly invoked as an umbrella species, as indicated by a private lands conservation biologist that works in the Swan Valley,

> This [using wildlife biology to guide conservation] is being applied across the Crown of the Continent. You take a certain subset of species, say the Grizzly Bear, and if you're doing what is right for grizzlies you are more than likely doing what is right for other species.

This vision and narrative is used to fuse multiple stakeholder groups with diverse interests into working coalitions, for example the Rocky Mountain Elk Foundation and Vital Ground, each

with significantly different demographic bases of stakeholders. As a former senior staff of the Rocky Mountain Elk foundation notes,

> I think I view partnerships similar to the way I view the grizzly and the landscape. How can groups like Vital Ground and the Rocky Mountain Elk Foundation cooperate on a project? It is because we are interested in the same piece of land. We have one landscape out there. We have different constituencies, different interests but the way we can be most effective is recognize what we have in common and setting aside our differences and focusing on what we agree upon…The elk foundation is sportsman based, politically very conservative, not sympathetic to large predators. Yet elk and grizzly share the same land. That is why Vital Ground and the Elk Foundation can work together to protect a piece of land in the Swan [Valley] because it is important for elk and grizzly…As a result of that partnership, we can bring the resources together to protect that landscape.

As the quote above illustrates, crafting that narrative of a healthy landscape is effective in bringing together different stakeholders. Similarly, there is an interesting intersection that exists at successful local problem framing with effective conservation outcomes that simultaneously reduce human-bear conflict as illustrated in the previous section, and a larger narrative of bears and healthy landscape.

In many ways, grizzly bear conservation is grounded. It is grounded in ways that local stakeholders draw on their current knowledge, understanding, and values to cognitively frame the problem of grizzly bears and grizzly bear conservation. Yet, it also represents a grander vision of large-scale ecological connectivity. Back in the Teton-Jackson area, the Teton Land Trust employee remarks on this intersection:

> On a large landscape, I think it is not widely known by the public the importance of connectivity. Certainly from those of us who have the wildlife biology background, we get it. That the population and meta-populations particularly around mostly wolverines and bears will not persist without that ability to connect terrestrially to other subpopulations. It takes a rare landowner or a rare donor that we can get that through too, but I wouldn't say it is necessary. There is enough of a local mandate for conservation that it if we can get them to believe in that then you've succeeded even if they don't realize the larger vision.

As this quote illustrates narratives have the ability to integrate parts, events, characters and institutions into meaningful wholes without fully recognizing the depth of each. The science of

connectivity may not "be necessary" for an effective network of grizzly bear habitat conservation. This raises a very important point that will be addressed in the next chapter on climate adaptation. The value of the problem frame and narrative of grizzly bear conservation may lie in its multiplicity and plurivocity, which is the quality of a narrative that allows different stakeholders to each tell the general story in their own ways (Lejano et al. 2013). This is the part of the narrative 'glue' that allows the blending of disparate voices sometimes coherent and other times dissonant to come together into one shared story. This is part of how the 'connectivity conservation' of the grizzly bear is assembled.

5.5 Assemblage Connectivity: Assembling Grizzly Conservation

Grizzly bear conservation is an interesting case of 'assembling' networks of landscape conservation. As the previous sections discussed, the role of organizations that bridge structural information holes is important, as is the grounded re-framing of the problem of grizzly bears. In grizzly bear conservation, different groups of people and organizations "story" themselves into boundary spanning networks of environmental and social relations. In addition to these networks and narratives, the relationship between humans and grizzlies are an important part of this story. Grizzlies are materially and symbolically important actors of this assemblage, as the "other", but in contrast to invasive species, an "other" that the network increasingly exists in balance with. However, in paying attention to the assembly of the network there are is still plenty of evidence of power imbalances and a particular imposition of the 'tools' of connectivity.

Assembling Grizzly Bear "Connectivity" Conservation

Grizzly bear conservation in the Northern Rockies, as a network of environmental governance, highlights several positive features of effective networks, namely that they bridge, integrate, translate, and generate. Particular organizations, such as the Heart of the Rockies, play

an important role in bridging place-based land trusts and other community-based groups to the science of grizzly bear conservation. In doing so, they often translate 'data' to meaningful information to those that can use it for conservation purposes and integrate community values into those conservation efforts. These efforts are often *rhizomatic*, in that they tend to establish connections between heterogeneous elements that extend beyond the original intent. These points will be elaborated below.

Technology plays an important role in assembling networks of landscape conservation for grizzly bears. New technologies have enabled dramatic growth in the scientific understanding of grizzly bear habitat conservation needs and have played a role in linking more progressive environmental conservation organizations with ranchers. In this case, tools such as GIS maps (see figure 5.6 below) 'speaks volumes' as one research participant noted.

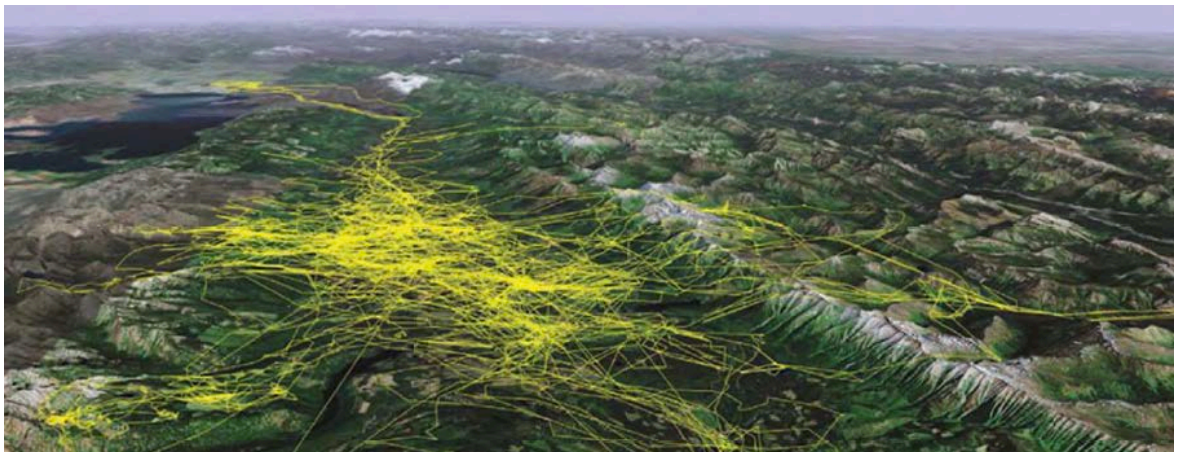


Figure 5.5. Map of a grizzly bear moving back and forth across the Swan Valley (Illustration courtesy of Chris Servheen)

The map above is one radio-collared grizzly bear and his movements across the Swan Valley. On the right side of the picture is the Bob Marshall Wilderness, on the left side of the image is Confederated Salish and Kootenai tribal territory (below Flathead Lake in the upper left portion of the image), and the lower part of the picture is the Clearwater watershed (with the

Blackfoot watershed just off the bottom of the screen). Visually illustrating grizzly bear movements is by no means an indicator of social connectivity. On the contrary, these movements in the very recent past presented many barriers for cross-scale collaboration as often the values of the communities were at loggerheads with the values of regional land managers in charge of grizzly bear conservation. Tools, such as GIS, and its products such as the map above provide resource managers with decision-support tools and expressions of connectivity (Beier et al. 2011) that have the capacity to 'bridge' the boundary between stakeholders with traditional disagreements and foster narratives that are inclusive of communities and their role in the conservation efforts. For example, a senior staff at the Heart of the Rockies (HOR) remarks,

> When we go into planning we start with all of the GIS data layers we can find from the state or whatever, and put those on the table and say okay this is what they are telling us is important for elk and wolverine or whatever. We use this data but then apply your local knowledge.

Using technologies, such as GIS, has been effective in empowering communities to have a role in finding solutions to complex challenges and as such has played an important role in assembling the network of grizzly conservation. This illustrates the complex ways in which 'natural' entities are transformed and contested through changing social contexts.

Grizzly bears were once not too long ago the 'other', such that rancher identity was constructed against existence of that other. Many ranchers are now not only more tolerant of bears, but advocates as well. A story was shared of one traditional rancher who in the last decade has gone from shooting bears to advocating for them. Recalls a Nature Conservancy staff on the Rocky Mountain Front,

> All of these ranchers used to shoot bears. And now they are the biggest advocates. There is one rancher that grew up shooting bears and now when you ask why conservation easements are important, grizzlies are the number one answer. Not the livelihoods, not the economics, the bears…He saw that our management was not impaired by the existence of bears when they started to come back and over time questioned his own actions, why are

> we shooting them? And then one of the things turned him the most was he had this moment with a bear on his ranch and he thought: why am I doing this? From then on he was the ardent supporter of living with bears.

Important in assembling this network is the grizzly bear as well as how changed local practices have also transformed grizzly bear behavior and reduced negative human-grizzly interactions. It is also the bridging organizations that connect multiple levels of grizzly bear conservation.

This network has transformed into one that works in balance with grizzly bears. As Lejano et al. (2013) note, whether a network exists in defiance to or, alternatively, in balance with, affects its function. Because of the factors outlined, the multiple-level networks of connectivity conservation are assembled in ways representative of landscape conservation. One forest scientist involved in the Southwestern Crown Collaborative project remarks,

> It is a general set of practices and policies and relationships that are designed to overcome the checkerboard pattern of landownership that is represented on that map and the fact that a grizzly doesn't see the land in that pattern that our society has imposed on the landscape.

Similarly, on the Rocky Mountain Front, a national NGO employee that has helped catalyze community-based conservation efforts remarks of landscape conservation,

> It is doing conservation at a very large scale while trying to blur the lines of distinction in terms of property ownership. It is basically trying to look at the landscape without all of these lines. The whole thing is sort of, it doesn't stop at the forest boundaries, it doesn't stop at the private boundaries, and it is all interrelated. It all functions as a much greater system. That is not a very good definition but I know it when I see it. It also involves communities.

Moreover, the network is assembled in ways that often generate new collaborations. This is illustrated by on member of the Heart of the Rockies (HOR) initiative talking about what he gleans from the HOR initiative:

> There are 25 organizations that are a part of that [Heart of the Rockies]. Most of what I get out of that [as a member] doesn't happen at those formal meetings. What I get out of the formal meetings is get to know who these people are. Get to build a personal relationship with them. I hang out for two days, I eat breakfast with them, I get to know them. I get to

> find out what kind of projects they are working on. The collaboration doesn't really happen at bi-annual HOR meetings. Afterwards is when we collaborate on a project.

As these efforts illustrate, there is value-added in assembling, at a regional level, actors that are tied into local landscapes and communities. Doing so facilitates collaborative action and connects regional science and assessment with local strategic action. However, in doing so stakeholders are dealing with the interconnections between these various spatial levels, the relationships between those levels, and the different types of histories and knowledges each brings into the network.

Power and Knowledge in the Connectivity of Grizzly Bear Conservation

Many interview respondents talked about the nature of grizzly bear science and the institution that the research has created. As noted previously, the Great Northern Landscape Conservation Cooperative was established in 2009 and since that time they have funded a significant amount of grizzly bear research documenting connectivity corridors and linkage zones across habitat. A local rancher, while most likely aware of the Endangered Species Act, may very well be unaware that the GNLCC has identified grizzly bear as a focal species prioritized funding research to support its conservation. However, as conventional institutional knowledge often exists outside of context (Jasanoff 2010) their efforts have in some places been duplicative and isolated from NGO research that has already happened in the Northern Rockies. As one regional NGO executive director notes,

> I scratch my head, they [GNLCC] were talking about the need to identify important linkages." The NGOs have been doing that for years and not in a vacuum. We've been networking and working together with biologists in the field. There are 10 gillion maps out there looking at linkage zones. We don't need to spend $10M more building more maps, we need to take the knowledge we have now and do something with it.

This is an important point - networks can't be forced. A network without a compelling narrative to knit together multiple stakeholder groups, such as federal agency scientists and the NGO research community, may not share information and duplicate efforts. A network of 'large

landscape conservation' can't be forced or just positioned in a landscape without a complementary narrative. "Assembling" the network involves power and positioning, and competing 'science' is not always ready to integrate.

This is not just between agencies and NGOs, but often the NGO community defends their science as 'the best.' One Nature Conservancy staff reflects on a particular "collaborative" meeting with the Wildlife Conservation Society,

> We had this weird meeting with the Wildlife Conservation Society. Their grizzly and wolverine biologist were working on potential dispersal corridors between Greater Yellowstone Ecosystem and parts to the west and north. They wanted to talk with a group of potential partners about how to implement conservation along the corridors that model suggest. At first look it seemed like an attempt to talk about collaborating. The problem was… they said this is what our science says need to happen, can you help us. We said maybe a little bit here, but that is not really our focus. And we are kind of questioning your science to begin with…On paper we are trying to do the same thing but we are not really finding ways to coordinate towards the same direction.

As this illustrates, these collaborative efforts don't always 'assemble' together in synergistic ways. As discussed in the social connectivity section, in many ways informal ties provide a bridge through otherwise layers of bureaucracy, notes one regional NGO employee,

> There are the formal networks and the informal networks. For the science stuff, I tend to rely on the informal networks as opposed to the many layers of bureaucracy that is out there. I appreciate what the GNLCC is trying to do, but it is a bureaucratic nightmare. The first meeting I went to, I said there is a bunch of us already doing what you guys are trying to figure out whether or not it even needs to be done. We are already doing it.

Moreover, 'what they are already' doing also sets power relations across multiple levels of governance. On the one hand, as illustrated above, the connectivity maps have served as 'objects' that bring stakeholders together. These maps tell a story and help link, stitch together, or socially connect different organizations across the Crown of the Continent landscape. However, on the other hand these map make all kids of assumptions that are obscured from the end-user of the maps. They designate some areas and communities 'priorities' and others not. Although the

proliferation of connectivity maps has in some ways ushered in their acceptance, there is also a history of resistance to such conservation planning (as indicated in in the previous section with the discussion on the PLACE project).

Organizations such as Yellowstone to Yukon (Y2Y) have a rich history of connectivity conservation in the Crown of the Continent landscape, and likewise initiatives such as Y2Y have been critiqued often for the 'conservation at all cost' approach at the exclusion of social and community interests (Wyborn and Bixler 2013). One research participant at a NGO in the Yellowstone area notes,

> Well the one thing with Y2Y, sadly, the way they framed it and presented it was very threatening to people. I said to [a new senior Y2Y staff] was the first thing you can do is put a picture of a human being on your website. Literally they didn't before, and it was pretty easy to see why people were so threatened by it. They didn't see themselves as part of the Y2Y vision. They saw Grizzly Bears and they saw wolverines and other critters but they didn't see themselves. They literally didn't see themselves…

Through my personal experience in this landscape, I have got the impression that increasing ecological connectivity is a vision that is connecting together a broader network of practitioners for grizzly bear conservation. The role of GIS maps and technology is a part of this. Again, however, this technology is not neutral. As was the case with invasive species, defining the Crown of the Continent is a contested issue. As one practitioner working with a community-based group in the whitefish area notes, "I think you can define the perimeter of the crown in two ways. The first way is put a radio collar on a Grizzly Bear and watch him walk. He will essentially define the perimeter. Honestly, it is fascinating to look at the lines."

However, defining the Crown and in doing so defining a level that allows for possible hierarchies of decision making and authority can raise some problems. A conservation biologist in the Swan valley remarks,

> The folks that I work with that are here or within the natural resource profession all get the concept of the Crown of the Continent. Some of the other segments of the community, I'm not sure that they necessarily get it. Maybe I don't know them well enough to say for sure. But I don't think they really understand the concept of the Crown of the Continent. In some ways they look at it as a legal way of blocking development. They look at it as protectionism to protect a large chunk of land to keep them off of it. I think that is what their perception is of it.

These concerns regarding the constitutions of various spatial levels and the power relationships between those levels will be discussed more in the next chapter on climate change adaptation.

5.6 Conclusion

There are several important driving factors behind the structure of this network, how it uses information, and its action orientation. Although not necessarily explored in-depth in the analysis above, nor discussed much by the research participants, the status (albeit status in flux) of the grizzly bear as protected under the Endangered Species Act significantly structures and directs this network. Grizzly bear conservation is about restoring and promoting a "good" as required by this law and the policies that derive from the law. This is an important point that indicates network governance cannot be understood without reference to institutions. Networks and institutions co-exist and co-evolve, shaping what types of institutional structures and associated networks are well suited to what types of environmental problems (Lubell et al. 2012). Legal and regulatory institutions, such as the Endangered Species Act, produce and shape particular types of networks in the case of grizzly conservation. It enacts private landowners into the network by legal statute. It directs funding towards science and research through state and federal agency mandate. Importantly, these institutional features simultaneously bind and fissure this network.

CHAPTER SIX: CLIMATE CHANGE AND GOVERNANCE OF CLIMATE ADAPTATION

6.1 Introduction

The empirical case studies selected for analysis have intentionally worked in a progression of increasing social-ecological complexity, culminating with this chapter on climate adaptation and natural resource management. Climate change is the most challenging governance question we will face in modernity, the hope in this analysis is to compare characteristics from the previous case studies to the challenges posed by climate change and climate adaptation and doing so highlighting some network dynamics that inform climate adaptation. In the final chapter, chapter seven, I will develop a broader synthesis for thinking about networks of environmental governance as well as a set of recommendations for climate adaptation work in landscape conservation.

Invasive species present a very visible and tangible problem and "threat." Grizzly bears, while perhaps more empirically distant from the everyday observer than noxious weeds, are still an active actor on the landscape. Climate change, on the other hand, is a very complex and intangible problem. It is epistemologically distant, i.e. the causes and effects are not immediately present to an observer (Carolan 2004, 2006b). The *scale* at which climate change operates has challenged the building of narratives and networks that are inclusive of communities. Climate adaptation and implementation of adaptation plans have been slow across the board, especially in interior mountain regions. This is a particularly sticky issue in the Northern Rockies and one that will be explored in detail in this chapter. Exploring cases where cross-scale networks have effectively mobilized towards governance ends and outcomes may help shed light on how to mobilize similar networks towards climate adaptive natural resource management.

In this chapter, I will discuss a number of organizations directly and indirectly involved with climate adaptation work. Specifically, the Great Northern Landscape Conservation Cooperative (GNLCC) will be discussed as they have emerged as one of the primary mediums that agencies are working across boundaries for climate adaptation work, as well as funding climate adaptation initiatives, such as the Rocky Mountain Partnership and the science-management partnership adaptation planning workshop they held (hosted by the Center for Large Landscape Conservation and the Wildlife Conservation Society). Another notable initiative that will be discussed is the Adaptive Management Initiative (AMI), an initiative that is being implemented through the Roundtable on the Crown of the Continent. Within this initiative, several community-based and watershed organizations will be mentioned, including: the Sun River watershed group, Water Matters (an Alberta community-based group), and the Southwestern Crown Collaborative as they've been involved with the AMI. Some community-based groups are engaged in climate adaptation work; however, as this chapter will illustrate in many ways it is on-the-ground work that community-based organizations are already doing that could be considered 'climate adaptation.' This chapter identifies that the organizations driving the climate adaptation work in the region are primarily science-based organizations.

In many ways, climate change drives this push towards landscape governance and thinking in terms of ecological connectivity. Ecological connectivity is crucial to the maintenance of biodiversity under scenarios of a warmer climate, giving species the freedom to range across north-south latitude as well as seek habitat at higher elevations. To work towards conservation to this effect, a foundation of social connectivity needs to exist. In the social connectivity section of this chapter, I will discuss the role of social capital, relationships, and trust building. Regardless of the scale or magnitude of the challenge, effective conservation must

require a foundation of relationships and trust. Boundary spanners can play an important role in trust building, as highlighted below. In this chapter, discourse connectivity will address the challenges of scale head-on, as the framing of 'scale' goes hand-in-hand with framing the problem. The opportunities for a narrative of network innovation will also be discussed. Lastly, assemblage connectivity will discuss the challenges of climate as part of the network and who 'speaks' for climate in the network.

6.2 Ecological Connectivity: Climate Change as a Landscape-scale Ecological Issue

Trends in temperature and precipitation from weather stations show that the United States has warmed over the past 100 years, but the trends differ by regions (Backlund et al. 2008). These trends are projected to continue, and average annual air temperatures across the continental United States are likely to steadily increase over the next century under scenarios of 'high' and 'low' trends of carbon emissions (Ryan et al. 2012). Compared to 1971 through 2000, average annual air temperature will likely increase from 0.8 to 1.9 degrees Celsius by 2050, from 1.4 to 3.1 degree Celsius by 2070, and from 2.5 to 5.3 degrees Celsius by 2099 (*ibid*). Although today's rate of warming is unusually rapid, it may not be unprecedented in geologic history, and major climatic instability has repeatedly influenced forests and biodiversity throughout the last 2-3 million years of glacial-interglacial cycles and stadial-interstadial shifts in temperature and precipitation (Stager 2011). Nonetheless, current and projected changes in temperature and precipitation, extreme events, increased atmospheric carbon dioxide, and increased nitrogen deposition are likely to affect landscapes and communities throughout this century.

Increases in temperature, changes in precipitation, higher atmospheric concentrations of carbon dioxide (CO2), and higher nitrogen (N) deposition will likely change ecosystem structure and function, yet the most rapidly visible and most significant short-term effects on forest

ecosystems will be caused by altered disturbance regimes. According to a US Forest Service Comprehensive Climate Synthesis (Vose et al. 2012), wildfire, insect infestations, pulses of erosion and flooding, and drought-induced tree mortality are all expected to increase during the 21st Century. Landscapes have an inherent capacity to survive disturbance events and facilitate recovery (exhibit resilience), however, current thinking suggests that the rapid pace and magnitude of climate change will exceed the resilience capacity of many forests, and novel ecosystems without analogs will develop (Hobbs et al. 2009). Under these conditions, traditional approaches to environmental governance that focus on historical conditions or protection of rare species or ecological communities will likely fail. Governance approaches that instead anticipate and respond to change by guiding development and adaptation of landscape ecosystem structure and functions will be needed to sustain desired ecosystem services and values across spatial and temporal scales (Millar et al. 2007).

In many ways, climate change drives this push towards landscape governance and thinking in terms of ecological connectivity. Ecological connectivity is crucial to the maintenance of biodiversity under scenarios of a warmer climate where most models project that species habitat will move upward in elevation and northward in latitude and will be reduced in current habitats at lower elevations and lower latitudes. New climatic conditions may move faster in some locations than tree species can disperse, creating uncertainty about the future vegetation composition of these new habitats (Vose et al. 2012). To colonize suitable habitat resulting from a changing climate, each affected species will either migrate or be moved (Iverson et al. 2004), and a network of landscape connectivity is critical for both dispersal, migration, and assisted migration.

Climate and climate change may be the ultimate contemporary common-pool resource problem. The attributes of the greenhouse gases (GHG) sinks such as the atmosphere and the oceans are common-pool resources writ large, the costs and benefits of using carbon vary significantly around the world, making it extremely challenging to eliminate free riding. The governance of climate change, carbon, and carbon sinks has clearly not overcome the "tragedy of the commons" (Adger et al. 2006; Paavola 2008; Paavola and Adger 2006). Global common-pool resources differ from local common-pool resources by the sheer number of users, that the actions causing degradation are often unintended consequences, they are highly complex and dynamic systems, and they have much longer temporal scales for regeneration (Stern 2011).

Climate change is an extremely complex commons problem due to the interaction between ecological, social, and economic factors across scales (Ludwig 2001). Global climate models are used to project changes in future scenarios of economic growth, population growth, and greenhouse gas emissions; different models are intended to represent the high and the low ends of future emissions. Short of dramatic alteration of trends in population growth and economic development, these models predict a significantly warmer future. Technical solutions to mitigation may be part of the solution, but no single technical fix will resolve the problem. Rather, on-going and adaptive governance is necessary to make decisions recognizing that future conditions will likely require different strategies. Moreover, and important to emphasize, these decisions may be maladaptive across scales and levels of implementation (Thornton and Manasfi 2010). Solutions cannot only be handed down from experts but rather multi-level approaches to governance are seen as central to negotiating conflicting values and contributing local knowledge necessary to manage certain aspects of climate change and climate change adaptation.

The direct and indirect climate-change effects are likely to impact some areas more than others, particularly where current infrastructure and resource production are based on past climate and steady-state conditions. The ability of communities with resource-based economies to adapt to climate change is linked to their direct exposure to these changes, as well as to the social and institutional structures present in each community and region. Despite difficulty in concluding that recently observed trends or changes in ecological phenomena are the result of human-caused climate change or other climatic variability, climate is clearly positioned as an important issue for management and policy. Environmental governance will need to consider coupled social-ecological transformations (management, policy, disturbance, invasive species) and will need to build on practices compatible with adapting to climatic changes and engaging in the adaptation process.

A Focus on Adaptation rather than Mitigation

Adaptation has become a key watchword and action frame in climate change discourse and policy (Thornton and Manasfi 2010). In the landmark 1992 United Nations Framework for Convention on Climate Change (UNFCCC) adaptation was mentioned in relation to stabilizing greenhouse gas emissions at a level where ecosystems and economies can adapt (Article 2), committing parties to develop adaptation programs (Article 4.1[b]), and encouraging cooperation in adapting vulnerable areas to climate change (Article 4.1[e]) (see Thornton and Manasfi 2010; Schipper and Burton 2008).

Initially borrowed from evolutionary biology, the term ‘adaptation’ has come into widespread use in climate change literature. In the biological sciences, adaptation refers to genetic characteristics that allow individual organisms to survive and reproduce in the environment they inhabit (Abercrombie et al. 1977). In the social sciences, adaptation typically

refers to the processes by which individuals and groups of people adjust their behavior and organization in response to changes in their environment. This type of cultural adaptation depends on diversity in ideas, practices, etc and a system of reproduction (i.e. learning) and cultural transmission. Coupling social and ecological systems, the IPCC defines adaptation as the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC 2007).

In a way, adaptation is a misleading term because it implies reacting to the consequences of climate change once it has occurred. However, adaptation clearly has to be anticipatory and preventative. It has only been in the last decade that adaptation to climate change has been acknowledged as an equal component in managing climate change risks, along with mitigation (Adger et al. 2005; Folke et al. 2002; Pielke Jr et al. 2007). Until recently, adaptation was neglected by the UNFCCC in international climate policy in favor of mitigation for fear that focusing on adaptation might give the impression of resignation and weaken the social will to mitigate; the difficulty of incorporating and evaluating adaptation measure into negotiations, considering the uncertainty of climate change impacts (Pielke 1998); and, the notion that adaptation costs would be significantly compounded if mitigation is not attended to first (Stern 2007). However, since the 2001 Marrakech Accords, both funding and funding mechanisms for adaptation have increased significantly (Schipper and Burthon 2008; Adger et al. 2003). In part, this is a recognition that even the most stringent mitigation efforts cannot avoid further impacts of climate change in the next few decades, which makes adaptation essential, particularly in addressing near-term impacts (Parry et al. 2007).

Climate change adaptation is of a central concern for multi-level governance networks because many of the impacts, and adaptation, will occur locally. Strengthening the role of

community-based conservation may be a fundamental key to broader systemic adaptation efforts for both local livelihoods as well as natural resources. Drawing from Giddens (2011), I use the term proactive adaptation to reflect this reality. Gidden's notes that political and economic convergence are key to adaptation, as they are variables that are likely to influence how far citizens accept whatever polices are proposed. As documented in previous chapters, social and discourse connectivity are key factors for assembling a network of landscape conservation. To promote adaptation, networks must help stimulate innovation and creativity in the diverse worlds across many sectors of participants: state and federal agencies, NGOs, and communities. Community involvement is necessary, with an equitable distribution of rights and responsibilities across the different levels of governance.

6.3 Social Connectivity: From Invasive Species to Climate Adaptation: Don't Forget the Basics - Relationship Building!

As discussed last chapter, organizations that bridge structural informational holes play an important role in translating information across contexts and knowledge systems. I have illustrated the importance of these organizations in previous chapters, four and five. However, even organizations that set the goal to 'bridge' must still develop a foundation for a relationship and engage in a process of trust building. This chapter will take a look at one major barrier to social connectivity, developing trust. The available climate science can be hard to translate into a language that makes sense to decision-makers and users. Moreover, scientists are often not aware of the needs of decision-makers and practitioners and the different sides often do not have sufficient trust. The development of trust implies the emergence of certain patterns of network relationships, as well as the more process-oriented aspects of 'building relationships.' Climate change is an intractable problem that is global in nature, and this is precisely why the importance

of being grounded and building relationships is so fundamental to a multi-level networked approach to climate adaptation.

6.3.1 Local Community-based Networks and Building Relationships

Background on Trust

Collective action and cooperation in the management of common pool resources requires trust among participants that each will adhere to the unspoken norms of reciprocity and of conduct. Trust has long been described as critical to successful collaboration (Isett et al. 2011; Provan and Kenis 2008; Huxham and Vangen 2005) because it is viewed as decreasing the costs of collective action in collaboration, and thus enhancing the likelihood of positive collaborative outcomes (Chen 2008). Trust may be based on prior experience, and it may also be based on subjective perceptions of trustworthiness, at least until proven otherwise. Likewise, trust in networks is based on an expectation of reciprocity. Provan et al. (2003: 655) note that "trust is not something that inevitably and immediately follows the establishment of relationships", but rather organizations may need to work together for years to develop true trusting relationships. So, although organizations are willing to connect to new partners, these new relationships will initially be untested and not deep, trust takes longer to develop (Provan et al. 2007). Gulati et al. (2011) talk about trust in relation to receptivity, noting that inter-organizational trust defines the extent to which an organization and its partners can rely on each other to fulfill obligations, behave predictably, and negotiate and act in good faith.

Because network structures must rely on exchanges that are based on interpersonal relations, building relationships forms the basis for the development of trust. One of the principal means by which a level of trust is achieved is frequent and ongoing communication. Face-to-face communication, in particular, has been shown to result in substantial increases in cooperation

(Ostrom 2000; Ostrom and Walker 1997). Even though verbal agreements among actors cannot be enforced, cooperation is often easily achieved when participants in a prospective collective action scenario have sufficient face-to-face time to “discuss the optimal joint strategy, extract promises from one another, and to give verbal tongue-lashings when aggregate contributions fall below promised levels” (Ostrom 2000: 140). Examples of this can be seen in emerging 'science-management' partnerships related to climate adaptation on national forest lands.

Reflections on the application of such partnerships have stressed several critical factors for success. The partnership should be established at the outset of a project with clear goals and objectives (Peterson et al. 2011; Littell et al. 2012). Engagement of the partners in a process of “co-production” is important (Webb et al. 2010; Lemos and Morehouse 2005), which may be facilitated by co-location and continuity of staff (Lindenmayer et al. 2013). The partnership must create formal opportunities for sharing information such as workshops and conferences; but also flexible opportunities and space for regular information exchange between parties, including sharing of experiences, discussion of new ideas and joint problem-solving (Webb et al. 2010; Peterson et al. 2011). Each partner’s knowledge base needs to be recognized (Peterson et al. 2011; Halofsky et al. 2011), in addition to his or her current beliefs, values and institutional roles and responsibilities (Ogden and Innes 2009; Webb et al. 2010). This understanding contributes to building trust and support among the partners (Lindenmayer et al. 2013).

Elsewhere, in their meta-analysis of collaborative governance, Ansel and Gash (2008) argue that the “thick communication” allowed by direct dialogue is necessary for stakeholders to identify opportunities for mutual gain. Other research supports this notion that face-to-face dialogue is at the core of the process of breaking down stereotypes and other barriers to communication, building trust and respect, shared understanding, and commitment to the process

(Ansel and Gash 2008; Tompkins and Adger 2004). These factors of relationship building and building trust seem particularly salient in the context of communities and climate adaptation.

Building Relationships – The People Component

Communities and community-based conservation groups are often reluctant to move forward in a process of climate adaptation planning without the recognition that the process is integrative of their values and concerns. Moving forward without an established relationship base can be problematic, as one USFWS employee and executive member of the Blackfoot Challenge notes,

> I will say this based on my experience – I don't think they get it [the GNLCC]. That is not meant to be a slap at the LCCs, but we are pitching back to Washington DC that we're going to put science back into this system and science is going to lead and this is partly about climate change. And that is all important, but where is the people component?

He goes on to say,

> Obviously you need both of these to mesh, but right now they are not meshing at all. So a lot of these groups are buying into climate change and science without wanting to put the time and effort into the people and the social components.

It is not surprising then that interviewees repeatedly mentioned the value of face-to-face interaction and its role in relationship building. However, somewhat surprisingly, it was not only the community-based groups emphasizing this point but also other organizations that are primarily concerned about the science of climate change. A staff member for the GNLCC notes,

> I still think people need to engage each other face to face. I think people need social time together, meal time, bar time, field trip time or they are not going to get to know each other or have that context to really work together. I'm sure there are other ways to do it, but I think it takes a lot longer.

This "need to engage each other face to face" lies in direct contrast to the increasing tendency to share climate related information through web technologies, such as interactive webinars.

In the course of this research, I participated on seven different webinars hosted by the

GNLCC for climate related information. This type of information exchange seems to be based on the science-policy assumption that benefits of science ensue from the unencumbered linear flow of information from research to decision making (Kirchhoff et al. 2013). There may be some value in exchanges of information via web technologies or monthly call-in meetings such as the COTC Roundtable Adaptive Management Initiative does (and discussed below), however, without a basis of a relationship these may have limited utility. As a staff member for the Greater Yellowstone Coordinating Committee notes:

> We are doing a bunch virtually, but you cannot do everything virtually. You need to meet together, form relationships. A lot of the relationship building is getting together, going out to dinner and having a beer. That is the basis of relationships.

Similarly, Blackfoot Challenge staff remarks,

> Webinars maybe have huge value for some young people. I get a little technical information out of them, but the electronic networking is really hard to build any type of relationship or learn lessons. You get information, but you don't really get the essence of what that information means when you are not connected together.

There is probably some value in exchanging information through a web-based communication, but only after relationships are established. During the research, I was having a conversation with an old rancher about the value of face-to-face meetings versus new technologies used to disseminate information, and he says, "oh, it is important to meet and then tweet."

To their credit, the GNLCC has made efforts in relationship building and to engage stakeholders in 'science-management' partnerships, most recently a workshop held in June 2013 in Bozeman, MT (funding from the GNLCC went to the Center for Large Landscape Conservation and the Wildlife Conservation Society to host this workshop). Moreover, the Center for Large Landscape Conservation is involved in other climate change adaptation

initiatives, primarily the Kresge Foundation funded Crown of the Continent Roundtable Adaptive Management Initiative (COTC AMI), and the director notes about that initiative:

> Then you have issues like climate change which none of them [community-based groups] really know what they are doing so they all have to learn together on something that is new to them. They are a part of a commitment to face-to-to face interactive learning and I think that is the only way it can go.

Throughout the course of this fieldwork, I became increasingly interested in this Adaptive Management Initiative and its role in relationship building. I will discuss this below.

Strengthening Community-based Networks

The Roundtable on the Crown of the Continent Adaptive Management Initiative is a joint effort among stakeholders to "build one of the first large-scale adaptive management systems in North America" (COTC 2013). Its goal is to build resilience into the Crown's natural and human communities by promoting climate adaptation strategies to improve ecological integrity and sustainable communities through local action. The objectives are to encourage mutual learning and to help ensure that successful efforts in one community, watershed, or landscape can inform others and be replicated into engaged local on-the-ground action. In the first year (2012), the Roundtable Leadership Team chose to fund thirteen local projects; ten webinars and conference calls were hosted for project leaders (I participated on eight); and 13 project leaders shared with the group during the webinars/conference calls. Selected projects were intended to contribute to the Crown of the Continent Roundtable's mission to facilitate regional networking, information sharing, relationship building, and collaborative problem solving at multiple scales. The year one report to the funding foundation reports several key findings, including:

- Building trust between stakeholders is imperative to improving landscape collaboration
- Conservation solutions that originate from the grassroots perspective are the most successful for the best community engagement, and

- Integrating science and climate change into the on-the-ground community work takes time and needs special consideration, as it is often distrusted.

There were many positive developments throughout this first year, as well as many barriers. Over the course of my six-month participant observation engagement, I did notice new connections and relationships emerge and some relationships evolve into stronger working relationships. For example, stakeholders in the Southwestern Crown Collaborative began working close and learning from a group in Alberta, Water Matters, regarding a community engagement process. Likewise, the Sun River watershed group was trying to implement a program that was directly 'transferred' from Water Matters to the Rocky Mountain Front, "source to tap." Prior to the AMI, there was no basis for any of these relationships. I found these observations interesting, and I conducted follow-up phone conversations with the "whole network" of AMI funded groups. See social network maps below, figure 6.1.

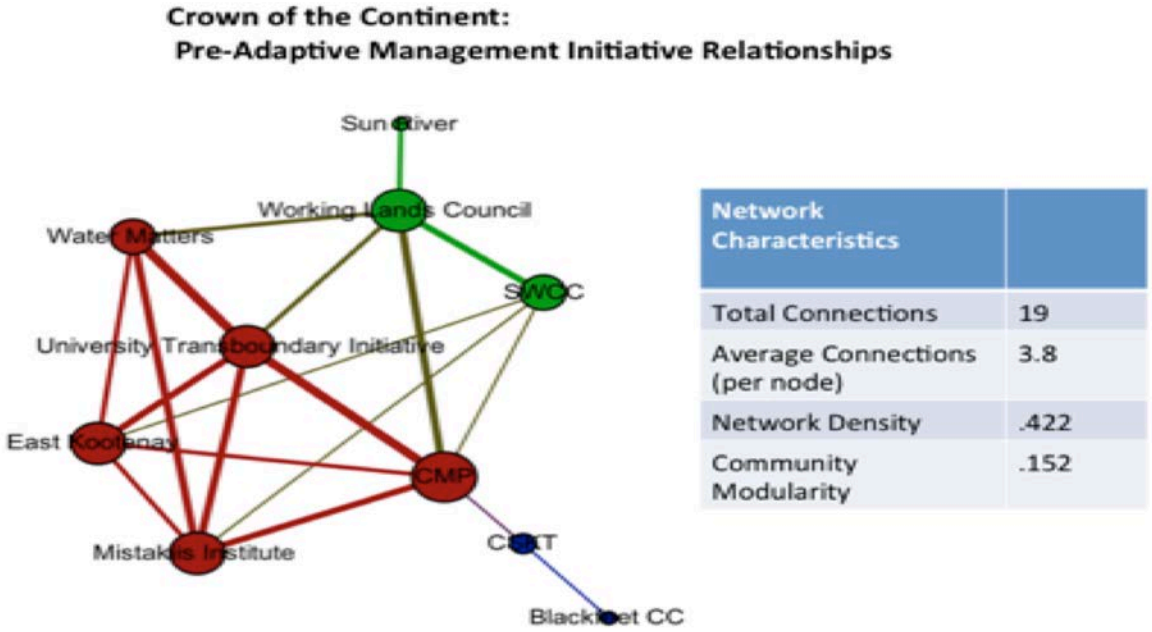


Figure 6.1. Reported ties and strength of ties prior to Adaptive Management Initiative

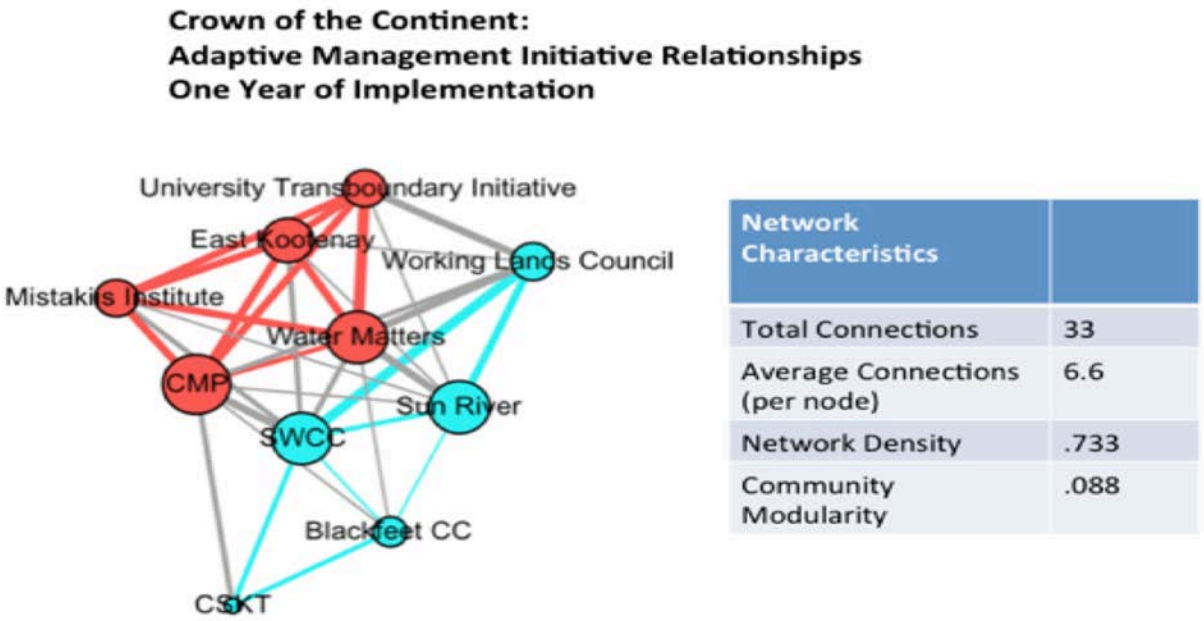


Figure 6.2. Reported ties and strength of ties after one year of implementation in the Adaptive Management Initiative

Specific network analysis findings indicate that the number of connections has increased from 19 to 33 prior to AMI to one year of implementation, respectively. Each initiative has an average of 6.6 connections (although important to note those connections are concentrated in particular initiatives with higher levels of centrality), the density of the network has increased from .42 to .73 (indicating a more strongly connected network of organizations) and the number of identifiable "groups" has decreased from 3 to 2, indicating more network closure. The color of the nodes in figure 6.1 and 6.2 represent the network groups. Centrality measures indicate two findings. First, certain initiatives have proactively used the COTC AMI as a forum to build relationships as indicated by the change in the size of the node from time 1 to time 2 (Sun River, Water Matters, and Southwestern Crown Collaborative are notable examples). Other, however, have less actively used the AMI to engage in network building. Successful natural resource governance "is one where actors, during periods of stability, develop new relational ties with

various other actors and stakeholders which can be drawn upon in times of change" (Bodin and Crona 2009: 372). This is reflected in what the co-chair of the AMI said,

> I'm not sure if they find the Kresge process yet relevant…We are trying to help you create a way of learning and doing adaptive management so when the time really comes and you need to know how to do this you've already made those social connections and you already have that phone tree of who to go to for what. I feel like I'm doing anticipatory relevance. But it doesn't make it easy.

In many ways, this is proactive adaptation. However, as those network maps indicate, some communities (even ones that get money for this initiative) are marginalized relative to the rest of the network (in Time 1, the two tribal communities - Blackfeet and Confederated Salish and Kootenai - were a part of their own 'module.' At time two, they did have more connections, but were still very peripheral organizations to the network).

6.3.2 Multiple-level Networks and the Role of Brokers in Trust

Boundary spanners facilitate transactions and the flow of information between people or groups separated or hindered by some gap or barrier, including a 'gap' in that members of one party have no basis on which to trust the other (Long et al. 2013). Boundary spanners hold positions of brokerage (that, as discussed in the previous chapter, use weak ties to bridge structural holes), and this specifically includes the idea of crossing organizational boundaries such as departments or organizations, or cultural boundaries in order to exchange knowledge or mediate interactions (Friedman and Podolny 1992).

We can use social network analysis to identify 'boundary spanners'. In a review of empirical, peer reviewed network literature Long et al. (2013: 162) found that betweenness centrality was the most used method to identify "the brokerage position [with] the intention to maximize efficient knowledge transfer, coordinate effort or to ensure the inclusion of people on the periphery." Betweenness centrality captures different dimensions of the more general notion

of centrality. Centrality generally measures the proportional number of network ties an actor has relative to other actors (Freeman 1979). When you look at a network and see that certain actors have a disproportionate number of ties compared to other actors, one generally concludes that these actors are more central to the network. Betweenness centrality measures how much potential control an actor has over the flow of information by taking into account the geodesic (shortest path) between two actors, i.e. identifies individuals located in-between others (see Burt 2005). That is, an actor's score increases the number of times that actor rests on the geodesic (shortest path) between two actors. If an actor rests between many other actors in the network, then this actor can choose to withhold or distort information she or he receives, thereby influencing the network as a whole. The distribution of betweenness centrality scores in a network is considered better at capturing the variation in actors centrality, thus the contrast between central and non-central actors are more highly contrasted (Wasserman and Faust 1994).

Figure 6.3 below illustrates the whole network map that is made up of six different network groups. Group zero (centered around the CRC) and one (centered around Miistakis Institute in Alberta) are two network groups separated from each other, but together represent about 20% of the network. Group two provides connecting links between groups zero and one and the University of Montana has a high level of betweenness centrality in this group. Group 5 represents the largest group, and is relatively homogenous including many of the science-based organizations in this network, i.e., Wildlife Conservation Society, The Wilderness Society, GNLCC, among others. Group 3 that includes the USFS, is a quite diverse group when considering the group composition of organizations working at different levels of the network, including community-based groups.

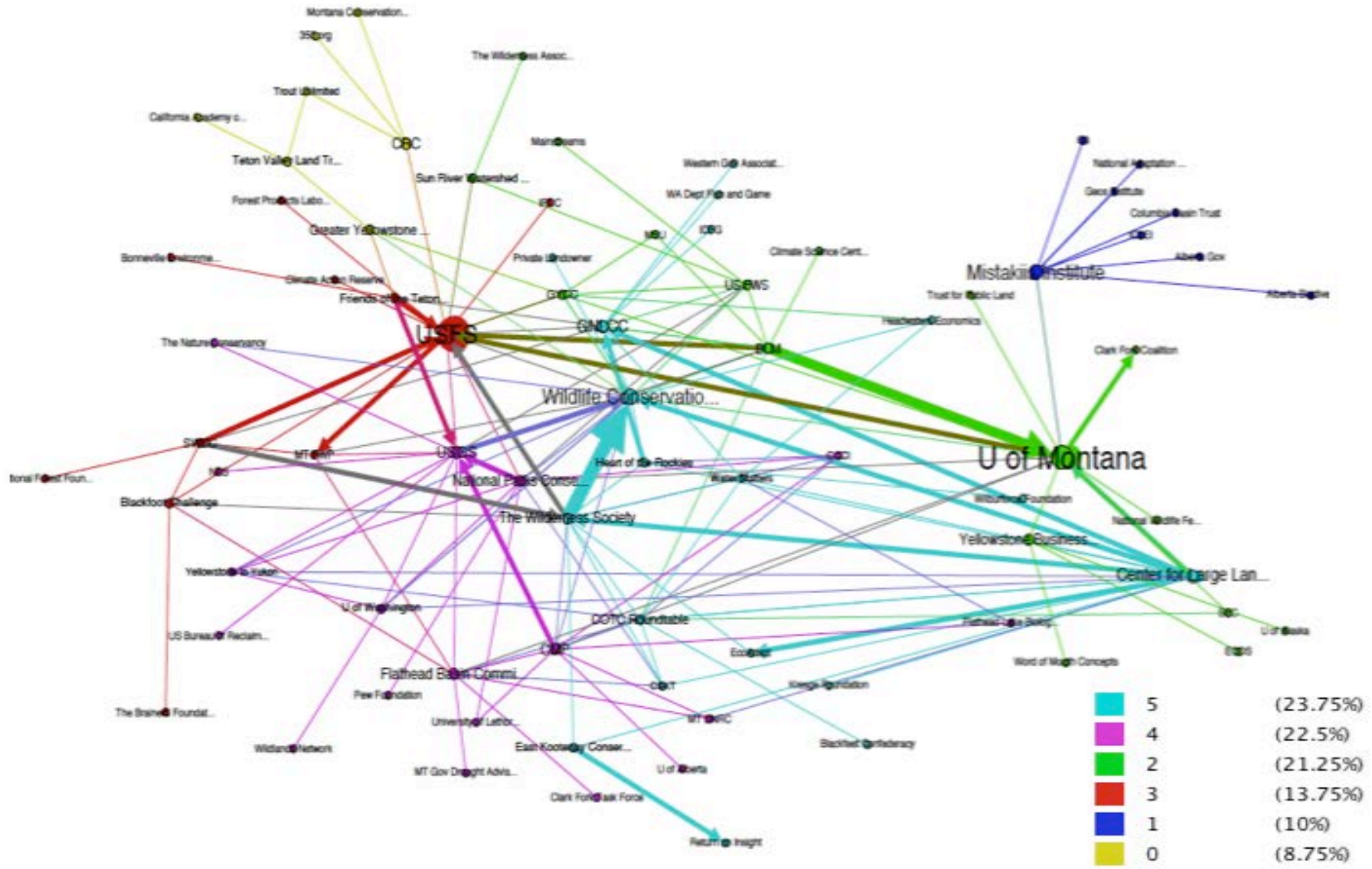


Figure 6.3. Map of Climate Adaption Network
*Nodal Size indicates betweenness centrality, edge thickness indicates tie strength, color groupings indicate modularity or network community groups, edge color represents the network group from which the tie originates

Brokers are intermediary actors who facilitate transactions between actors lacking access or trust in one another (Burt 2004). However, the power and benefits of brokerage are lost if the broker is untrustworthy (*ibid*). From the perspective of a community or community-based group, there are not many organizations on the map below (Figure 6.4, a subset of the map of above but only illustrating the top ten betweenness centrality organizations) that are 'perceived trustworthy (considering the long history of mistrust with the Forest Service, Universities, or NGO's such as the Wilderness Society). In the following map, the organizations with the highest levels of betweenness centrality are identified (and represented as the largest nodes), the top ten organizations include (from lowest to highest betweenness centrality): the Yellowstone Business Partnership, the Crown Managers Partnership, the Flathead Basin Commission, USGS, GNLCC, Center for Large Landscape Conservation, Miistakis Institute, Wildlife Conservation Society, USFS, and U of Montana. As an executive director of one of the organizations above notes,

> It has to be that the process has to be open to trusted, dedicated coordination. If it wasn't trusted or semi-trusted…you never really build full trust between some of these cultures, but if you have semi-trust. Agencies, by definition, just don't….they are hard.

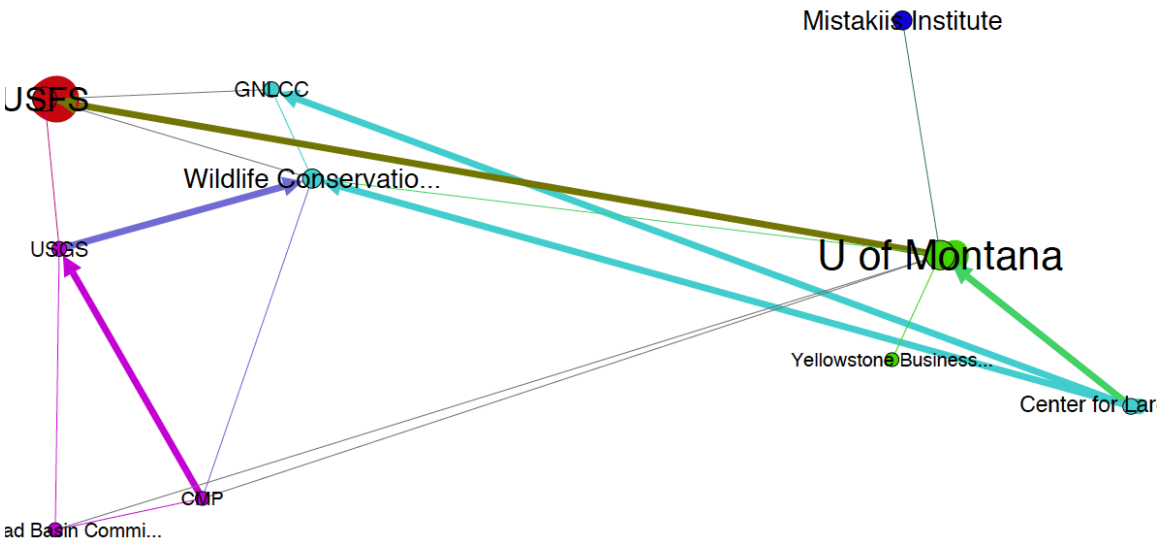


Figure 6.4. Subset of Top Ten Organizations Based on Betweenness Centrality

As the network map in figure 6.4 indicates, there is a diversity of network groups as indicated by the color of the nodes, however, a significant majority of the organizations with the highest betweenness centrality are science-based organizations. However, science is just information and information must be socially mediated to become knowledge. This reiterates the importance of building relationships as noted above and also directs attention to the ways that boundary spanners act as bridges, bringing in new information and as communication hubs, disseminating information beyond the core where the information moves through communication channels from the densely connected core to more loosely connected peripheral actors influencing collective action (see Isaac et al. 2007).

The presumption of climate science as value-free and objective is presumptuous, and fails to give due attention to how knowledge influences and is influenced by social practices, identities, discourses, and institutions. Moreover, it is not just the overrepresentation of science organizations in the core map above, but also the lack of community-based conservation organizations. With climate adaptation, both the network and the narrative are challenged by the exclusion of community-based groups. The next section will discuss the challenges of the narrative of climate adaptation.

6.4 Discourse Connectivity: The Challenge of Scale

The idea that climate change 'framing' matters is not a new one. Climate change science and policy may especially be issues that can be framed and reframed in several ways (Nisbet, 2009; Robinson et al. 2006; Schlumpf et al. 2001). Considering climate change and climate adaptation, using frame analysis to depict and engage in the array of arguments and counter arguments that surround this complex issue has led to fruitful analysis. Sociologist John Urry notes, “in the subsequent twenty years, there has been global contestation between three major

discourses" that include: skepticism, gradualism, and catastrophism (Urry 2011: 20-21). Skepticism involves challenging sciences of climate change, especially in the light of huge uncertainties involved in scientifically predicting changes in temperatures over future decades. Gradualism argues that climates are changing around the world, that human activities are significantly responsible for these changes, but that economies can adjust in order that adaptation to the change can take place. This perspective, largely embraced by the IPCC, treats climate change as a matter of relatively calculable probabilistic risk and that behaviors can be changed through incentives (Urry 2011). Third, catastrophism acknowledges the significance of uncertainty and limits of science from the former and some elements of the science of climate change from the latter, but critiques both by emphasizing the non-linearity, thresholds, and abrupt and sudden change of likely positive feedback loops. Proponents of this argument note that there can be no effective adaptation, only the most extensive and sustained attempt at mitigation.

Moreover, getting more into the specifics of problem framing, De Boer et al. (2010: 503, emphasis added) note:

> "The frame may include the aspects ‘‘attribution to climate change’’ (which may be likely or unlikely), ‘‘identifiable places’’ (e.g. existing or latent), ‘‘time horizon’’ (e.g. short- or long-term), and possibly also ‘‘uncertainty about science’’ (e.g. high or low), ‘‘uncertainty about politics’’ (e.g. high or low) and ‘‘source of information’’ (e.g. trusted or not). Within this frame, the climate change manifestation can be understood as a specific co-occurring set of relevant aspects, e.g. ‘‘changes in snow’’ may be linked to a combination of ‘‘likely attribution’’, ‘‘identifiable place’’, ‘‘short time horizon’’, ‘‘low uncertainty’’, and ‘‘sea level rise’’ to a combination of ‘‘likely attribution’’, ‘‘latent place’’, ‘‘long time horizon’’, and ‘‘high uncertainty’’. Also, within a frame each aspect may be associated with its own frame and more specific sub-aspects (e.g. variants of uncertainty); this dynamic relational structure makes frames flexible and context dependent."

Building on the discussion in the previous chapter, I emphasize the role of the source of information and whether it is "trusted or not". Brokers play an influential role in moving

information across boundaries that need to be spanned in order to increase understanding and making ecological issues relevant across multiple levels of organization. The boundaries of interest here are cultural, those boundaries between climate scientists, policy and decision-makers, and users of that knowledge. These dynamics will be discussed through the lens of narrative and the role of scale in problem framing.

6.4.1 Problem Framing: Framing Scale

Scale, it has been argued, is produced by capitalism (Lefebvre 1991). The argument therein is that scale is at once socially produced and is socially producing in the struggle to delineate the spatial scope in which some societally dominant group exercises power (Swyngedouw 1997). People impose a definition of scale for a particular purpose and for a particular issue, relative to certain political, scientific, legal, or cultural lenses (Brenner 2001; Cash and Moser 2000). Scale, then, is used to describe social organization and the interactions between those levels of organization (i.e. household to community to state to federal to international) (Sheppard and McMaster 2004; Brown and Purcell 2005; Sayre 2005). Because scale is socially constructed, the conceptualization of scale brought to any specific case by particular players is mutable and amendable to adaptation so as to best fit the management of the environmental problem at hand (Silver 2008; Manson 2008).

Scale as a social and/or political construct should be understood in the context of the processes and power relations that create it (Sheppard and McMaster 2004; Brown and Purcell 2005; Brenner 2001). Since these relationships constantly change, power relations between actors across many different political and economic levels continuously define, contest, and reconstruct the processes between scales. The “politics of scale” refers to these strategies that individuals or

groups across levels of social organization use to pursue a particular agenda (Brown and Purcell 2005). Scale and politics of scale have implications for climate change adaptation.

Similar arguments have been made in environmental governance (Andonova 2010; Brown and Purcell 2005; Sheppard and McMaster 2004) and this point seems particularly salient in climate change and climate adaptation. Scientists and managers employ scale as a heuristic to organize their understanding of the world and the relationships therein. Scale, then, is socially constructed and politically contested and is at once and continuously an issue with climate change. With climate change, for example, Urry writes:

> "The IPCC states that the warming of the world's climate through these increased GHGs is now 'unequivocal.' With 'business as usual' and no significant reductions in high carbon systems, the stock of GHGs could treble by the end of the century. By 2100, there is a 20 percent risk of more than a 5 degree Celsius increase in temperatures. If this happens, the world's physical and human geography would be transformed." (Urry 2011: 5).

Statements like that are not only typify discussions and are representative of larger narratives of climate change, but also challenge normal notions of temporal and spatial scales of both personal and social organization. The notion of climate change has undergone a globalization, and although the impacts are uneven, all people and all societies are implicated in its consequences (Urry 2011). Challenges then arise because these social and ecological systems operate on fundamentally different temporal and spatial scales complicating the design and implementation of institutions for environmental governance, particularly global environmental governance that needs consideration at multiple levels (Young 2006, 2002; Sayre 2005; Cash and Moser 2000).

Cash and Moser (2000) note three challenges of scale for environmental governance: (1) matching scales of biogeophysical systems with scales of management systems (an institutional fit problem), (2) avoiding scale discordance (matching the scale of ecological assessment with the scale of management) and (3) accounting for cross-scale dynamics (understanding the

linkages between scales, and how they affect decision-making information flows, and the integration of information into the decision-making process). These challenges have been well documented in the literature (Ekstrom and Young 2009; Cumming et al. 2006; Anderies et al. 2004; Dietz et al. 2003; Young 2002; Ostrom 1990). However, few studies have produced a grounded analysis in the way that scale is negotiated in climate adaptation governance. How, exactly, does the scientific knowledge become applicable for local users? One Blackfoot Challenge field biologist notes,

> We got some money from the LCCs, so we are trying to make it value-added, but… Models at the 30,000-foot elevation. I suppose they are good for something but I'm not sure what. So until we get down to specifics in the Crown and specifics in the Blackfoot exactly where, exactly what.

And moreover, a director of a regional NGO notes:

> There is a lot of new research coming out of agencies and academic institutions that we want to access and scale so we can plan on the ground. Same with climate change adaptation. Those are very important questions for us.

To be effective at producing usable information, assessments need to straddle the line between understanding complex problems and producing information that meets decision makers' needs. Matching the scale of the assessment to the scale of potential response can significantly improve the likelihood of adaptation (Kirchhoff et al. 2013). In order to do so, as illustrated in chapters four and five, the way that climate adaptation is framed is an important variable.

One practitioner in the Rocky Mountain Front who works with the Nature Conservancy notes:

> I think we are going to have to be deal with climate change. It is a huge learning issue. Our scientists tell us people come in and ask what we're doing for climate change and what we're saying is we're not affecting things at a global scale but we're doing the best we can which is to work at a large-landscape scale so that if there is movement plants and animals we've got elevational gradient and we've got room for things to change and so the scale is a lot better than if we were looking at a smaller scale.

In this comment, he shifts the focus from the 'global scale' to focus on the 'landscape scale.' Although this is an important shift because it makes impacts and adaptations more tangible, it is still too abstract to find space and meaning for experiential knowledge of local level actors. This aspect needs to be integrated in the narrative of climate change adaptation for community-based conservation. One research participant that works with communities in the Greater Yellowstone Area illustrates this point:

> I kind of feel like there is enough common ground here that I think all we need to do is work on stuff that communities do want to work on you can really accomplish a lot of good conservation work. It is just the way you frame it. Take the climate change issue. My feeling is if you go into a community and say we are going to help you put together a climate adaptation program that will better help you adapt to changes that are happening. Climate change, that is a tough sell to people. But on the other hand if you go into a community and say what are your development goals and what community goals do you have in the pipeline then they'll start talking about connecting open space that is exactly what the climate change professionals will tell you should do. It is no longer a climate change adaptation project but it is now a community project.

However, in other ways this is more simply recognizing that work already being done works towards similar goals,

> We've had restoration projects here for years and years trying to do some restoration projects on Bull Trout and trout streams. Different tribes in the region are doing different things. They didn't start out saying we're going to do this because the climate is changing, but just restoration projects in general. I think you have to look at those…I've heard from a lot of different tribes throughout the whole West.

These quotes illustrate the challenges that exist in the way that climate adaption is framed and the usability of climate knowledge at different levels. In many ways, this is a challenge with the broader narrative of climate and climate adaptation.

6.4.2 The Narrative and Usability of Climate Knowledge

Climate change knowledge is complicated, overwhelming, and the causes are contentious and predictions not uniform. These aspects of climate knowledge confound culturally connecting

with the issue. Participants very frequently reported that they receive very complex reports on climate change adaptation from scientists, and sometimes reported that findings conflicted with one another. Complex and conflicting findings from climate change science are a major barrier to adaptation to climate change. The resonance of models with lived experience and local knowledge is often very incongruent. Moreover, interview participants remained skeptical that documents from more formal institutions did not reflect the local realities of the impacts of climate variability or climate change. In many ways, this is a problem about the narrative of climate information and its perceived usability and application.

Part of this challenge returns us to the problem framing of scale as noted in the previous section, notes this contradiction from one community-based practitioner outside of Glacier National Park:

> But when you go to predictions you start running into compounding problems of the large uncertainties of what will happen with climate change and the scale at which conservation happens which happens at the scale of something like Glacier NP which is impossibly small in the climate world understanding global circulation…

The challenge therein lies in linking climate science and knowledge to its usability for adaptation and conservation. Scholarship has long contended that this gap between researcher and manager exists, and is indicated in the literature on boundary and bridging organizations. Bridging organizations can act as brokers between hierarchical stakeholders connecting science-policy-management (Crona and Parker 2012; White et al. 2008; White et al. 2010).

A number of strategies - often covered by the broad banner of knowledge transfer - are used in attempts to bridge the knowledge divides between research, policy formulation, management decisions, and implementation. To resolve the gap between producers and potential users of climate information, some have suggested sustained interaction between scientists and decision-makers (Bidwell 2013). Science-management partnerships have been established in

various regions of national forest lands (Raymond et al. 2013; Littell 2012). These partnerships have created (and continue to create) formal opportunities for sharing information such as workshops and conferences; but also flexible opportunities and space for regular information exchange between parties, including sharing of experiences, discussion of new ideas and joint problem-solving (Webb et al. 2010; Peterson et al. 2011).

Particularly in climate change, these strategies are increasing. For example, Littell et al. (2012) document science-management partnerships on the Olympic National Forest in Washington State and the Tahoe National Forest in California and Raymond et al. (2013) in North Cascadia. Through this process, climate change scientists provide the scientific knowledge base on which adaptations could be based, and resource managers develop adaptation options based on their understandings of ecosystem management. These science-management partnerships typically involve iterative sharing of climate and climate effects information by scientists, and of local climate, ecological, and management information by managers and have become a forum for conducting vulnerability assessments and developing adaptation plans at both the strategic and tactical levels (Cross et al. 2013; Little et al. 2012; Peterson et al. 2011).

One research participant notes the intention of the GNLCC in trying to bring people together, "it is this idea to make agencies work together for the common end, particularly related to things like climate change. It is just one more attempt to pull people together across boundaries." These forums are important, but considering the new governance arrangements and the significant increase in community-based conservation organizations that are doing a significant part of project implementation across private and public lands, this interface needs further elaboration.

There is value in bringing scientists and managers across agencies together and doing so is not without its own challenges. However, these are just two of four critical groups that need to be incorporated in these discussions, others including policy/decision makers and communities and CBNRM groups. Moreover, these 'groups' aren't static, but rather the dynamic interaction between these groups as individuals play different roles in different networks needs to be recognized. In this sense, the imagery is much less like a Venn diagram and more like a 'helix' of collaboration.

Science-management partnerships are largely formalized initiatives that designate two days for willing participants to come together to put together vulnerability assessments and adaptation plans. These initiatives are often instigated from 'the top' with the intention of being 'formal' networks. With this structure and formalized process, they loose the qualities of emergence and informality that where value-added variables with invasive species (chapter four) and grizzly conservation (chapter five). Moreover, a direct, two-way model of communication between producers and users of climate information is probably overly simplistic. Sharing information among scientists and decision-makers has been described as a complex, continuous web of interactions rather than a simple linear exchange. Thus, these interactions might be better characterized as knowledge networks, and this framing has important implications for how we encourage the development of such networks.

6.5 Assemblage Connectivity: Assembling Adaptive Networks of Climate Governance

Many different and important elements assemble together to make this network of climate adaptation-landscape governance. As illustrated, the core-network of actors are biased towards the role of science, however, there seems to be a disconnect between the science produced and its usability. In part, this may be attributable to the information's spatial and

temporal scale resolution. Regardless, there are interested stakeholders, namely community-based conservation organizations, which find themselves with no significant role in the climate adaptation narrative or network. This has important implications for both the landscape conservation and network governance aspects of climate adaptation.

Even if more institutional connectivity may strengthen the transfer, and potentially the preciseness of knowledge necessary for decision making, there is a need to critically identify solutions connected to existing tools, objects and devices that are involved in the enactment of climate adaptation policy and practices. Providing relevant knowledge is of course important, however there may also be advantages of looking further into what way climate adaptation strategies may be grafted into to existing conservation practices.

Assembling Innovation

In addition to the definitions of governance networks provided earlier by Provan and Kenis (2008: 230) and Isett et al. (2011, p. 158), Robins et al. 2011 note that: an effective governance network system includes: (1) network structures that facilitate effective coordination of action, support the development of trust and team-like collaboration; (2) widespread agreement among network actors about goals and actions; and (3) specific goals and actions that are adequate to address the broader intent of the governance system. Previous sections illustrated the importance of building trust as well as crafting a narrative that frames the problem in a way that leads to agreement across scales about goals and actions. There is little empirical evidence of either trust being built or climate adaptation frames being agreed upon.

However, the Center for Large Landscape Conservation has had some success in bridging the cultural boundaries of agencies and assembling a broader scientific knowledge base. A senior conservation biologist at the Center for Large Landscape Conservation says,

> I'm very strategic; I work with existing entities that want to collaborate versus creating a new entity. If I wanted to create my own entity, I wouldn't have the capacity to do that. My organization is a networked organization…I call myself a post-modern conservation group. We have a seamless relationship between university of Montana and CNREP [Center for Natural Resources and Environmental Policy] and Western Transportation Institute, something called ARC solutions where we share staff capacity and resources. The brand is not the issue, we are really flowing across institutions because we could not grow big enough to address the scale of challenges required.

Assembling together these types of 'post-modern' conservation organizations is going to be necessary to navigate the boundaries necessary with climate change. Multiple-level networks should be assembled more as a consortium, cultivating relationships with knowledge brokers and capitalizing on existing knowledge networks, and increasing community engagement. One way to do this is to design multiple-level governance networks with a focus on innovation.

A good mix of bonding and bridging ties in a network will, as suggested by Tompkins and Adger (2004), lead to greater resilience and an increased ability to adapt. Adaptation is only half the advantage gained by such social networks; the greater strategic imperative lies in the capacity of the collective for creative innovations that enhance resiliency. When thinking about the multiple level climate adaptation it is important to keep in mind that the spread of ideas and the ways in which the sharing lessons learned occurs is dependent on whom communicates with whom which shapes the spread of influence, ideas, and products (Valente 1995). Often, adaptation is achieved only through radical reorganization or innovation in the face of de-stabilizing stress (Thornton and Manasfi 2010). Innovation in network theory is presumed to come from two places: bridging structural holes and weak ties that bridge heterogeneous actors. As discussed in chapter five, the ability for an organization to bridge structural holes is a source of novel information and provides for a collaborative advantage in getting conservation done on the ground. In addition to be positioned to bridge structural holes, the involvement of heterogeneous actors has been considered the foundation of innovation in networks (Corsaro et

al. 2012; Doloreux 2004). Innovation is the result of the interaction among several actors belonging to diverse sectors and engaged in reciprocal, preferential, and supportive actions (Powell 1990). Interaction in networks is an important means of gaining and transferring new knowledge, gathering relevant information about new organizations, and finding external support and services. This exchange of information and resources, as noted in chapter four, affects the efficiency of organizations' decision-making and conservation operations and as that chapter illustrates results in collaborative increasing returns where the cost of conservation is less for each individual organization because they are working together in a larger, integrated network. In large part, this is a result of the heterogeneity of the central and core actors of that network. See invasive species network 'core' below.

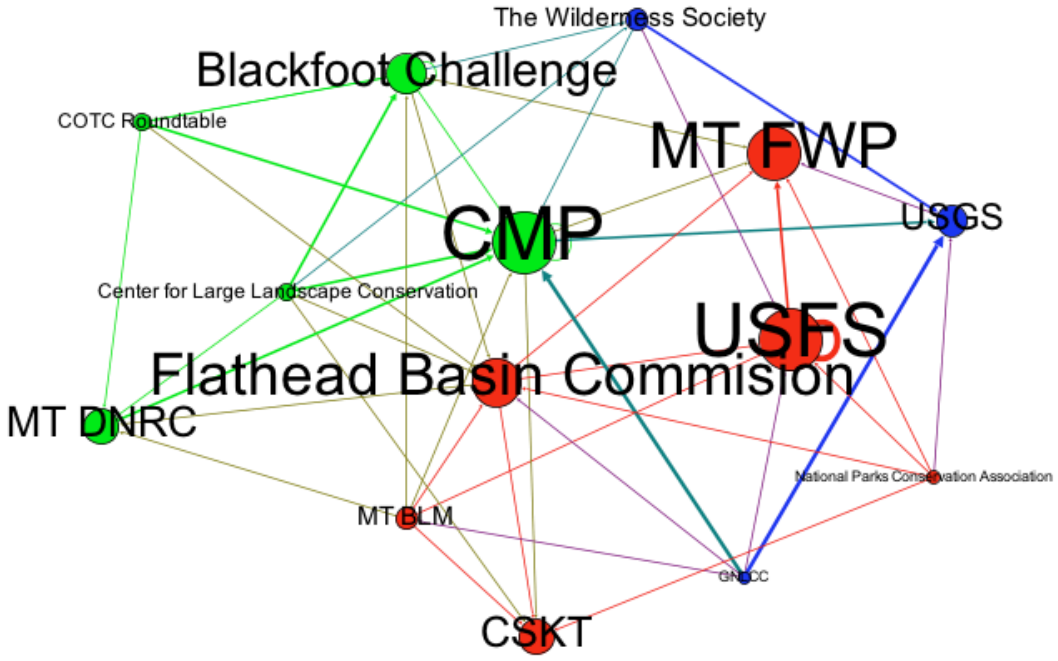


Figure 6.5. Invasive Species Core
*Nodal size indicates in-degree, node color represents network group, edge color represents network group of originating node

The organizational and strategic management literature has researched the role of actor's heterogeneity in innovation networks. The types of variables include: differences in values, role expectations, incentive structures, goals (Siegel et al. 2003), languages, understandings and cultures (Barnes et al. 2002), and practices (Carlile 2002). As that network map illustrates, there is a good mix of community-based groups (Blackfoot Challenge and Confederated Salish and Kootenai); state agencies (MT FWP and MT DNRC); federal agencies (USFS, BLM); science-based NGOs (the Wilderness Society); and regional collaborative organizations (Flathead Basin Commission, Crown Managers Partnership [CMP], and the COTC Roundtable). Within those groups, there is heterogeneity in values, goals, worldviews, and knowledge bases. In contrast, the climate core is composed primarily of science and management organizations/agencies (see below).

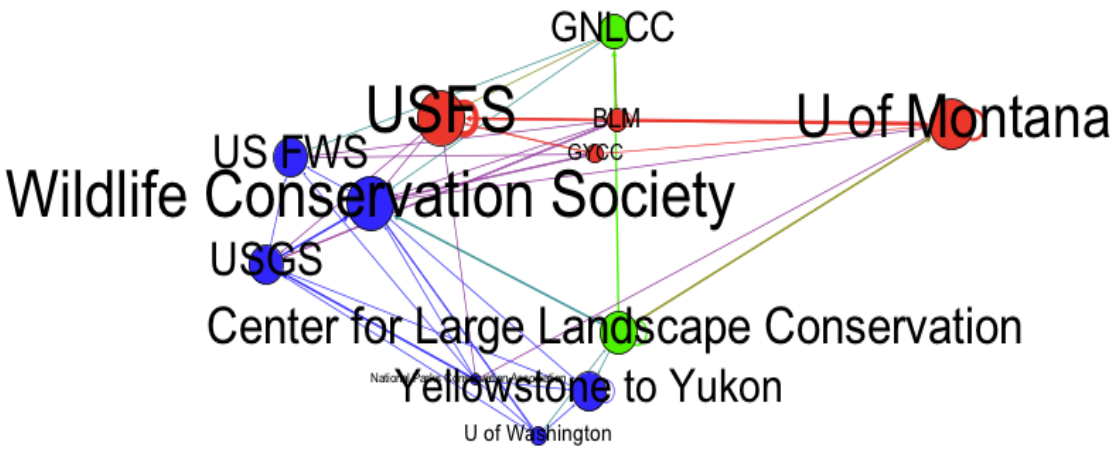


Figure 6.6. Climate Adaptation Core
*Nodal size indicates in-degree, node color represents network group, edge color represents network group of originating node

There is a lack of diversity of goals, values, and knowledge bases in this network that both homogenizes the narrative of the network and also reduces the likelihood of innovative adaptation. Betweenness centrality, as discussed above, is a measure of 'control' of the flow of

information. In many ways, the organizations displayed above retain all of the power in this network in forms of formal authority (agencies with the authority to make final management decisions), resources, and the discursive legitimacy (Purdy 2012). Effective adaptation will require each partner's knowledge base needs to be recognized (Peterson et al. 2011, Halofsky et al. 2011), in addition to his or her current beliefs, values and institutional roles and responsibilities (Ogden and Innes 2009; Webb et al. 2010). But that doesn't always happen, in part because of power discrepancies.

Power and Knowledge in Assembling Climate Adaptation

Despite concerted efforts there remains a contradiction between the science of climate change and the relevance of that information for work 'on-the-ground.' This is representative of a discursive legitimacy (Purdy 2012), defined as the ability of an organization to represent a discourse or issue and to manage meaning by influencing how information is presented. In the case with climate change and climate adaptation, 'science' maintains discursive legitimacy. When asked about landscape conservation, a Blackfoot Challenge member notes:

> It encompasses all of those smaller pieces. Especially with climate change. And the connectivity, the north and south. I think that really does make sense. I don't quite get…I think they are more in the science of it. I've been to that website a number of times [GNLCC], it is okay. But I'm sort of the person that wants to get on-the-ground.

Neither a narrative nor a network can be constructed out of thin air. It is not simply weaving a good story or a network, as both have to resonate with people by being authentic and reflecting the everyday contexts and experiences of each of these persons. Narrative and networks are enacted (into landscape conservation) only if it takes root in a place and in a community. To put it another way, it cannot simply be imposed upon a community; it also has to be co-constructed by and from community.

Recognizing that landscape conservation is a heuristic employed by scientists, managers, practitioners, foundations, and whoever else to organize their understanding of the ways that the social and ecological (should) interact is to therein recognize that the landscape is both socially constructed and politically contested. That is not to undermine the ecological dimensions and processes that occur in landscapes that are biological, but it does suggest that people impose a definition or particular perspective of landscape conservation for particular purposes relative to certain political, scientific, legal, or cultural lenses.

Harvey (1996, p. 174) observes those in power may "strive discursively as well as institutionally to manage [contain] the heterogeneity of discourses," thereby maintaining structures of top-down power. Drawing on the primacy of science in the realm of climate adaptation has implications for the ways that 'landscape conservation' are conceived and put forth, that is resource management programs that illustrates the power of discourse to govern - govern the ways in which we talk about problems, govern the way we organize to solve problems, and delimits what the 'rational' approach to organize environmental governance. Landscapes, as human geographers suggest, are a kind of text, through which powerful discourses are inscribed by competing social forces (Duncan 1990) and landscape conservation is a mechanism that enacts certain forms of power, ideas, and knowledges. In this sense, unpacking the ways that 'landscape conservation' has become the 'rational' approach to conservation is an important exercise.

I heard over and over again that landscape conservation is 'the new way of doing business.' There is collective momentum to join 'the coalition of the willing' or be left behind. But this itself is full of controversy and power struggles as the 'traditional way' of doing

conservation is very entrenched within agency bureaucracies that aren't necessarily going to give up authority and autonomy easily, nor are landowners.

This returns us to the challenge of scale with climate change, as well as in landscape conservation. Proponents of landscape conservation argue that "going to scale" involves protecting ecosystem integrity and connectivity, restoring and protecting water resources, providing important wildlife habitat and corridors, and increasing adaptive capacity in the face of a changing climate. The word 'scale' appeared 271 times in my interview data, very high on the frequency list. Many participants evoked scale as a way to describe important ecological aspects of landscape conservation. This is not surprising, and thinking in terms of multi spatial- and temporal- scales is a grounding principle of landscape ecology. When asked about landscape conservation, one participant working to coordinate national park management into the broader context of the landscape noted, "it is a matter of scale."

Another participant working for a regional NGO noted, "I guess it is working at a…part of it is looking at a large enough scale that you are making a difference on some kind of ecological level." These are precisely the types of definitions that challenge the role of communities in this climate adaptation network and narrative. However, there is hope in thinking about the innovation and practices that 'assemble' together to create landscape conservation in the Crown of the Continent. To deal with climate, to adapt to climate change, community-based conservation will need new 'combinations' of elements that, over time, are appropriately assembled together. One Montana BLM employee remarks,

> […] there are commensurate community-based groups on the Canadian side, but if they bring all of those together then they have the community-based equivalent of stepping that up in scale. The to-be-determine part is how do you form that, how do you get them to work together, how do you get products out of that?

So while climate adaptation is a challenge, it is also an opportunity for organizational and network innovation. It is opportunity for new combinations of existing elements of technology, text, materials, and organizations whose actions stretch across local, national, and global levels. In the next, concluding chapter, I will discuss opportunities and challenges to assembling this type of innovative network for landscape conservation.

6.6 Conclusion

As indicated throughout this chapter, there are several significant factors that shape the structure and motivation of this network. First and foremost is the role of science in both the network structure and the narrative. This point is two-fold in that climate adaptation is driven by the "facts" produced by science on the one hand, and on the other hand is about addressing uncertainty in both outcomes and events associated with climate change. This is a significant finding, because it affects the quality of collaboration in the landscape governance of this issue. As indicated in chapter two, over half (58.9%) of the network ties are to federal agencies and science-based organizations (128/217). This is a significant concentration and control of the information being shared in the network. It makes sense then, that this network is more about science and less about practice and implementation.

In the case of the Adaptive Management Initiative, climate adaptation has served as a catalyst for community-based organizations to build social capital, build their network out. That illustrates another major driver of collaboration in this network (that is not indicated in the network maps), agency and foundation funding. The AMI would not exist without the Kresge Foundation; likewise that is where the Roundtable on the Crown of the Continent has drawn its financial support to establish its roots in the landscape. Climate change and climate adaptation are clear funding priorities for both private foundations as well as federal agencies. It is the

organizations with a spectrum of PhDs, and the cultural capital that go along with those PhDs, that are able to organize themselves to be on the receiving end of this financial foundation and agency support, further marginalizing the community-based groups. A significant question exists as to what happens to the network once the funding for these initiatives is not available anymore? Will the network ties and social capital developed between the local-level groups in the AMI persist, if there is not sustained funding flowing to them to support their climate adaptation efforts and keeping them in touch through monthly calls and other meetings?

CHAPTER SEVEN: SYNTHESIS, RECOMMENDATIONS, AND FUTURE RESEARCH

This dissertation focuses on the role of networks and narratives in multi-level landscape governance, with a particular interest in the role of community-based conservation in these efforts. Community-based conservation is an influential, but often overlooked, stakeholder group that is central to the process creating actionable knowledge, facilitating effective multi-level governance, and delivering on-the-ground conservation implementation. Drawing on a broad range of literature, this dissertation identified networks and narratives as influential forces shaping environmental governance across the three issue-case studies explored. I have illustrated how concepts such as "knowledge" and "scale" need to be used with more sensitivity in order to account for issues of power and equity. If networked environmental governance is to offer an alternative to market regulation or state control of the environment, than it must be sensitive to what is perceived as proper knowledge and how the environment and resources are influenced by power asymmetries. Landscape governance rests upon a "politics of scale" that is more than a reflection of the biophysical scale, but a negotiated product of social and politically embedded knowledge and moral claims made by scientists, resource managers, community and regional NGOs, foundations, and private landowners who have a stake in the landscape. Drawing boundaries around a landscape is a contested process that determines what is inside the landscape and who are the legitimate actors.

The existence of social networks is instrumental for building social capital, mobilizing resources (political, financial, technical), and framing a problem or narrative that mobilizes multiple levels of actors for landscape governance. Moreover, networks are essential for identifying knowledge gaps and bridging structural informational holes that exists and often help translate information to knowledge to action.

My interest in networked environmental governance is more than just the promotion of networks as an alternative governance form, but also a critique and opportunity for a more informed "social" in social-ecological systems. The development of the connectivities used in this analysis – the social, discourse, and assemblage – is an effort to offer alternative ways to conceptualize the social in environmental governance. The ascendancy of common-pool resource literature, while advancing the field significantly and giving a voice to the social in resource management problems, has also primarily promoted a particular kind of "social", the rational choice actor. This institutionalist perspective has deeply penetrated the theorizing and research on the "adaptive" and "collaborative" approaches by asserting that actors pursue their interests by making choices within institutional constraints, and that in the absence of institutions, transaction costs can frustrate collective action (Ingram and Clay 2000). These approaches have been, as mentioned in chapter two, very successful in identifying a set of specific criteria (or design principles) that characterize sustainable resource management, such as a bounded set of actors, ability to self-organize, rule following, commitment to comply, etc (Ostrom 1990). Although I don't intend to dismiss institutions (and rather argue that networks and narratives need to be considered in a matrix of institutions), I do contend that as resource management problems become more complex on the one hand, and with more barriers for action on the other, there is a significant need to advance theory and research of social-ecological systems beyond that of the institutionalist perspective. In this dissertation, I offered some alternatives to this conversation by illustrating the role of multi-level networks (social connectivity), the role of framing and narrative (Discourse Connectivity), and the application of assemblage theory to resource governance (assemblage connectivity). This final chapter draws together the research findings into a discussion and conclusion regarding the capacity for multi-level governance in

the Crown of the Continent and in other landscape conservation initiatives. The chapter has three sections. The first section discusses the substantive results of each analysis and closes with a synthesis of the main arguments and findings, relating them to the overarching aims of the research question. The substantive research results depend upon the analytical framework used to attain them, and the theoretical perspectives that guide those frameworks, the second section discusses the theoretical and practical contributions of the study. This includes the study's conclusion regarding landscape conservation in the Crown of the Continent. The chapter closes with a brief discussion of potential areas for future research.

7.1 Synthesis of Substantive Results

An early decision point in the writing stage was an analytical decision to separate the empirical chapters by issue (i.e., invasive species, grizzly conservation, and climate adaptation), rather distinguishing chapters by the social, discourse and assemblage connectivity. This strategy now offers the opportunity to tease out some main points across the three empirical chapters for each of the social, cultural, and assemblage connectivity, and to make some distinctions regarding the networks of the different issues, how they are structured and how the collaboration is differentiated between them.

There are important distinctions concerning the structure of each issue/problem. Invasive species is about preventing a "bad" that the network actors agree is a bad. Grizzly bear conservation on the other hand is about restoring and promoting a "good" as required by law and policy. Climate adaptation is about addressing uncertain outcomes caused by uncertain events associated with climate change. In environmental governance analyses, the structure of the problem often goes unexamined to the detriment of understanding governance. How the problem is structured directly influences how the network is structured and that in turn influences capacity

for action and outcomes. On the one end of the spectrum with invasive species, there are clear and immediate actions that have obvious and tangible responses. In grizzly bear conservation, the Endangered Species Act exerts a powerful influence over grizzly conservation and directs, through statutory mandate, the expectations of federal land agencies, regardless of their participation in broader networks. This legal-rational framework interacts with network decision space and action. With climate adaptation there are uncertain interventions with uncertain outcomes. The structuring of this problem makes it more likely for some organizations to participate over others, and may limit the engagement of community-based groups that are more attuned to seeing outcomes on the ground. Distinct from invasive species management and grizzly conservation where land ownership, jurisdictions, and authority provide a basis for governance, with climate adaptation there are no clear lines of authority and action.

There are also some interesting points of comparison when considering the network dimensions of invasive species and climate adaptation of chapters four and six, respectively. As discussed in the methods chapter, these two are slightly easier to compare given the depth of the understanding of the networks due to the social network survey conducted. As table 7.1 indicates, in the invasive species management network there are a larger proportion of community-based groups in the network relative to other types of group (46.5%), whereas in the climate adaptation network the highest proportion by organization type is science-based organizations at 42.5% of the network. Moreover, in the climate adaptation network federal agencies and science-based organizations make up 57.6% of the total ties, where as in the invasive species network community-based groups and regional NGOs make up 56.6% of the ties.

Table 7.1 Comparison of Invasive and Climate Networks

	Invasive Species	**Climate Adaptation**
Organization Types of Nodes (Total Ties)		
Community-based Groups	40 (69)	14 (14)
Regional NGO	15 (38)	18 (44)
Science-based Organization	12 (23)	34 (71)
State Agency	9 (31)	7 (12)
Federal Agency	10 (31)	7 (57)
Total	**86 (189)**	**80 (222)**
Network Statistics		
Nodes	86	80
Edges	162	171
Total Ties	189	222
Average Degree	1.884	2.138
Average Weighted Degree	2.291	2.538
Network Diameter	7	6
Density	.042	.052
Modularity	.466	.411
Number of Communities	9	6
Connected Components	3	1
Average Path Length	3.3	3.178

The invasive species network has more nodes (86) but less ties (189) than the climate adaptation network with 80 nodes and 222 ties, respectively, leading to the hypothesis that the invasive species network is more decentralized than the climate adaptation network. This is confirmed by the network statistics that show that the invasive species network is less dense (.042 compared to .052) with more distinguishable "communities" (9 identifiable communities compared to 6, invasive species management and climate adaptation, respectively).

The qualitative data supports this notion, as does the analysis in the preceding chapters. Invasive species management is a problem with a clearly defined problem with a clear set of action items. Stakeholders across multiple-levels have a sense of invasive species as a problem, that is the problem is defined very similarly from the landowner parcel to the highest levels of federal land management agencies. There is no comparable understanding with climate

adaptation. This leads to a more centralized network, as well as a more centralized framing of the problem. In the climate adaptation network there is less space for multiple network motivations, rather, as illustrated in chapter six, the current network motivations are currently defined mostly around climate science. In the invasive species network values trump science, and motivations around invasive species as "invaders" bind the network together in a broader spectrum of connected clusters.

Chapter five on grizzly conservation, although using a different kind of network data, presents an interesting comparison to both the invasive and climate network. Specifically, two distinct types of legal institutions, the Endangered Species Act and conservation easements (which has authority through the tax code), shape the network action through particular parameters. There are significant resources for both science-based organizations for endangered species research, as well as for communities and landowners through easement incentives. The grizzly network has an interesting mix of science-based organizations and community-based organizations (primarily land trusts), however, this analysis is limited by qualitative method the network analysis in chapter five.

Other insights can be gleaned from comparing across the "connectivities" of each chapter. Table 7.2 summarizes the comparisons from chapter four, five, and six. Dimensions of this table will be discussed in the subsequent sections below.

Table 7.2. Comparison Across the Connectivities

Comparative Lessons Learned			
	Invasive Species	**Grizzly Bear Conservation**	**Climate Change and Adaptation**
Social Connectivity	Strategic Interdependence and Stitching together to Scale-up "Prestigious" local knowledge that grounds and connects	Bridging ties as network resources Weak ties that bridge structural holes Bridging organizations and boundary spanners	Relationship building, *meet then tweet* Boundary spanners and trust
Discourse connectivity	The Ultimate "other": Invasives as "invaders" and an "economic threat" Narratives that Ground and Connect	Umbrella Species and the "good vision" Local practices changing the narrative	Framing scale to frame problems Building an inclusive network and narrative
Assemblage Connectivity	Invasive species management as polycentric networks The role of weeds (as an actor) shaping landscape conservation Knowledge in practice Politics and power in 'landscape' boundaries	Technology and maps in assembling network Conflicting science can fragment network	Network Heterogeneity and Innovation Discursive legitimacy of science Subjectivities of landscape governance

7.1.1 Social Connectivity

Scholars and practitioners of environmental governance are increasingly aware that effective and sustained connections between people responsible for regional systematic conservation planning and those responsible for local conservation actions are critical for achieving effective and sustainable environmental governance. This notion of multi-level governance is increasingly noted in the literature, but empirical illustrations are few and translating this to practice is a recurrent challenge. As the preceding chapters illustrated, social networks can emerge from collaborative relationships of information and/or resource exchange

when stakeholders are concerned with achieving common objectives. Moreover, as the preceding chapters illustrated particular patterns of relationships, and not merely the absence or presence of relationships between stakeholders, are critical in facilitating effective governance processes and outcomes. These findings have been noted elsewhere (Bodin and Crona 2009; Bodin et al. 2006).

The collaborative arena that actors organize themselves and operate in is largely defined by the patterns of their relationships. In the most extreme case, if a relationship doesn't exist then there will be no information transfer, no learning, and no governance (interestingly, some scholars simply define social learning as "interaction", see Lauber 2011). Therefore, regardless of the social-ecological complexity of the problem, a focus on building relationships and building trust is a primary concern for social connectivity. It is by building trusting relations that social networks are created and maintained, at both the local level and across levels, and through trust that key properties of reciprocity emerge (see Molm 2003). With invasive species management, the trust embedded in reciprocity is crucial for the scaling-out of networks to achieve increasing returns in collaboration. In grizzly bear conservation, those trusting relationships are relevant to the informal channels and practical implications of sharing information from scientists to practitioners. It is necessary to build those same types of relationships with regards to climate change information and climate adaptation. Although the networks will be different, the basis of trusting relationships is immutable.

To be adaptable, and govern challenges like climate change adaptably, multiple level networks are necessary. We can glean some important findings from comparing the empirical cases across the issues, the role of core-periphery structures that have heterogeneity and include community-based groups. Local community-based conservation groups being a part of the core of an issue can provide legitimacy to the broader network efforts while also increasing the flow

of information into communities through their bridging ties to outside organizations. It is also relevant for assessing where the information and practices of the network originate and the effect that has on the overall network of governance. This was acutely perceptible in comparing the invasive species and climate adaptation core.

Additionally, the role of brokerage and bridging is crucial for the function of multi-level networks of environmental governance. Repeatedly, organizations that played bridging roles were identified as central to the network for both tasks of information sharing and taking conservation action. In chapter four, these organizations were critical for both transferring information and lessons learned across the broader landscape, coordinating action between community-based groups, and strategically allocating resources. In many cases, the bridging organizations playing a brokerage role are engaged in "meta-governance" or the governance of the networks (Kickert et al. 1997; Koppenjan and Klijn 2004). In many ways this is precisely the "experiment" that the Roundtable on the Crown of the Continent in playing its "network of networks" role. The challenge, therein, lies in where to intersect with already existing networks across multiple levels and provide a mechanism for emergent communication and coordination in ways that does not undermine existing community-based conservation efforts.

7.1.2 Discourse connectivity

Discourse connectivity revels the quality of network relationships as well as the complex motivations and the relational knowledge that sustains attachment to the environmental governance process. Narratives are part of the glue that binds networks, and they expose the quality and substance rather than just the structure and the organization of the networks. Discourse connectivity reveals these processes and helps explain the *why* behind actors being socially connected in a network and engaging in multi-level or cross-scale governance. This is

apparent in the ways that the problem of invasive species is framed as "the other." Invasive species represent a threat to a common place, and as such has expanded the landscape that makes up that common place. Patterns of interaction are embedded in this context, in this organizing against a threat to livelihood and way of local life.

The "good vision" narrative of grizzly bears (as well as other umbrella species) is reminiscent of the "we are all in this together" mantra of sustainability. Yet the story is much more than all things "live in harmony", as clear material conflict between grizzly bears and ranchers illustrate. The innovative and engaged focus to change the social context, and therefore change the narrative, is grounded in the efforts to learn and have a competence about how to manage appropriately within the social-ecological complexity of grizzly bear conservation. These lessons can contribute to the role of narratives and the narrative process in environmental governance. See table 7.3 below for a summary.

Table 7.3. Lessons of Narrative and Governance Process

Empirical Example	**Narrative Process**	**Governance Process**	**Description**
Climate change as problem beyond local scale	Disenchantment with grand narrative	Problem identification	Resentment over current framing of problem, presents opportunity for new frame
Invasive Species framed as "other"	Centrality of local storytellers	Mobilize actors and resources into a network	Individuals and community-based groups tell their story, envision the type of management and change they desire
Grizzly bear – human conflict reduction via local innovation	Narration of new Narratives	Setting governance goals, objectives, and expectations	Influential actors express and formalize sentiments among peers

As table 7.3 illustrates, these general aspects of the narrative process, dis/enchantment with the grand narrative, centrality of storytellers, narrating and transmitting new narratives can also be

seen as crucial to the processes of governance. Focusing on the stories that actors share supports giving closer attention to the informal and everyday realities of people, regardless of organization or level. It further emphasizes the informal and relationality between people networked together (rather than formal institutions), and allows us to describe these relationships in complex ways that a purely structural approach fails to address. Discourse connectivity is a crucial part of the integrated whole, and these examples provide lessons to ways to think about the narrative of climate adaptation, a narrative that includes the role of local knowledge and community-based conservation.

7.1.3 Assemblage Connectivity

Assemblage connectivity can provide some important insights to the politics of scale. Referring back to figure 6.5 and figure 6.6 (invasive species and climate adaptation core, respectively) the variation in the heterogeneity of the central actors themselves illustrates a power and a particular perspective that influences the politics of scale. In the core climate adaptation are organizations that focus their efforts at large geographic scales (i.e. the Great Northern LCC, Yellowstone to Yukon, Wildlife Conservation Society) as, again, compared to the regional and community-based NGOs found in the invasive species core. As illustrated in chapter six, betweenness centrality is used as measure of power in network analysis, and combining betweenness centrality to an analysis of core-periphery, can provide some informative insights to the politics of scale debate in environmental governance.

The boundaries of scales and levels related to environmental governance are negotiated and renegotiated over time. For example, the scale that grizzly bear conservation was ‘relevant’ changed. It was once that grizzly bears needed ‘the entirety of the northern Rockies’, however, through the interactions of a more heterogeneous group of actors across the multiple levels of

grizzly conservation, the role and importance of local action became an equally powerful narrative, as did their livelihood activities. This is illustrated by the Heart of the Rockies, who is trying to re-shape the scale that science is applicable:

> It [science] might say western MT is important for Grizzly Bears – cool. That is real helpful in terms of highlighting a particular piece of private land you want to protect for grizzlies. What we have been trying to do with some support from the LCCs, science support. Finding ways to get into the data the folks are using to roll up those plans. Scale it at a level that you can apply it on the ground.

In this statement we find a tension between the 'scale that science' is operating and the translation of that information to usable knowledge that can be applied on the ground. This example illustrates the point that science is just one part of the 'assembled' network, and that finding the appropriate balance between science and locally based knowledge is a part of assembling the network. In chapter four it was illustrated that knowledge about invasive species was a social competence that was also practice. We need to think about assembling networks of climate adaptation where knowledge about climate change and adaptation is also socially mediated in that communities develop forms of discourse that frame and give meaning to the information that is brought in and put into practice.

In large part, assemblage connectivity is about power and exemplifies the need to be able to explain the deeper dynamics of power at work in multi level governance arrangements. Why do some arrangements succeed where other, seemingly good intentioned and similar initiatives, fail? There are forms of power at work that lie behind the creation of governance initiatives and can explain divergent degrees of success.

Assemblage connectivity also illustrates how people create ties with nonhumans that define and delimit what is and what is not possible. The inclusion of nonhuman in the narrative and network reveals the source of connection between people who share little else other than

their attachment to a plant, animal, or landscape. This has been illustrated in both a network formed against the narrative of the "other", or noxious weed; as well as a narrative and network that has embraced the grizzly bear as a constituent part of the network. The challenge, then with climate adaptation, is reifying that "other" or non-human element of the network assembly that can play an active role. Climate is too abstract and too easily confused with weather, which is a more tangible aspect of climate but problematic in the framing of climate change as a problem. There is a need for a concrete representation of 'climate adaptation', and landscapes have the potential to be that alternative.

7.2 Theoretical and Practical Conclusions

7.2.1 Theoretical Contribution to Environmental Governance and Social-Ecological Systems

Collaborative, flexible and polycentric approaches are increasingly theorized in the environmental governance literature, generally summarized as approaches to adaptive governance. This conceptual framework commonly emphasizes an integrative approach to governance that transcends land tenure and jurisdictional boundaries as well as the constraints of spatial and temporal scales (Armitage et al. 2009; Folke et al. 2005). Adaptive governance promises collaboration that builds social capital and innovation (Folke et al. 2005) and multi-level learning and polycentricity that promote effective governance and adaptation (Pahl-Wostl et al. 2012). These approaches promise improved decision-making under uncertainty, collective learning and collective action, long-term experimentation and inclusive decision-making and governance (Folke et al. 2005).

Yet empirical evidence is thin (Holley et al. 2012), and many have questioned the link between social learning and collaborative governance with social or environmental outcomes (Ojha et al. 2013; Cundill and Rodela 2012; Backstrand et al. 2010). This research contributes to

the empirical evidence of environmental governance conceived through a network lens. It provides evidence of collaborative ties growing stronger, evidence of ways networks organize differently across issue sets, and illustrates the role of problem frames and narratives in this process.

This research has illustrated that attention should be paid to the ways in which multiple networks operate simultaneously and in conjunction with each other. Just as there is no fixed spatial scale at which 'adaptive governance' should take place, there is no one network that is to do the adapting. While some networks are more effective than others, there is no one "network" in the Crown of the Continent landscape, rather multiple networks across multiple levels that intersect in places where intersecting adds value to their organizational efforts. This research has illustrated that the ability to combine and meaningfully connect actors and problem frames is often contingent on historical conditions (which give rise to particular modes of governance) and that social contexts are constantly in flux. This requires us to recognize the diversity among governance initiatives while not losing sight of the commonalities and patterns among them or the common causalities of when, how, and for whom they were created. There are some implications here for network theory, as it deemphasizes the "node" and brings attention to the emergent nature of the "linkage." The focus on the linkage resonates with ideas that question conventional understands of individual and community subjectivities, particularly neoliberal subjectivities as motivated by a rational actor model, are inadequate to explain how people knit themselves into relationships of responsibility and reciprocity and by doing so create a collective or network rationality.

This work also offers new directions for research on resilience and social-ecological systems. Walker et al. define resilience as "the capacity of a system to absorb disturbance and

reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks" (2004:2). This body of literature has pointed the direction of research towards the processes of adaptation or even transformation, the panarchy of the system (Gunderson and Holling 2002). This research contributes to the refinement of systems models (so common in SES research) to include the social and organizational processes of adaptation and change that include social and cultural contexts and complexity. This research suggests that before attempting to capture system resilience and adaptability in physical models and computer simulations, these phenomena need to be a part of the ways networks are assembled, they need to be a part of the network and the narrative. If adaptation and resilience are to become part of the collective or network rationality, they need to become part of the background story for why social actors engage in multiple level networks.

The focus on social, cultural, and assemblage connectivity addresses the sometimes inevitable tendency of resilience research to revolve around technical analytical exercises. Through understanding 'connectivities' we begin to better understand that the search for resilience is not primarily a technical problem among those affected by environmental change but a search for a network and a narrative that connects actors to meaning in a landscape.

This dissertation has also contributed three potential uses of social network analysis to systematic assessments of multi-level governance and conservation planning and action. First, social network analysis is a useful tool for visually identifying stakeholders and their roles in social networks as well as characterizing the relationships between actors. In particular, social network analysis helps to gain a broader view or "map" of the landscape of interactions among local and regional conservation actors. When contextualized in research and assessment reports, these "maps" have been used to facilitate discussions among network organizers and the

foundations that fund the initiatives. For example, as an outcome of this research the maps created for the Adaptive Management Initiative discussed in chapter six were used to catalyze discussions among regional NGOs, the funding foundation, and local groups for the strategic allocation of resources to improve the initiative. In this research, these maps have stimulated broad interest from stakeholders as a useful tool for identifying and involving stakeholders as well as identifying conservation opportunities and constraints. This is inline with other findings from Prell et al. (2009), Vance-Borland and Holley (2011). Second, social network can be used to design and facilitate strategic networking to strengthen linkages between local and regional conservation initiatives, or otherwise help explain the lack of those multiple level linkages. Third, social network analysis has the potential to be a valuable tool to support conservation actions using measures of social connectivity alongside ecological data. This will be discussed more in the future research section below.

Finally, I believe this research contributes to a very small, but growing, body of scholarship on landscape conservation. Landscape conservation is still a conceptual and theoretical framework that has gained traction in policy circles, but not institutionalized in any real way. This research points towards examining the ways that landscapes become "real." Landscapes themselves are a part of the network, but how a landscape transitions from becoming an object of the natural world or a thing, to a subject imbued with meaning, to a place with identifiable boundaries is a process that has relevancy for both environmental governance and social-ecological systems and resilience research. Landscape conservation is both a discourse (or narrative) and a form of governance (or a network) and has very real implications for the ways that actors organize socially. Perhaps, most importantly, it guides conservation practice. Social

and ecological outcomes will derive from landscape governance that shapes practices that enhance community-based resource management.

7.2.2 Practical Contributions

Several decades of participatory resource conservation has illustrated the opportunity to go beyond traditional forms of citizen participation in environmental decision-making and policy-forming process in natural resource management. Many collaborative resource conservation initiatives, including ones studied in this dissertation, have had successes in setting program objectives and getting outcomes as illustrate in both the invasive species management and grizzly bear conservation cases. However, there is little empirical evidence of this 'conservation action' around climate adaptation. Enacting a network of governance for climate adaptation in the Crown of the Continent landscape, as well as other rural landscapes in the U.S. is fundamentally necessary as the challenges of climate change accelerate in the coming decades. The following recommendations are offered for consideration to practitioners in the Crown of the Continent landscape:

1. Actively encourage and incentivize inter-affiliation interaction among conservation partners, including community-based conservation groups.
2. Commit time and resources to engaging relevant but underrepresented organizations as well as consequentially unrepresented sectors, including energy and transportation. Moreover, make the most effective use of the money that is available to improve governance in the short-term. This includes how both landscape- and community-based initiatives can access or benefit from investments in non-traditional conservation sectors such as transportation, etc.

3. Work to identify how diverse epistemological perspectives and expertise can be brought together in practice to obtain the range of knowledge needed to address landscape level ecological stressors. This includes designing ways to value local ecological knowledge appropriately.
4. Focus on identifying and communicating clear examples of how the multi-level landscape governance adds value to community-based conservation.
5. Address issues related to the appropriate role of landscape assessment and management plans and assesses the degree to which landscape conservation priorities can be sufficiently addressed by the current network of conservation actors.
6. Developing the right set of tools, from better communications and more appropriate framing, for capacity building (relationships and social capital). The investment is significantly front-loaded.
7. Resource managers with formal authority need to be socially embedded in social networks to accomplish collaborative means.

7.3 Future Research

A research inquiry such as this is an inherently reflexive process. It raises as many questions as it seeks to address, sometimes more. Several areas for potential future research were identified.

First, there is a significant lack of scholarship on the role of innovation in resource management or conservation practices. Whether this is a policy innovation or a new innovative practice, the ways these innovations emerge and are transferred is not well understood. Innovation within a complex social-ecological arena like environmental governance occurs at many levels and can be incremental, radical, and systemic. Although we cannot predict

innovation, we can foster it by providing environments that encourage it, and it's learning. Necessity is not always the mother of invention; innovation is a very emergent property. Innovations can shift our resource management from one paradigm to another, allowing us the freedom to abandon problematic unsustainable behaviors with the necessary political will and enabling conditions.

Second, integrating social-ecological network models could enable novel cross-disciplinary analyses of social-ecological systems. In theory, entities in a network map could be anything, and this includes habitat patches or patches of invasive weeds, or areas of proactive climate adaptation. Regardless of 'what' the entities are, network models characterize and construct the structural aspects of nodes and links. Along these same lines, a refined conceptual approach for aligning social connectivity data alongside ecological indicators will provide a necessary innovation to the challenges of measuring social and ecological outcomes in collaborative environmental governance.

Finally, I would encourage and intend to further develop ways to apply assemblage theory to environmental governance. Analyzing landscape assemblages, as forms of social-ecological governance, allow us to better articulate and understand how processes of multi-level governance can disproportionately distribute resources and privilege certain ways of knowing the environment. This has consequences for communities and environments, making them less adaptive to environmental change.

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