The role of bridging organizations in facilitating socio-ecological transformation:
A case study of the Great Northern Landscape Conservation Cooperative

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ABSTRACT

It is apparent that contemporary environmental changes may be overwhelming conservation institutions’ capacity to protect esteemed and ecologically vital components of the biosphere. In an effort to improve understanding of how responses to this environmental change and management dilemma can be improved, this study examines the Great Northern Landscape Conservation Cooperative (GNLCC) and its efforts, as a bridging organization, to facilitate a transformation to collaborative landscape-scale conservation in the bi-national Great Northern region. Complementary theoretical perspectives (socio-ecological resilience and political ecology) are linked via a novel mixed method approach (social network analysis and institutional ethnography) to critically examine the GNLCC, the nature of relationships among actors in the social network it is cultivating, and how those relations are improving or inhibiting socio-ecological transformation. The study demonstrates that the GNLCC, through network building and endogenous financial, scientific, and technological capacity, is playing a key role in tipping conservation efforts in the Great Northern region towards more ecologically and socially tenable conditions. However, the study also identifies that interactions among actors (or lack thereof) in co-management arrangements can produce multifaceted outcomes where perceived benefits of collaboration can obscure procedural justice and efficacy issues. In view of this consequential variation, eight specific recommendations for improving the GNLCC’s bridging efforts are presented. By developing and demonstrating the value of new conceptual and methodological approaches (which address identified limitations of existing bridging organization research), the study makes a modest but salient contribution to socio-ecological resilience scholarship aimed at understanding the role of bridging organizations in facilitating socio-ecological transformation.
# TABLE OF CONTENTS

List of figures ......................................................................................................................... iv  
List of tables ............................................................................................................................ v  
Chapter 1: Introduction ........................................................................................................ 1  
  1.1 Landscape Conservation Cooperatives as bridging organizations ................................. 2  
  1.2 Research question, aims, and organization ................................................................... 3  
Chapter 2: Literature Review ............................................................................................... 5  
  2.1 Non-equilibrium and landscape ecology ....................................................................... 5  
  2.2 Socio-ecological resilience ............................................................................................. 7  
  2.3 Political ecology ........................................................................................................... 12  
  2.4 A social relational approach/social network analysis .................................................... 14  
Chapter 3: GNLCC Case Study ............................................................................................. 18  
  3.1 Socio-ecological context ............................................................................................... 18  
  3.2 Landscape-scale stressors ............................................................................................. 19  
  3.3 Conservation actors ....................................................................................................... 20  
  3.4 Vision, mission, guiding principles, goals, and strategies .............................................. 21  
  3.5 Organizational structure ............................................................................................... 23  
  3.6 Operations ..................................................................................................................... 26  
Chapter 4: Methods .............................................................................................................. 28  
  4.1 Rapid institutional ethnography .................................................................................... 28  
    4.1.1 Content analysis ....................................................................................................... 28  
    4.1.2 Key informant interviews ....................................................................................... 29  
    4.1.3 Participant observation ............................................................................................ 30  
  4.2 Social network analysis ................................................................................................. 30  
    4.2.1 Questionnaire content and development ................................................................ 31  
    4.2.2 Study design and procedures .................................................................................. 32  
  4.3 Data analysis and interpretation .................................................................................... 32  
Chapter 5: Results and Discussion ...................................................................................... 34  
  5.1 Research outcomes ....................................................................................................... 34  
  5.2 Social network analysis results .................................................................................... 35  
  5.3 The GNLCC’s role in facilitating transformation ............................................................. 45  
    5.3.1 How transformation is being facilitated .................................................................. 46  
    5.3.2 To what extent transformation is being facilitated ................................................. 50  
  5.4 Recommendations ........................................................................................................ 60  
  5.5 Study limitations .......................................................................................................... 60  
  5.6 Study contributions ....................................................................................................... 62  
Chapter 6: Conclusion .......................................................................................................... 64  
References ............................................................................................................................... 66  
Appendix A: Secretarial Order 3289 .................................................................................. 78  
Appendix B: GNLCC Questionnaire, Study Design, and Data Analysis ................................. 82  
Appendix C: Research Outcomes .......................................................................................... 96  
Appendix D: Summary Statistics .......................................................................................... 98  
Appendix E: Social Network Analysis Measures ................................................................... 112
LIST OF FIGURES

Figure 1: National LCC network ........................................................................................................ 3
Figure 2: Multiple Basins of attraction ................................................................................................ 8
Figure 3: Stability landscape .................................................................................................................. 8
Figure 4: Conceptual model of bridging organization ......................................................................... 11
Figure 5: The Great Northern region .................................................................................................. 18
Figure 6: GNLCC organizational structure ........................................................................................ 24
Figure 7: Network of interaction on issues related to landscape-scale stressors ......................... 37
Figure 8: Network of information seeking on issues related to landscape-scale stressors .......... 39
Figure 9: Network of provisioning of resources for work on landscape-scale stressors ........... 41
Figure 10: Network of influence in relation to landscape-scale stressors ...................................... 43
Figure 11: Network of distribution of work on landscape-scale conservation priorities ........... 45
Figure 12: Concrete changes in organizations as a result of the GNLCC’s influence .................... 56
Figure 13: Distribution of work on landscape-scale conservation priorities .................................... 59
LIST OF TABLES

Table 1: Five dominant themes in political ecology .......................................................... 13
Table 2: Organizational interaction on issues related to landscape-scale stressors .......... 36
Table 3: Organizational information seeking on issues related to landscape-scale stressors . 38
Table 4: Organizational provisioning of resources for work on landscape-scale stressors ..... 40
Table 5: Organizational influence in relation to landscape-scale stressors ...................... 42
Table 6: Organizational distribution of work on landscape-scale conservation priorities ...... 44
Chapter 1: Introduction

Humanity’s impact on the biosphere is far greater than at any point in human history, with anthropogenic effects inextricably linked to dominant modes of development reshaping the structure and function of entire earth systems (Barnosky et al., 2012; Ellis et al., 2010; Koppenjan et al., 2012; Steffen et al., 2011b). The situation presents decisive challenges to the conservation community (broadly defined) who now face environmental changes occurring at scales, rates, and levels of complexity that transcend the scientific and operational capacity of many conservation institutions (i.e. well-established constellations of conservation organizations, thought, and practice) (Hodgson et al., 2009; Jacobson and Robertson, in review; Loarie et al., 2009). Increasingly, insights from ecological sciences and coupled socio-ecological systems (SES) research indicate that—in light of today’s sweeping environmental changes—collaborative landscape-scale conservation approaches will be required to successfully conserve esteemed and ecologically vital components of the biosphere (Biermann et al., 2012; Blicharska and Mikusinski, 2011; Laven et al., 2005).

Socio-ecological resilience scholars posit that requisite shifts in conservation practice will entail fundamental changes in the way conservation organizations plan for and respond to environmental change (i.e. not just adapting current approaches), what is known in the field as a socio-ecological transformation (Chapin et al., 2010; Folke et al., 2009; Olsson et al., 2010). However, because institutions and powerful interests are often highly resistant to paradigmatic changes (e.g. shift from top-down jurisdictionally bounded conservation approaches to collaborative landscape-scale conservation model), it can be exceptionally difficult to realize transformations to more socially and environmentally sensible conditions (Duit and Galaz, 2008; Young et al., 2008). In view of this situation, there is a need for greater clarity about the role specific factors play in facilitating transformative changes in SES (Folke et al., 2010). Numerous studies have suggested that bridging organizations can play a facilitative role by creating social networks wherein knowledge co-production, trust.
building, sense making, social learning, vertical and horizontal collaboration, and conflict resolution can occur (e.g. Olsson 2004b; 2007; Hahn et al., 2006; Schultz 2007; 2009; 2010; 2011; Berkes 2005; 2009; Fabricius 2007; Walker et al., 2009). As argued below, however, eschewing of socio-economic/political dynamics and reliance on discursive/non-formalized methodological approaches are important limitations of previous bridging organizations research. This dissertation examines the Great Northern Landscape Conservation Cooperative (GNLCC)—a constituent of the US Department of the Interior’s (DOI) Landscape Conservation Cooperative (LCC) programme—in an effort to contribute to the resolution of these theoretical and methodological shortfalls while advancing understanding of a specific bridging organization.

1.1 Landscape Conservation Cooperatives as bridging organizations

The LCC programme was initiated September 14, 2009 through Secretarial Order 3289 (Appendix A) as part of the DOI’s response to conservation challenges related to landscape-scale stressors (e.g. habitat fragmentation and climate change) (DOI, 2012; Salazar, 2009). The LCC network is composed of 22 individual LCCs, which together cover the entirety of the Unites States and portions of Canada and Mexico (Figure 1). The geographic framework reflects recognition that contemporary environmental changes often affect entire ecosystems and landscapes and therefore transcend existing political/jurisdictional boundaries and single agency mandates (FWS, 2012a). Consequently, LCCs trace large ecologically meaningful terrestrial and aquatic systems wherein federal, state, tribal, non-governmental, and university-based organizations are coordinated by LCC staff to form public/private applied science/conservation partnerships (Austen, 2011; Millard et al., 2012). This ‘bridging’ role of LCCs—in conjunction with significant government financing and scientific/technological capacity—is central to how barriers to landscape-scale conservation are being addressed and overcome. Individual LCCs function as autonomous partnerships; however, organizational and administrative standards ensure programme-wide coherence and the ability to aggregate
regional insights for national/international conservation planning (FWS, 2012b). LCCs are not regulatory bodies and do not have the authority to supersede the jurisdiction/mandates of individual actors. Though a fairly new initiative, the LCC programme is indicative of a transformation in North American conservation, consistent with challenges posed by contemporary environmental changes.

Figure 1: National LCC network

1.2 Research questions, aims, and organization

Conducting a case study of an individual LCC—the GNLCC—provides an opportunity to closely examine a bridging organization’s attempt to facilitate transformation within a specific socio-ecological context. In particular, it provides a sufficiently well-defined SES wherein innovative conceptual and methodological approaches can be applied and where results of both scholarly and practical relevance can be obtained within a relatively short period. As such, this dissertation examines the questions: How and to what extent is the GNLCC in its role as a bridging organization facilitating a transformation towards tenable
landscape-scale conservation in the Great Northern region? The study aims i) to link complementary theoretical perspectives (socio-ecological resilience and political ecology) via a novel methodological approach (social network analysis (SNA) and institutional ethnography) to advance strategies for analysing bridging organizations and the networks they cultivate; ii) to use this interdisciplinary foundation to critically examine the GNLCC, the nature of relationships among actors in the social network being developed by the GNLCC, and how those relations may be improving or inhibiting the emergence of tenable landscape-scale conservation; and iii) to identify ways in which the GNLCC might improve its bridging efforts. The overarching objective of the study is to make a modest but salient contribution to socio-ecological resilience scholarship aimed at understanding factors that facilitate socio-ecological transformations.

This dissertation is comprised of six chapters. Following the Introduction, Chapter 2 provides a review of scholarly literature related to the subject matter considered in this dissertation. Consequential knowledge gaps are identified whereafter the study’s approach to addressing them is presented. Chapter 3 introduces the GNLCC case study. Chapter 4 details the methods used while Chapter 5 summarizes results and provides a comprehensive discussion of the study’s findings. A final chapter concludes.
Chapter 2: Literature Review

Assessing the role of the GNLCC in facilitating a transformation towards tenable landscape-scale conservation requires a sound understanding of key themes in relevant natural and social sciences as well as a cogent conceptual framework and methodological approach to examining its efforts. To establish this foundation, this chapter examines scholarly literature from the fields of ecology, socio-ecological resilience, political ecology, and SNA. The review also points up consequential knowledge gaps and sets out the study’s interdisciplinary approach to addressing them.

2.1 Non-equilibrium and landscape ecology

The justification for landscape-scale conservation has emerged as the corollary of a paradigmatic shift in ecological thinking whereby the classic Clementsian-inspired equilibrium understanding of ecosystems has been replaced by a more nuanced non-equilibrium model (Fiedler et al., 1997; Hobbs et al., 2010; Pickett et al., 2009; White et al., 2010). This view underpins the field of landscape ecology, which focuses on large spatial extents (i.e. interacting mosaics of ecosystems), spatial heterogeneity, and the influence of humans on landscape composition, structure, and function (Forman, 1995; White et al., 2010; Wu and Hobbs, 2002).

Non-equilibrium ecology points up the inherent dynamism and complexity of ecosystems and in particular the reality that diverse factors operating at multiple spatial and temporal scales have a significant effect on ecosystem characteristics (Fiedler et al., 1997; Mori, 2011; Pickett and White, 1985; Pressey et al., 2007; Wallington et al., 2005). In this view, ecological processes (e.g. disturbance regimes) interact with heterogeneous biotic and abiotic conditions (e.g. hierarchical patch dynamics) in unique, complex, and sometimes contingent ways (Bennett et al., 2009; Fraterrigo and Rusak, 2008; Kotliar and Wiens, 1990; Wallington et al., 2005). Importantly, anthropogenic influences (historically, today, and into the future) often alter these processes through, for example, the loss of top predators, the
spread of invasive species, livestock grazing, habitat degradation and fragmentation, air and water pollution, and climatic changes (Arno and Fiedler, 2005; De Poorter et al., 2007; Ehrlich and Ehrlich, 2008; Fischer and Lindenmayer, 2007; Fleischner, 2010; Goudie, 2006; IPCC, 2007; Lovett et al., 2009; Wright et al., 2011). These 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 (CBD, 2010; Lavergne et al., 2010).

Together, dynamic, complex, and often human influenced factors mean that ecosystems do not follow the linear, self-regulating, and deterministic succession model suggested by Clements (and others); instead they tend to follow stochastic, threshold dominated development trajectories where ecological outcomes are much less predictable (Hobbs et al., 2010). Consequently, the idea that ecosystems have intrinsic ‘natural’ states (i.e. stable end points of succession)—the idea upon which the North American conservation model (i.e. exclude ‘unnatural’ disturbances to protect ‘natural’ conditions) is premised—is no longer tenable (Cole et al., 2008; Hobbs et al., 2010; Sprugel, 1991).

With the goal of conserving ‘natural’ ecosystems scientifically outmoded (and its legacy of social injustice and limited success) (Gillison and Willis, 2004; Wallington et al., 2005), ecologists (and those in related fields such as conservation biology) have begun advocating conservation efforts aimed at the maintenance and/or recovery of ecological integrity (which is a characterization of ecosystems’ composition, structure, and function compared to historical ranges of variability) and, relatedly, ecological resilience (which is a characterization of ecosystems’ ability to handle stress without experiencing a fundamental loss of character or change in state) (Mori, 2011; Tierney et al., 2009; Woodley, 2010). Because these conditions are known to depend on dynamic and complex processes operating at multiple scales, there is a need for landscape-scale conservation efforts, which are attentive to dynamism and complexity across scales (Opdam and Wascher, 2004; Woodley, 2010).
However, as Laven et al. (2005) observe, the implementation of landscape-scale conservation will “require new strategies and innovative collaboration across disciplines and political and ecosystem boundaries” (p. 6). The interdisciplinary field of socio-ecological resilience has played an instrumental role in advancing understanding of these cross-cutting dimensions of human/environment relations.

2.2 *Socio-ecological resilience*

Socio-ecological resilience literature examines the interdependence of social and ecological systems; it is concerned with the structure and function of SES and how they experience and respond to processes of change (Folke, 2006; Holling, 1973; Resilience Alliance, 2010; Walker et al., 2004; Zavaleta and Chapin III, 2010). Socio-ecological resilience provides the core theoretical framework for this study. The field has its roots in non-equilibrium ecology and early social science research informed by the non-equilibrium paradigm (e.g. Holling, 1961, 1973; Lewontin, 1969; May, 1977; Vayda and McCay, 1975). More recent work has built upon this foundation; pointing up the ubiquitous impact humanity now has on the functioning of earth systems (e.g. Crutzen, 2002; Rockstrom et al., 2009; Steffen et al., 2011a). An important insight from this scholarship is awareness that SES (not just ecosystems) often exhibit thresholds (i.e. tipping points) separating potential system states (i.e. basins of attraction), which if transgressed lead to fundamentally different system characteristics (i.e. regime shifts) (Figure 2) (Folke et al., 2009; Gunderson and Holling, 2002; Lenton et al., 2008; Walker et al., 2004). Due to dynamic and complex socio-ecological factors, multiple basins of attraction can exist within a given socio-ecological context, as the stability landscape concept illustrates (Figure 3) (Folke et al., 2010; Walker et al., 2004).
Figure 2: Simplified model of multiple basins of attraction (valleys), tipping point (peak), and regime shift (ball movement). Based on Folke et al., 2009

Figure 3: Stability landscape showing multiple stable states within a given socio-ecological context. Based on Walker et al., 2004

With this premise as a backdrop, socio-ecological resilience literature revolves around three related concepts: resilience, adaptability (and vulnerability), and more recently transformability (Folke et al., 2010; Janssen and Ostrom, 2006). The common definition of resilience in the field (as introduced in Holling, 1973) is analogous to that used in ecology—the ability of SES to develop in ways that enable them to remain within existing basins of attraction (Folke et al., 2010). Adaptability refers to the capacity of a system to follow an existing development trajectory in the face of change and is therefore a constituent of a system’s resilience (Gallopin, 2006; Smit and Wandel, 2006). When adaptive capacity is insufficient, systems can be vulnerable to stressors and may experience undesirable regime shifts (Adger, 2006; Folke et al., 2004). The concept of transformability—the capacity to
create fundamentally new SES when existing systems become untenable (i.e. deliberately crossing a critical threshold into a more desirable basin of attraction)—has emerged from recognition that today’s unprecedented socio-ecological challenges sometimes exceed the adaptive capacity of SES (Gunderson and Holling, 2002; Kates et al., 2012; Olsson et al., 2010; Walker et al., 2004; Westley et al., 2011). Research on transformative change complements an emerging turn in socio-ecological resilience literature, which recognizes that traditional conceptions of resilience based on stability, recovery, and robustness are becoming antiquated in view of the novel stressors affecting present-day SES (Folke et al., 2010).

The concept of transformation requires clarity about two basic questions: transformation of what and transformation to what (informed by Carpenter et al., 2001)? Problems of institutional fit and path dependence—both of which undermine the capacity of systems to respond effectively to processes of change—provide useful criteria for identifying systems for which deliberate transformation may be advisable (Oberthür and Stokke, 2011; Young et al., 2008). Problems of fit are present when institutions that regulate SES operate in ways that undermine or are incompatible with spatially and temporally complex ecosystem dynamics (e.g. operations based on steady-state ecological thinking) (Cash et al., 2006; Folke et al., 2007; Galaz et al., 2006; Olsson et al., 2007). Path dependence exists when past system characteristics (e.g. institutional structures, norms, and goals) dictate future system directions, thereby limiting options for directed reorganization (Folke et al., 2009; Harris, 2011).

A large body of resilience literature examining characteristics of sound SES helps clarify the “transformation to what” question. With respect to conservation (and related environmental management) institutions, the objective of adaptive co-management—which advocates learning, collaboration, and multi-level governance—has been identified as a suitable approach to governing dynamic, complex, and evermore stressed SES (e.g. Armitage et al., 2009; Berkes, 2009; Olsson et al., 2004a; Olsson et al., 2007; Plummer and Armitage, 2007; Schultz et al., 2011). ‘Adaptive’ does not have the same connotations as above. In this
context it implies that conservation institutions do not assume optimal conservation outcomes *a priori*, rather they respond to (and learn from) changing and sometimes unpredictable socio-ecological conditions in ways that support the recovery and/or maintenance of ecological integrity and ecological resilience (Chapin III et al., 2010; Mori, 2011; Pressey et al., 2007; Wallington et al., 2005). As Berkes (2009) notes, co-management is often required to accomplish this objective because “knowledge for dealing with ecosystem dynamics…is dispersed among local, regional, and national agencies and groups [making] it difficult for any one group or agency to possess the full range of knowledge needed” (p. 1694). Adaptive co-management improves (in principle) the fit between institutions and complex ecological realities by combining the science-based principles of adaptive management with the coordination capacity of centralized structures and the learning capacity of distributed groups and organizations (Olsson et al., 2007; Schultz, 2009). Given clarity about transformation of what and to what (the details of which will always be context specific (Duit and Galaz, 2008; Folke et al., 2005)), means of facilitating transformation must be found.

Bridging organizations function as intermediaries between different knowledge systems and organizational levels, and, through supporting interaction among diverse groups of actors, providing forums wherein adaptive co-management arrangements can develop, mature, and catalyse (Figure 4). Bridging organizations are similar to boundary organizations (which traditionally focus on the translation of peripheral concepts at the interface of science and policy); however, bridging organizations are considered to have a broader and more formalized scope (Cash and Moser, 2000; Hahn et al., 2006). Because bridging organizations provide a pathway from situations of poor institutional fit to more tenable adaptive co-management arrangements (through bringing together different actors, building trust, shared vision, and goals, accessing and coordinating resources, and resolving conflicts (Berkes, 2009)), a growing body of socio-ecological resilience scholarship suggests that they may play a key facilitative role in socio-ecological transformations.
Figure 4: Simple conceptual model of a bridging organization – interaction (black arrows) of diverse actors (red shapes) facilitated through bridging organization (green circle), which, through trust building, conflict resolution, vision and goal setting, etc., enables development, maturation, and catalysis of adaptive co-management arrangement (blue circle).

A number of empirically grounded case studies of bridging organizations have been conducted by leading resilience scholars, including Schultz (2009; 2011; 2007; 2010), Olsson (2007; 2004b), Folke (in collaboration with others), Berkes (2005), Hahn (2006), and Fabricius (2007). Olsson et al.’s work (2007; 2004b) on the Ecomuseum Kristianstads Vattenrike bridging organization (which facilitated development of a successful adaptive co-management arrangement to oversee the lakes and wetlands of Kristianstads Vattenrike, Sweden), in particular, is widely cited and has been used to ground truth much theoretical work on the subject (e.g. Berkes, 2009; Folke et al., 2005; Walker et al., 2006). A commonality in all bridging organization research (theoretical and empirical) is that the development of vertically and horizontally interlinked social networks is a prerequisite for gleaning the benefits that bridging organizations can yield. However, save for recently published work by Rathwell and Peterson (2012), attempts to use formalized methods to understand the social networks cultivated by bridging organizations has been an important methodological omission. Also common in the bridging organizations literature is discussion of who is involved (or not) in the emergence of, and the networks developed by, bridging...
organizations. Though existing work succeeds in documenting and characterizing these dimensions, it too often fails to critically situate them (and their implications) in the context of existing socio-economic/political conditions. Consequently, understanding of why systems under stress resist transformation remains largely insufficient to inform corrective action.

These two shortfalls, which are observable across existing bridging organizations literature, pose theoretical and methodological impediments to understanding the role bridging organizations play in facilitating socio-ecological transformation. Therefore, the remainder of this chapter examines complementary literatures, which will be drawn upon in developing an innovative conceptual and methodological approach to examining the GNLCC.

2.3 Political Ecology

Political ecology is an interdisciplinary field (drawing especially on insights from geography, anthropology, political science, development studies, sociology, and environmental history) that endeavours to understand and reveal the socio-economic/political circumstances that influence relations between humans and the environment; it is a response to ‘apolitical’ socio-ecological narratives (Blaikie and Brookfield, 1987; Peet and Watts, 2004; Schmink and Wood, 1992). At the outset it is important to clarify that socio-ecological resilience literature is not entirely apolitical (e.g. Peterson, 2000), such a claim would be unfair and inaccurate. However, it is apparent that scholars in the field have a tendency to elide relevant socio-economic/political variables when explaining socio-ecological change (or lack thereof) (e.g. Walker et al., 2004). The author posits that this is because socio-ecological resilience explanations are firstly rooted in complexity theory/mathematical representations of system change (e.g. stability landscapes) (e.g. *ibid*), which do not easily accommodate the vagaries of power, culture, etc.

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1 There are of course additional critiques of the broader socio-ecological resilience literature within which bridging organizations work (as discussed in this dissertation) is situated, for example, that it is too focused on material ecological conditions at the expense of non-material socio-cultural considerations; that it deals too much in the realm of hard to operationalize and measure boundary objects; that its conceptualizations of system change are too deterministic; and that it is too focused on seeking factual principles vis-à-vis SES (e.g. Crane, 2012; Hornborg, 2009; Brand and Jax, 2007; Nadasdy, 2003).
Political ecology revolves around five dominant themes, as summarized in Table 1. This study draws on these themes to provide a more grounded explanation of transformative change in the Great Northern region.

Table 1: Five dominant themes in political ecology (based on Robbins, 2012)

<table>
<thead>
<tr>
<th>Theme</th>
<th>What is explained</th>
<th>Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degradation and marginalization</td>
<td>Environmental conditions (especially degradation) and reasons for change</td>
<td>Situates environmental degradation in larger socio-economic/political context</td>
</tr>
<tr>
<td>Conservation and control</td>
<td>Conservation outcomes (especially failures)</td>
<td>Shows that conservation is a normative pursuit with sometimes pernicious effects on subordinate/marginalized social groups</td>
</tr>
<tr>
<td>Environmental conflict and exclusion</td>
<td>Access to the environment and exclusion from it</td>
<td>Shows that environmental conflicts are often part of larger gender, class, and ethnic struggles</td>
</tr>
<tr>
<td>Environmental subjects and identity</td>
<td>Identities of people and social groups</td>
<td>Shows that political and social identities are linked to livelihood and environmental issues</td>
</tr>
<tr>
<td>Political objects</td>
<td>Socio-economic/political conditions (especially deeply structured ones)</td>
<td>Shows that environmental objects (e.g. climate) are entwined with socio-economic/political systems, making them inherently political</td>
</tr>
</tbody>
</table>

In the context of this study, insights regarding the existence and implications of divergence in cultural models vis-à-vis conservation goals (Atran et al., 2005), procedural justice issues related to conservation co-management (Adger et al., 2005; Blaikie, 2011), and the frequent dependence of conservation decisions and outcomes on influence, accepted knowledge, and material resources (Peet et al., 2011; Robbins, 2012), are particularly relevant. Brockington et al. (2008) expand on the first point, explaining that the term conservation “implies a unity of thought, values, and practice that is simply not there” (p.7). Consequently, it is unlikely that a largely western science-based conservation programme like the LCC is inclusive of society’s diverse conservation preferences. Procedural justice refers to the right to be included in processes that resolve disputes and allocate resources (Blaikie, 2011; Rawls, 1971). The concept is important when examining co-management arrangements, which often highlight cooperation while obscuring marginalization (Nadasdy, 2003; Adger et al., 2005). Clarity about why people/aspects of society are excluded (deliberately or
inadvertently) from co-management arrangements is as important as understanding who is included (ibid.). Finally, the dependence of conservation decisions and outcomes on influence, accepted knowledge, and material resources, suggest that deeply embedded power dynamics (not dispassionate scientific realities) are the overarching determinant of society’s (or more accurately powerful actors within society) response to environmental change (Foucault, 1977; Peet et al., 2011; Robbins, 2012). These insights demonstrate that there are ‘winners’ and ‘losers’ in processes of social and environmental change (O'Brien and Leichenko, 2003), a point that complicates the orderly state and transition model of transformation found in the socio-ecological resilience literature.

Political ecology is no panacea for understanding the complex dynamics of socio-ecological change (Ostrom et al., 2007); however, insights from the field do provide an important theoretical lens for examining socio-economic/political issues often missed in traditional socio-ecological resilience research. As such, political ecology is viewed herein as a complementary literature that can deepen understanding of the barriers to (e.g. path dependence) and implications of socio-ecological transformation.

2.4 A social relational approach/social network analysis

Recognition of the inherently relational nature of environmental governance in the foregoing discussion of bridging organizations and political ecology (e.g. networks and power) provides an entry point for a type of formal analysis rarely used to investigate these subjects (Prell et al., 2009); namely, SNA. A social relational approach—the theoretical framework that underpins SNA—seeks to “explain and shed light on human and system behaviours by investigating how patterns in social relations among actors within a system enable or constrain actors and processes” (Bodin et al., 2011 p. 7). The approach (informed especially by sociology and anthropology) is based on three main ideas: 1) social relations are often more important than individual attributes in explaining actor’s (e.g. individuals, organizations) attitudes, perspectives, and behaviours; 2) observed socio-economic/political
conditions are produced through the structure of relations among actors not aggregate individual actions; and 3) collective social relations lead to emergent properties, in particular, social structures (e.g. co-management arrangements) (Bodin et al., 2011; Emirbayer, 1997; Knoke and Yang, 2008; Schweizer, 1997; Wasserman and Faust, 1994). Importantly, a social relational approach helps collapse the agency/structure dichotomy that often divides research in the social sciences by taking as its referent related actors that give rise to emergent properties rather than individuals (e.g. rational unitary actors) or monolithic structures (e.g. ‘the state’) (Bodin et al., 2011; Borgatti et al., 2009).

Social networks (i.e. social relational structures) have been acknowledged as playing an important role in the success or failure of bridging organizations (i.e. collaborative approaches to improving interdependent socio-ecological conditions) (Folke et al., 2005). However, network analysis in most of this research has been limited to either a ‘binary metaphorical approach’ (i.e. identifying whether co-governance networks exist, for example *ibid.*) or a ‘descriptive approach’ (i.e. identifying the character of networks, for example Olsson et al., 2007) (Bodin et al., 2011). A social relational approach (as described herein) enables analysis to go further by providing the theoretical foundations for ‘structurally explicit’ network analysis methods (Bodin and Crona, 2009).

SNA refers to the formal study and representation of social entities (i.e. nodes), their relationships with other actors (i.e. ties), and the patterns and implications of these interactions (i.e. structural relations) (Wasserman and Faust, 1994); it is “guided by formal theory organized in mathematical terms…and grounded in the systematic analysis of empirical data” (Bodin et al., 2011 p. 10). The basic unit of analysis in SNA is the ‘dyad’, which refers to two nodes and the possible ties between them; specific types of ties (e.g. influence) are referred to as structural variables (Wasserman and Faust, 1994). Higher-level studies examine the more complex tie relations of triads, sub-groups, groups, and whole networks (*ibid.*). This study focuses on complete networks (i.e. all the ties among the actors in
a predefined network) and groups (i.e. a set of actors defined by common relational or attribute characteristics). Relationships among actors are interpreted using theories of structural relation and formal network measures; those utilized in this study are explained in Appendix E.

Though SNA has been used for a number of years to investigate substantive research questions (e.g. Borgatti and Cross, 2003; Leavitt, 1951; Nemeth and Smith, 1985), it is only beginning to be employed by socio-ecological resilience scholars (e.g. Bodin and Prell, 2011; Prell et al., 2009; Tindall et al., 2011). To the author’s knowledge only one other study has utilized it in the context of bridging organizations (i.e. Rathwell and Peterson, 2012). However, because SNA provides a way to formally analyse the relational dimensions of bridging organizations’ efforts, it appears to be a highly relevant methodological approach for productively linking literatures of interest to this study (consistent with broader observations by Folke, 2011). Though SNA enables investigation of research questions often difficult to unpack with more traditional methods, it like all research methods has important limitations. For example, SNA does not provide the contextual understanding needed to situate measured social relational structures and does not (yet) provide sufficient means of assessing temporal dynamism in networks. Therefore, SNA is most compelling when mixed with other methods, such as institutional ethnography (as detailed in Chapter 4).

As this chapter has outlined, this study measures the GNLCC’s landscape-scale conservation efforts in relation to contemporary insights in non-equilibrium and landscape ecology, situates its analysis within the socio-ecological resilience literature on transformational change and bridging organizations, and complements this foundation with critical perspectives from political ecology and methodological approaches from SNA. The study is a carefully considered interdisciplinary endeavour, which aims to simultaneously provide a cogent analysis of the GNLCC while addressing the need for more nuanced
conceptual and methodological approaches to the study of bridging organizations vis-à-vis socio-ecological relations and transformation.
Chapter 3: GNLCC Case Study

3.1 GNLCC socio-ecological context

The GNLCC is a 1,160,000 km² bi-national conservation region encompassing portions of interior British Columbia, southwest Alberta, eastern Washington, northeastern Oregon, northern Idaho, western Wyoming, western Montana, and minor areas of Utah and Colorado (Figure 5) (GNLCC, 2011e). It includes major rivers and their basins (e.g. Columbia, Missouri, Fraser), peaks and valleys of the Rocky Mountains, and the undulating hills of the Columbia Plateau. The region supports a multitude of species dependent on large tracts of intact habitat, including grizzly bear (*Ursus arctos horribilis*), grey wolf (*Canis lupus*), sage grouse (*Centrocercus urophasianus*), and cutthroat trout (*Oncorhynchus clarkii*) (GNLCC, 2012d; Mahr, 2007). Today’s GNLCC landscape is a physical manifestation and co-evolution of spatially and temporally diverse geomorphological activities, ecological processes, and human settlement, livelihood, and land management activities (informed by Balée, 2006).

![Figure 5: The Great Northern region](image)
Many of the most transformational changes in North American lands management were initiated in the region. Key examples include the establishment of Yellowstone National Park (1872 – 8,983 km²), widely held to be the world’s first National Park; the establishment of Waterton-Glacier International Peace Park (1932 – 4,556 km²), the first transboundary park established between Canada and the US; and the development of the Yellowstone to Yukon Conservation Initiative (1997 -1,300,000 km²), North America’s most significant landscape-scale, transboundary conservation programme prior to the LCC programme (Mahr, 2007; Nash, 2001; Tanner et al., 2007). Notwithstanding, the ‘fortress model’ of conservation epitomized by Yellowstone National Park, has been widely criticized as marginalizing ‘silent constituencies’ (i.e. former First Nations inhabitants) (Adams and Hutton, 2007; Robbins, 2006). And although Waterton-Glacier International Peace Park was a milestone in international conservation cooperation, its relatively small size predisposes it to a loss of ecological integrity and ecological resilience in the face of contemporary landscape-scale stressors (Scott et al., 2011). The Yellowstone to Yukon model is largely consistent with contemporary ecological insights; however, absent significant government participation, it lacks the buy-in and capacity needed to implement its vision. The GNLCC builds upon the region’s notable conservation legacy while ostensibly avoiding the now-recognized limitations of previous approaches.

3.2 Landscape-scale stressors

In the Great Northern region climate change is expected to, for example, change the temporal, thermal, and volumetric characteristics of discharge regimes (Shepherd et al., 2010); alter the frequency and intensity of fire regimes (Bowman et al., 2009); and initiate shifts in the distribution of terrestrial and aquatic species (Malanson et al., 2007). Examples of land-use changes of regional concern include, oil, gas, wind, and hydroelectric energy development, related infrastructure (e.g. transmission lines, dams, roads), and urban and exurban development (Hebblewhite, 2011; Theobald et al., 2011); changes that could
compound already significant habitat loss and fragmentation issues. Invasive organisms
significant at the landscape-scale such as cheat grass (Bromus tectorum) and whirling disease
(Myxobolus cerebralis) have been documented, with others expected to arrive as a result of
socio-ecological changes (Banks and Baker, 2011; Murcia et al., 2011). The interaction of
these stressors threatens to erode the already tenuous ecological integrity and ecological
resilience of the Great Northern region, with ancillary impacts on culturally important ‘First
Foods’ (e.g. mule deer (Odocoileus hemionus)) and resource dependent sectors of the regional
economy (GNLCC, 2011b; 2012d).

3.3 Conservation actors

A diverse community of federal, state, provincial, tribal, non-governmental, and
university-based conservation actors operate within the Great Northern region. In the US portion, federal agencies with some form of conservation responsibilities manage ~52% of the
total area (US Forest Service 34%, Bureau of Land Management 14%, National Parks Service
3%, Fish and Wildlife Service <1%; total federal land = 66% of region) (GNLCC, 2011e).
However, under the auspices of the North American Model of Wildlife Conservation, states
often view themselves as the primary shepherds of conservation issues, with reticence about
federal involvement sometimes evident (informed by Jacobson et al., 2010). Tribal groups are
today better represented in conservation planning at state and federal levels, yet sometimes-
significant epistemological differences and legacies of marginalization still affect these
interactions (informed by Bohnee et al., 2011). Non-governmental conservation groups are
pervasive, and work on a range of issues at a range of scales. University-based groups work
with various conservation actors and play an important role in conducting primary research
related to conservation in the Great Northern region. In Canada, non-governmental and native
group circumstances are broadly similar, however, federal and provincial conservation
programmes differ significantly from those in the US. For example, because provinces
manage ~95% of their land area (i.e. Crown Land) through integrated management plans
(with the federal government playing a relatively minor role), there are far fewer jurisdictional barriers to landscape-scale conservation (e.g. conflicting federal, state, and private priorities). For this reasons, the GNLCC is not as major an ideological shift for Canadian conservation actors. Despite the presence of many conservation organizations in the Great Northern region, the (former) absence of forums for inter-organizational interaction and collaboration on landscape-scale stressors has been a barrier to effective engagement with landscape-scale conservation challenges.

Given its scale, the socio-economic/political characteristics within the GNLCC are difficult to summarize. However, as a general rule population densities (and related direct ecological impacts) decrease with increasing latitude, livelihoods are often dependent on the natural environment (e.g. logging and ranching), and public/political support for conservation is perhaps less enthusiastic than that encountered in other bridging organization studies (i.e. most conducted in arguably more environmentally progressive European settings, for example Olsson et al., 2004b) (Mahr, 2007). Given the Great Northern region’s important ecological characteristics, significant landscape-scale threats, presently insufficient conservation situation, and challenging socio-economic/political context, it is a logical SES to study in relation to socio-ecological transformation. And because the GNLCC is one of the most active and well-organized LCCs, sufficient information is available to yield results of both scholarly and practical relevance. For these reasons the GNLCC is considered an appropriate and compelling case study.

3.4 GNLCC vision, mission, guiding principles, goals, and strategies

The GNLCC is an applied science/conservation partnership comprised of federal, state, provincial, tribal, non-governmental, and university-based conservation partners. Together, partners are working to “facilitate inter-jurisdictional, transboundary management of land, water, fish, wildlife, and cultural resources in response to landscape-level challenges such as climate change, land use change, and invasive species that impact the broadest
ecological scale” (GNLCC, 2012d p.1). The GNLCC’s vision for the Great Northern region is “A landscape that sustains its diverse natural systems to support healthy and connected populations of fish, wildlife, and plants; sustains traditional land uses and cultural history; and supports robust communities” (GNLCC, 2012d p. 2). The vision is explicit about the interdependence of the social and ecological dimensions of landscape scale conservation, consistent with core insights from socio-ecological resilience literature (though some of the wording (e.g. ‘natural’) could have been more carefully chosen). The organizational mission of the GNLCC is to effect coordination among conservation actors, support science development, inform conservation action at the landscape-scale, monitor and evaluate landscape-level conservation indicators, and communicate and educate about the importance of landscape-scale conservation (GNLCC, 2012b). In its operations, the GNLCC’s guiding principles are to (quote):

1. Work cooperatively and collaboratively to improve effectiveness of [partner] organizations’ large scale landscape conservation programmes and efforts

2. Conduct open and frequent communications within the GNLCC network, between related climate change and landscape programmes, and among the expanded climate change and landscape conservation community

3. Consider and respect each participating organizations unique mandates and jurisdictions

4. Coordinate with other committees, workgroups or organizations that add mutual value, maximize capacity, avoid redundancies, and leverage resources

5. Focus on solving scientific, ecological and biological issues to promote scientifically-sound, outcome-based adaptive [co-]management

6. Respect social, political and legal limitations while promoting solutions to landscape-level stressors that benefit the greater GNLCC conservation community

7. Be transparent in operations and ensure equal and open access (GNLCC, 2012b)

These principles clearly emphasize the bridging role of the GNLCC as well as the diplomatic but outcome driven approach of its organizational efforts.
The GNLCC has chosen to focus on landscape-scale stressors that fall under the broad headings of climate change, land-use change, and invasive species; they have proposed four specific conservation goals (quote):

1. Maintain large, intact landscapes of naturally functioning terrestrial and aquatic community assemblages

2. Conserve a permeable landscape with connectivity across aquatic and terrestrial ecosystems, including species movement, migration, dispersal, life history, and biophysical processes

3. Maintain hydrologic regimes that support native or desirable aquatic plant and animal communities in still and moving water systems

4. Promote landscape-scale disturbance regimes that operate within a future range of variability and sustain ecological integrity (GNLCC, 2012d p. 6-8)

These goals are commensurate with contemporary ecological understanding and (especially in the case of goal 4) are anticipatory of future environmental changes. Despite this, it is notable that the human dimensions of conservation have not been included in the wording (aside from implicit recognition of the normative dimensions of conservation, i.e. ‘desirable’ in goal 3).

3.5 GNLCC organizational structure

The GNLCC is a dynamic organization led by a Steering Committee, supported by an Advisory Team, informed by a Science Community, and supportive of a Partnership Community (Figure 6) (GNLCC, 2012c). The GNLCC has five dedicated staff (a Coordinator, Landscape Coordinator, two Science Coordinators, and a Canadian Coordinator) who initiated the development of these assemblages, facilitate coordination among them (and other relevant entities), and ensure that the organization’s structure and activities maintain coherence with the national LCC vision (ibid.). Per Secretarial Order 3289, US based LCC staff must be hired from DOI agencies; in the GNLCC the Fish and Wildlife Service (Coordinator and Science Coordinator), the National Parks Service (Landscape Coordinator), and the US Geological Survey (Science Coordinator) are represented. The Canadian Coordinator is staffed through the British Columbia Ministry of Forests, Lands and Natural
Resource Operations. GNLCC headquarters are based in Bozeman, Montana; however, there are satellite offices in Boise, Idaho, and Kamloops, British Columbia.

**Figure 6: GNLCC organizational structure**
Source: [http://greatnorthernlcc.org/overview](http://greatnorthernlcc.org/overview)

The Steering Committee is the main visioning and decision-making body of the GNLCC. It currently includes twenty-four executive-level representatives from land/natural resource management and conservation organizations in the Great Northern region; federal, state, provincial, tribal, and non-governmental groups are involved. Key functions of the Steering Committee are to (quote):

- Set the vision, goals and priorities for GNLCC
- Provide direction to the GNLCC Coordinators [i.e. indicate what is needed from GNLCC staff to engage and support regional conservation stakeholders in landscape-scale planning]
- Approve long-term strateg[ies] and operations
- Approve GNLCC capacity needs
- Approve funding for annual workplan[s] including priority setting process[es]
- Provide communication on GNLCC relevant organizational programmes and initiatives (GNLCC, 2012c p. 3)
All Steering Committee decisions are made through consensus, which is defined as no dissenting voices and at least 60% of Steering Committee vote participation (*ibid.*). The Steering Committee’s functions and decision making criteria point up the fact that although the GNLCC is part of a federally mandated conservation programme, visioning and programme direction are linked to regional conservation knowledge and needs.

The Advisory Team functions as the GNLCC’s ‘think tank’. It is led by the GNLCC Coordinators, is comprised of persons recommended by the Steering Committee, and works to develop foundational concepts, analyse landscape-scale conservation issues, draft technical documents, and provide specific recommendations to the Steering Committee (GNLCC, 2012c). A key Advisory Team output to date is the GNLCC’s Strategic Framework, which outlines specific regional conservation issues of concern and conservation goals and strategies (note: this is a ‘living document’ still undergoing revision) (as introduced in section 3.2).

The Science Community is comprised of various government, non-governmental, and university scientists; it represents the collective scientific capacity of the GNLCC (GNLCC, 2012c). The Science Community—through specialized working groups, panels, and committees—works to develop scientific frameworks for landscape-scale research and to deliver information on identified scientific needs (through GNLCC funded research) (*ibid.*). Key scientific partners for the GNLCC are the DOI’s Northwest and North Central Climate Science Centers, which “provide fundamental scientific information, tools, and techniques…to anticipate, monitor, and adapt to climate change impacts” (DOI, 2011 p. 3). The Science Community is rooted in the western scientific tradition, but is exploring how other ways of knowing (e.g. traditional ecological knowledge (TEK)) can complement its efforts.

The Partnership Community is comprised of a diverse group of conservation organizations and existing conservation partnerships within the GNLCC; it is organized into three overlapping Partner Forums: Rocky Mountain, Columbia Basin, and Sage-Steppe (the
creation of a Cascadia Partner Forum is being discussed) (GNLCC, 2011d). Partner Forums provide an opportunity for conservation practitioners (e.g. conservation groups and state agencies) working within an ecotypic region to collectively identify priority science and resource needs relevant to landscape-scale conservation (*ibid.*). Feedback from Partner Forums on the GNLCC’s progress and services is used to iteratively improve the GNLCC’s relevance to conservation partners working at the ground level (GNLCC, 2012c).

### 3.6 GNLCC operations

In April 2010 the first Steering Committee meeting was held in Bozeman; in December 2010 the GNLCC Governance Charter was adopted (GNLCC, 2011c). The GNLCC Coordinators, drawing on extensive experience and connections in the region, have played key leadership roles in operationalizing the GNLCC. To date, most effort has been put into developing a competent, representative, and committed Steering Committee; thirteen meetings in person or through teleconferences have been convened in pursuit of this goal.

Establishing the Advisory Team was also an early focal point and, with the Steering Committee and GNLCC staff, it has played a central role in the development of the GNLCC over the last two years. The Science Community remains somewhat undefined but nonetheless capable of responding to requests for science support (as measured by numerous research projects, which respond to identified information needs, see GNLCC, 2011a; 2012a). Operationalizing Partner Forums is a recent focus, with efforts to link the GNLCC’s emerging scientific and operational capacity to the needs of end users being recognized as an important next step. The GNLCC has been a fairly well funded federal initiative (i.e. $2,100,000/year) and since 2010 has provided $3,400,000 to thirty-four projects aimed at identifying and addressing landscape-scale conservation challenges (through primary research as well as training and logistical/networking support) (*ibid.*). Given that partners are dispersed across the Great Northern region, conference calls are a common basis of connecting and provide a regular forum for partner interaction.
In the following chapters, the GNLCC is referred to in two senses: 1) as a tangible bridging organization, its staff, operational capacity, and resources; and 2) more broadly as a multi-organization network of conservation actors within which GNLCC staff, operational capacity, and resources are embedded (i.e. GNLCC organization embedded within its four constitutive wings). These two senses are not mutually exclusive; the network is cultivated by the GNLCC (the organization) and the network informs the activities of the GNLCC (the organization). Importantly, the GNLCC (the organization) is not merely an aggregation of networks; its particular design features (as introduced in this chapter) matter to its success in cultivating an adaptive co-management response to landscape-scale stressors (informed by Dietz et al., 2003; Ostrom, 1990).
Chapter 4: Methods

To gather information about the contextually specific nature of the GNLCC’s efforts as a bridging organization, this study employed a mixed method approach utilizing qualitative and quantitative techniques. The approach aimed to glean the benefits of qualitative and quantitative assessment methods while minimizing the disadvantages of relying on either technique alone. A rapid institutional ethnography (~ six months of desk-based work (March 1, 2012 - August 20, 2012) and two-and-a-half weeks at GNLCC headquarters (July 2, 2012 – July 18, 2012)) was conducted to augment and inform the study’s SNA; these methods are described in turn whereafter analysis and data integration procedures are explained.

4.1 Rapid institutional ethnography

Institutional ethnography is a bottom up approach to social research whereby researchers study actors and institutional activities in everyday contexts (Smith, 2005). It is focused on the nature and implications of social relations, with an emphasis on the culturally, historically, and politically embedded qualities of coordinating activities (Grahame, 1998). Given the inherently subjective character of institutional ethnography, great care was taken to remain reflexive throughout the course of field- and desk-based research (informed by Massey, 2003; Walby, 2007). In this study, common institutional ethnography techniques were utilized to garner a contextualized understanding of the GNLCC and the network of conservation actors it is cultivating. As will become evident, these qualitative methods for ‘mapping social relations’ (Campbell and Gregor, 2002) dovetail nicely with quantitative SNA methods.

4.1.1 Content analysis

Content analysis involves the systematic review of tangible materials produced by or about an organization (in this case); it can provide useful insight into organizational activities, relations, and perspectives (Babbie, 2007). Content was first collected at a broad level, where all communications related to the LCC programme were sought and obtained (presumably).
This was accomplished by searching the websites of all involved organizations, scholarly search engines (Web of Science and Google Scholar), grey literature sources (e.g. news outlets, NGO websites), and mixed media outlets (e.g. YouTube) using key word searches. The same procedures were followed to gather content specific to the GNLCC; however, recovered GNLCC materials were also crosschecked with local staff to ensure that they were exhaustive. Recovered content (e.g. planning documents, meeting minutes, YouTube videos) were reviewed in relation to key principles in non-equilibrium/landscape ecology, theories of bridging organizations and transformative change, and the five dominant themes in political ecology. Consistency with, and deviation from, expected approaches (based on literature review) to landscape-scale conservation, bridging efforts, and transformative change were noted and used to identify topics for key informant interviews.

4.1.2 Key informant semi-structured interviews

Key information interviews, if carefully conducted and recorded, can enable detailed and sometimes unanticipated information about an organization and its operations to be obtained (DeVault and McCoy, 2006; Schensul et al., 1999). To enable good spatial and issue coverage, ‘key informants’ were classified as any person on GNLCC staff or an official member of the four constituent wings of the GNLCC (e.g. the Steering Committee). A semi-structured interview approach was utilized to support flexibility between investigation of known topics of interests (e.g. the GNLCC’s bridging activities) and topics emerging during discussion. A questionnaire was not utilized for semi-structured interviews; rather questions were tailored to each interviewee’s specific situation and position within the GNLCC network. Key points from interviews were recorded by hand during meetings, after which time detailed notes (i.e. key points plus reflection on discussion) were entered into an Excel spreadsheet. Information from key informant interviews—coupled with preexisting insights from an extensive literature review and compressive GNLCC/LCC content analysis—
provided the foundation needed to undertake informed observations of the GNLCC and its activities.

4.1.3 Participant observation

Observational approaches in institutional ethnography aim to achieve an intimate familiarity with social relations, actions, and coordination in a given context through researcher observation of organizational activities (Diamond, 2006). Given the receptiveness of GNLCC staff, there were numerous opportunities to observe the GNLCC’s inner workings. Almost daily engagement with GNLCC staff, attending numerous conference calls with partner organizations, and sitting in on official meetings (e.g. Steering Committee) provided occasions to closely examine the GNLCC in action (i.e. actively endeavouring to advance landscape-scale conservation). These activities also provided a means of crosschecking (and augmenting) information derived from key informant interviews.

4.2 Social network analysis

SNA is a quantitative method used to study social entities, their relationships with other actors, and the patterns and implications of these interactions (Wasserman and Faust, 1994). SNA was used in this study to rigorously and precisely assess the network of conservation actors the GNLCC is cultivating (and consequently the GNLCC’s role as a bridging organization). The Steering Committee (i.e. the federal, state, provincial, tribal, and non-governmental conservation groups that comprise the GNLCC’s most significant visioning and decision-making body) was selected as the study’s target population for practical and theoretical reasons. As a fairly new initiative, the GNLCC’s network development is relatively nascent (e.g. loosely demarcated Partner Forums), however, the Steering Committee is quite formalized and well defined. As well, Steering Committee organizations represent the most significant conservation actors in the region; they must be engaged and supportive for a transformation towards landscape-scale conservation to proceed. Therefore, examining relations between this group of actors (as facilitated by the GNLCC) is
logical, and consistent with theory regarding the role bridging organizations play in facilitating transformation. In selecting the SNA target population, careful consideration was given to the fact that system boundaries are never naturally given, that they imply the inclusion/exclusion of particular social, economic, political, and environmental factors (informed by Ulrich, 1993). Related points are returned to in Chapter 5.

4.2.1 Questionnaire content and development

A questionnaire—designed for each organization’s Steering Committee representative—was utilized to obtain data for the study’s SNA. In addition to general questionnaire development considerations (as outlined in e.g. Oppenheim, 2000), developing a SNA questionnaire required understanding of formal relational questioning approaches. To gain needed competence, key SNA methodological texts (e.g. Knoke and Yang, 2008; Prell, 2011; Wasserman and Faust, 1994) and previous studies employing SNA were carefully reviewed for guidance; interactions with SNA scholars at the Stockholm Resilience Centre and in the Departments of maths, statistics, and computing at the University of Oxford provided further guidance (the author also drew on questionnaire development experience/lessons learned from previous work in Arctic Canada and the Nepal Himalaya (see Ford and McDowell, in review; McDowell et al., 2012)). Given awareness that targeted respondents were mostly time-strained executive-level officials, an emphasis was placed on developing question structures that allowed the acquisition of requisite information while being simple and efficient to answer. Consequently, the questionnaire was comprised almost entirely of closed-choice questions, however, opportunities for respondents to include further information were provided where relevant. Respondents were asked to answer from the perspective of their organization, which, given respondents’ positions as leadership-level staff/members, was considered reasonable. The development of specific questions was based on a pre-fieldwork literature review, insights obtained through ethnographic methods, and topics of practical interest identified by GNLCC Coordinators. Five SNA specific themes
were identified as particularly relevant and were explored through a series of relation questions; investigation of tie direction and strength was included where relevant. More common non-relational questions were included to better situate relational data. The Questionnaire was piloted with GNLCC staff (see Appendix B for full questionnaire).

4.2.2 Study design and procedures

The aim of this study was to obtain responses from all twenty-four Steering Committee members (i.e. sample population = target population), with the organization being the unit of analysis. A personalized email containing a cover letter explaining the study, a consent form, and the questionnaire was sent to every Steering Committee member. Cognizant of potential anonymity concerns (e.g. respondents not wishing to be identified as sources of information about their organizations), information was decoupled from respondents’ names and instead attributed to their respective organization (per justification described in section 4.2.1). See Appendix B for full protocol.

4.3 Data analysis and interpretation

Qualitative information obtained using ethnographic methods was documented in Excel or saved in digital file folders (for content analysis materials); it was analysed for manifest and latent content. Data from non-relational questions were entered into Excel whereafter question-specific summary statistics and data visualizations were performed. Relational data (i.e. that used for SNA) was analysed using the software package UCINET (version 6.402). Networks were visualized using the SNA package NetDraw (version 2.120).

Actors were classified by affiliation: US federal agencies (blue), US state agencies (bright green), Canadian federal agencies (red), Canadian provincial agencies (dark aqua), tribal groups (yellow), NGOs (pink), and existing multi-organization partnerships (light grey). Qualitative information derived from the questionnaire’s open-ended response options was classified and analysed as per ethnography-based information. See Appendix B for full protocol.
Rapid institutional ethnography and SNA were treated as complementary methods, each with stand-alone benefits but together enabling a deeper and more precise investigation of the GNLCC’s role as a bridging organization. Ethnographically derived data provided a broad view, temporal perspective, and otherwise unattainable insight into the inner workings of the GNLCC; points that greatly improved interpretation of SNA results. SNA allowed precise analysis and visualization of the Steering Committee network (i.e. a co-management arrangement); it also provided another tool for interpreting socio-economic/political topics identified using ethnographic techniques. Results discussed in the following chapter (especially section 5.3.1 and 5.3.2) reflect this complementary approach to data integration, with qualitative and quantitative data woven together in ways that elucidate the key socio-ecological relations that are the subject of this study.
Chapter 5: Results and Discussion

5.1 Research outcomes

This study conducted a rapid institutional ethnography and SNA to understand how and to what extent the GNLCC is facilitating a transformation towards tenable landscape-scale conservation in the Great Northern region. The rapid institutional ethnography was able to obtain good access to key information, participants, and events. Appendix C provides a numerical summary of the study’s rapid institutional ethnography (as well as a key informant citation guide); specific insights are revealed in forthcoming sections.

The Steering Committee questionnaire, which sought data for the SNA (as well as more standard non-relational information), obtained a response rate of 75% (18 of 24). Though the response rate is considered quite good given the sample population, any sub-100% response rate for a full network SNA implies that results can only be indicative of social entities’ relationships with other actors and the patterns and implications of these interactions (because some relations are not accounted for). Notwithstanding, because responses were obtained from organizations of all key affiliation types (i.e. US federal agencies (6), US state agencies (3), Canadian federal agencies (2), Canadian provincial agencies (2), tribal groups (1), NGOs (2), and existing multi-organization partnerships (2)) in relative proportion to actual participation in the full Steering Committee, and because a numerical goodness of fit test revealed no significant differences in network measures between an interpolated full network and a sample network (see Hanneman and Riddle, 2005 for technical discussion), data obtained is considered a good proxy for the full Steering Committee. Participating organizations’ core conservation foci were reported as fish and wildlife (56%), science development (39%), multi-use management (33%), climate change or other landscape scale stressors (22%), and cultural resources (11%), respectively. Together, respondents from these organizations represent a combined 341 years of conservation experience within the Great Northern region. Appendix C provides a list of all Steering
Committee organizations, acronyms for use in later data interpretation, and indication of which organizations responded to the Steering Committee questionnaire.

5.2 Social network analysis results

SNA was used to analyse five themes: 1) inter-organizational interaction on issues related to landscape-scale stressors (this captures the overarching social network through which other interactions and exchanges are facilitated and/or operate); 2) inter-organizational information seeking on issues related to landscape-scale stressors; 3) inter-organizational provisioning of funding or other tangible resources for work on landscape-scale stressors; 4) inter-organizational influence in relation to landscape-scale stressors and 5) the inter-organizational distribution of work on issues identified as landscape-scale conservation priorities. This section presents the results of SNA on these themes (Tables 2 - 6) as well as accompanying network visualizations (Figures 7 - 11). Full summary statistics for non-relational questions are presented in Appendix D. Exploratory counterfactual SNA (i.e. SNA of themes with GNLCC removed) was also conducted; these results will appear in Section 5.3.2. Appendix E explains the network measures presented in the following tables and will be a useful reference for the reader in the discussion to follow. Three of these measures are previewed below:

- Density (network level): The percentage of actual ties relative to all possible ties. Gives insight into phenomena such as the speed at which, e.g. information diffuses through a network.

- Centrality (node level): ‘In degree’ is a measure of how many ties are received by a node. ‘Out degree’ is a measure of how many ties originate from a node. In degree provides an indication of a node’s prestige, out degree provides an indication of a node’s influence.

- Betweenness (node level): A measure of whether or not a node lies on the shortest path between two other nodes. It provides an indication of the degree to which a node is a broker of, e.g. information.
**Table 2: Inter-organizational interaction on issues related to landscape-scale stressors**

**Question asked**: Which of the following organizations does your organization interact with directly on issues related to landscape-scale stressors?

| # of nodes | 19 |

<table>
<thead>
<tr>
<th><strong>Nodes by group</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian Gov. Provincial</td>
<td>2</td>
</tr>
<tr>
<td>Canadian Gov. Federal</td>
<td>2</td>
</tr>
<tr>
<td>Multi-agency Partnership</td>
<td>2</td>
</tr>
<tr>
<td>Tribal, US</td>
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</tr>
<tr>
<td>NGO</td>
<td>2</td>
</tr>
<tr>
<td>US Gov. Federal</td>
<td>7</td>
</tr>
<tr>
<td>US Gov. State</td>
<td>3</td>
</tr>
</tbody>
</table>

| **Types of relations measured** | Directional; weighted |

<table>
<thead>
<tr>
<th><strong>Density (network)</strong></th>
<th>Density (%)</th>
<th>Number of ties</th>
<th>Average ties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>66.7</td>
<td>228</td>
<td>12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Density (groups)</strong></th>
<th>Density (%)</th>
<th>Number of ties</th>
<th>Average ties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian Gov. Provincial</td>
<td>100</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Canadian Gov. Federal</td>
<td>100</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Multi-agency Partnership</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tribal, US</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NGO</td>
<td>50</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>US Gov. Federal</td>
<td>78.6</td>
<td>33</td>
<td>4.71</td>
</tr>
<tr>
<td>US Gov. State</td>
<td>100</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Density (groups weighted)</strong></th>
<th>Density (sum of weights/possible ties)</th>
<th>Sum of weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian Gov. Provincial</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Canadian Gov. Federal</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Multi-agency Partnership</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tribal, US</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NGO</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>US Gov. Federal</td>
<td>1.48</td>
<td>62</td>
</tr>
<tr>
<td>US Gov. State</td>
<td>1.67</td>
<td>10</td>
</tr>
</tbody>
</table>

| **Connectivity (min. point connectivity)** | 4 |

<table>
<thead>
<tr>
<th><strong>Centrality (network) (Freemans’s)</strong></th>
<th>Centrality (%)</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out degree</td>
<td>37.26</td>
<td>12</td>
<td>4.68</td>
</tr>
<tr>
<td>In degree</td>
<td>31.05</td>
<td>12</td>
<td>2.75</td>
</tr>
</tbody>
</table>

<p>| <strong>Centrality (node level) (Freemans’s)</strong> |  |
| Out degree (top 3 orgs. and score) | GNLC (18) | AESRD (18) | CTUIR (18) |
| Out degree (bottom 3 orgs. and score) | NOAA (5) | NRCS (5) | WNPC (4) |
| In degree (top 3 orgs. and score) | GNLC (17) | USGS (16) | NPS (16) |
| In degree (bottom 3 orgs. and score) | CTUIR (8) | AESRD (8) | HRI (9) |</p>
<table>
<thead>
<tr>
<th>Betweeness (network) (node based)</th>
<th>Centralization index (%)</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5.61</td>
<td>6</td>
</tr>
<tr>
<td><strong>Betweeness (node level) (node based)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top 3 orgs. and score</td>
<td>GNLCC (22.26)</td>
<td>NPS (20.3)</td>
<td>USGS (11.36)</td>
</tr>
<tr>
<td>Bottom 3 orgs. and score</td>
<td>WNPC (0.64)</td>
<td>NOAA (0.56)</td>
<td>WGF (0.43)</td>
</tr>
<tr>
<td><strong>Distance (geodesic)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Link distance</td>
<td>Frequency (%)</td>
<td>Average distance</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>228</td>
<td>66.7</td>
<td>1.3</td>
</tr>
<tr>
<td>2</td>
<td>114</td>
<td>33.3</td>
<td></td>
</tr>
<tr>
<td><strong>Reciprocity (hybrid)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reciprocated ties (%)</td>
<td></td>
<td>55.1</td>
<td></td>
</tr>
<tr>
<td><strong>Clustering</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network clustering (%)</td>
<td></td>
<td>71%</td>
<td></td>
</tr>
<tr>
<td><strong>Hierarchy (Krackhardt GTD Measures)</strong></td>
<td>Connectedness</td>
<td>Hierarchy</td>
<td>Efficiency</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0.16</td>
<td>1</td>
</tr>
<tr>
<td><strong>Factions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faction 1</td>
<td>CWSEC, WNPC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faction 2</td>
<td>APD, AESRD, CBFC, CTUIR, HRI, GNLCC, IWJV, MFWP, NOAA, NPS, NRCS, USFWSP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goodness of fit</td>
<td></td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td><strong>Cut points</strong></td>
<td></td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 7:** Visualization of inter-organizational interaction on issues related to landscape-scale stressors. Interpretation: Black ties = less than five interactions per year; blue ties = five or more interactions. Organizations with shorter geodesic distance (i.e. greater similarity in their interaction characteristics) are located closer in space.
<table>
<thead>
<tr>
<th>Question asked</th>
<th>From which of the following organizations does your organization directly obtain information about landscape-scale stressors?</th>
</tr>
</thead>
<tbody>
<tr>
<td># of nodes</td>
<td>17</td>
</tr>
<tr>
<td>Nodes by group</td>
<td></td>
</tr>
<tr>
<td>Canadian Gov. Provincial</td>
<td>2</td>
</tr>
<tr>
<td>Canadian Gov. Federal</td>
<td>2</td>
</tr>
<tr>
<td>Multi-agency Partnership</td>
<td>2</td>
</tr>
<tr>
<td>Tribal, US</td>
<td>1</td>
</tr>
<tr>
<td>NGO</td>
<td>2</td>
</tr>
<tr>
<td>US Gov. Federal</td>
<td>5</td>
</tr>
<tr>
<td>US Gov. State</td>
<td>3</td>
</tr>
<tr>
<td>Types of relations measured</td>
<td>Directional</td>
</tr>
<tr>
<td>Density (network)</td>
<td>Density (%)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>36.8</td>
<td>100</td>
</tr>
<tr>
<td>Density (groups)</td>
<td>Density (%)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Canadian Gov. Provincial</td>
<td>100</td>
</tr>
<tr>
<td>Canadian Gov. Federal</td>
<td>50</td>
</tr>
<tr>
<td>Multi-agency Partnership</td>
<td>0</td>
</tr>
<tr>
<td>Tribal, US</td>
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<tr>
<td>NGO</td>
<td>0</td>
</tr>
<tr>
<td>US Gov. Federal</td>
<td>65</td>
</tr>
<tr>
<td>US Gov. State</td>
<td>100</td>
</tr>
<tr>
<td>Density (groups weighted)</td>
<td>N/A</td>
</tr>
<tr>
<td>Connectivity (min. point connectivity)</td>
<td>1</td>
</tr>
<tr>
<td>Centrality (network) (Freemans’s)</td>
<td>Centrality (%)</td>
</tr>
<tr>
<td>Out degree</td>
<td>71.67</td>
</tr>
<tr>
<td>In degree</td>
<td>50.42</td>
</tr>
<tr>
<td>Centrality (node level) (Freemans’s)</td>
<td></td>
</tr>
<tr>
<td>Out degree (top 3 orgs. and score)</td>
<td>GNLCC (16)</td>
</tr>
<tr>
<td>Out degree (bottom 3 orgs. and score)</td>
<td>CWSEC (2)</td>
</tr>
<tr>
<td>In degree (top 3 orgs. and score)</td>
<td>GNLCC (13)</td>
</tr>
<tr>
<td>In degree (bottom 3 orgs. and score)</td>
<td>WCS (4)</td>
</tr>
<tr>
<td>Betweenness (network) (node based)</td>
<td>Centralization index (%)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>36.43</td>
<td>9.94</td>
</tr>
</tbody>
</table>
### Betweeness (node level) (node based)

<table>
<thead>
<tr>
<th>Top 3 orgs. and score</th>
<th>GNLCC (92.23)</th>
<th>USGS (18.98)</th>
<th>IWJV (14.74)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom 3 orgs. and score</td>
<td>CBFC (0)</td>
<td>WCS (0)</td>
<td>CTUIR (0)</td>
</tr>
</tbody>
</table>

### Distance (geodesic)

<table>
<thead>
<tr>
<th>Link distance</th>
<th>Frequency</th>
<th>(%)</th>
<th>Average distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>143</td>
<td>53</td>
<td>1.8</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

### Reciprocity (hybrid)

| Reciprocated ties (%) | 42.9 |

### Clustering

| Network clustering (%) | 54.3 |

### Hierarchy (Krackhardt GTD Measures)

<table>
<thead>
<tr>
<th>Connectedness</th>
<th>Hierarchy</th>
<th>Efficiency</th>
<th>LUB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.12</td>
<td>0.55</td>
<td>1</td>
</tr>
</tbody>
</table>

### Factions

**Faction 1**
- HRI, GNLCC, IWJV, MFWP, NPS, NRCS, USFWSP, USGS, WDFW, WCS, WGF

**Faction 2**
- APD, AESRD, CWSEC, CBFC, CTUIR, WNPC

### Goodness of fit

| 0.65 |

### Cut points

| 0    |

**Figure 8:** Visualization of inter-organizational information seeking on issues related to landscape-scale stressors. Interpretation: Organizations with shorter geodesic distance (i.e. greater similarity in their information seeking characteristics) are located closer in space. Arrows indicate the direction of information seeking.
Table 4: Inter-organizational provisioning of funding or other tangible resources for work on landscape-scale stressors

<table>
<thead>
<tr>
<th>Question asked</th>
<th>Which of the following organizations have provided funding or other tangible resources to assist your organization’s work on landscape-scale stressors?</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th># of nodes</th>
<th>17</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Nodes by group</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian Gov. Provincial</td>
<td>2</td>
</tr>
<tr>
<td>Canadian Gov. Federal</td>
<td>2</td>
</tr>
<tr>
<td>Multi-agency Partnership</td>
<td>2</td>
</tr>
<tr>
<td>Tribal, US</td>
<td>1</td>
</tr>
<tr>
<td>NGO</td>
<td>2</td>
</tr>
<tr>
<td>US Gov. Federal</td>
<td>5</td>
</tr>
<tr>
<td>US Gov. State</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Types of relations measured</th>
<th>Directed</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Density (network)</th>
<th>Density (%)</th>
<th>Number of ties</th>
<th>Average ties</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.3</td>
<td>47</td>
<td>2.77</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Density (groups)</th>
<th>Density (%)</th>
<th>Number of ties</th>
<th>Average ties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian Gov. Provincial</td>
<td>100</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Canadian Gov. Federal</td>
<td>100</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Multi-agency Partnership</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tribal, US</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NGO</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>US Gov. Federal</td>
<td>20</td>
<td>4</td>
<td>0.8</td>
</tr>
<tr>
<td>US Gov. State</td>
<td>50</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Density (groups weighted)</th>
<th>N/A</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Connectivity (min. point connectivity)</th>
<th>0</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Centrality (network) (Freemans’s)</th>
<th>Centrality (%)</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out degree</td>
<td>65.4</td>
<td>2.77</td>
<td>2.86</td>
</tr>
<tr>
<td>In degree</td>
<td>51.3</td>
<td>2.77</td>
<td>2.49</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Centrality (node level) (Freemans’s)</th>
<th>Note: out = providing funding, in = receiving funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out degree (top 3 orgs. and score)</td>
<td>GNLCC (12)</td>
</tr>
<tr>
<td>Out degree (bottom 3 orgs. and score)</td>
<td>AESRD (0)</td>
</tr>
<tr>
<td>In degree (top 3 orgs. and score)</td>
<td>IWJV (10)</td>
</tr>
<tr>
<td>In degree (bottom 3 orgs. and score)</td>
<td>CBFC (0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Betweenness (network) (node based)</th>
<th>Centralization index (%)</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.46</td>
<td>10.29</td>
<td>17.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Betweenness (node level) (node based)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Top 3 orgs. and score</td>
<td>IWJV (56.5)</td>
</tr>
<tr>
<td>Bottom 3 orgs. and score</td>
<td>WNPC (0)</td>
</tr>
</tbody>
</table>
### Distance (geodesic)
- **Link distance**
- **Frequency (%)**
- **Average distance**

<table>
<thead>
<tr>
<th>Distance</th>
<th>Frequency</th>
<th>Average distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>47</td>
<td>17.3</td>
</tr>
<tr>
<td>2</td>
<td>41</td>
<td>15.1</td>
</tr>
<tr>
<td>3</td>
<td>27</td>
<td>9.9</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>5.9</td>
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<tr>
<td>5</td>
<td>8</td>
<td>2.9</td>
</tr>
<tr>
<td>6</td>
<td>133</td>
<td>48.9</td>
</tr>
</tbody>
</table>

### Reciprocity (hybrid)
- **Reciprocated ties (%)**

| Reciprocated ties (%) | 11.9 |

### Clustering
- **Network clustering (%)**

| Network clustering (%) | 32 |

### Hierarchy (Krackhardt GTD Measures)
- **Connectedness**
- **Hierarchy**
- **Efficiency**
- **LUB**

<table>
<thead>
<tr>
<th>Connectedness</th>
<th>Hierarchy</th>
<th>Efficiency</th>
<th>LUB</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.88</td>
<td>0.65</td>
<td>0.74</td>
<td>0.86</td>
</tr>
</tbody>
</table>

### Factions
- **Faction 1**
  - APD, AESRD, CBFC, CTUIR, NPS, WNPC, WCS
- **Faction 2**
  - CWSEC, HRI, GNLCC, IWJV, MFWP, NRCS, USFWSP, USGS, WDFW, WGF
- **Goodness of fit**
  - 0.53

### Cut points
- 0

---

**Figure 9:** Visualization of inter-organizational provisioning of funding or other tangible resources for work on landscape-scale stressors. Interpretation: Organizations with shorter geodesic distance (i.e. greater similarity in their resource provisioning characteristics) are located closer in space. Arrows indicate the direction of resource provisioning (note that CBFC is an isolate = no ties).
Table 5: Inter-organizational influence in relation to landscape-scale stressors

<table>
<thead>
<tr>
<th>Question asked</th>
<th>Which of the following organizations have directly influenced your organization’s perspective on landscape-scale stressors?</th>
</tr>
</thead>
<tbody>
<tr>
<td># of nodes</td>
<td>17</td>
</tr>
<tr>
<td>Nodes by group</td>
<td></td>
</tr>
<tr>
<td>Canadian Gov. Provincial</td>
<td>2</td>
</tr>
<tr>
<td>Canadian Gov. Federal</td>
<td>2</td>
</tr>
<tr>
<td>Multi-agency Partnership</td>
<td>2</td>
</tr>
<tr>
<td>Tribal, US</td>
<td>1</td>
</tr>
<tr>
<td>NGO</td>
<td>2</td>
</tr>
<tr>
<td>US Gov. Federal</td>
<td>5</td>
</tr>
<tr>
<td>US Gov. State</td>
<td>3</td>
</tr>
<tr>
<td>Types of relations measured</td>
<td>Directional; weighted</td>
</tr>
<tr>
<td>Density (network)</td>
<td></td>
</tr>
<tr>
<td>Density (%)</td>
<td>Number of ties</td>
</tr>
<tr>
<td>39.7</td>
<td>108</td>
</tr>
<tr>
<td>Density (groups)</td>
<td></td>
</tr>
<tr>
<td>Density (%)</td>
<td>Number of ties</td>
</tr>
<tr>
<td>Canadian Gov. Provincial</td>
<td>100</td>
</tr>
<tr>
<td>Canadian Gov. Federal</td>
<td>50</td>
</tr>
<tr>
<td>Multi-agency Partnership</td>
<td>0</td>
</tr>
<tr>
<td>Tribal, US</td>
<td>0</td>
</tr>
<tr>
<td>NGO</td>
<td>50</td>
</tr>
<tr>
<td>US Gov. Federal</td>
<td>5</td>
</tr>
<tr>
<td>US Gov. State</td>
<td>33</td>
</tr>
<tr>
<td>Density (groups weighted)</td>
<td></td>
</tr>
<tr>
<td>Density (sum of weights/possible ties)</td>
<td>Sum of weights</td>
</tr>
<tr>
<td>Canadian Gov. Provincial</td>
<td>2.5</td>
</tr>
<tr>
<td>Canadian Gov. Federal</td>
<td>1</td>
</tr>
<tr>
<td>Multi-agency Partnership</td>
<td>0</td>
</tr>
<tr>
<td>Tribal, US</td>
<td>0</td>
</tr>
<tr>
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<td>0.5</td>
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</tr>
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**Figure 10:** Visualization of inter-organizational influence in relation to landscape-scale stressors. Interpretation: Black ties = weak influence; blue ties = moderate influence; orange ties = strong influence. Organizations with shorter geodesic distance (i.e. greater similarity in their influence characteristics) are located closer in space. Arrows indicate the direction of influence.
Table 6: Inter-organizational distribution of work on landscape-scale conservation priorities

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<th>Question Asked</th>
<th>Which of the following issues does your organization work on?</th>
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<tr>
<td>Ecosystem restoration</td>
<td>Ecosy</td>
</tr>
<tr>
<td>Fish and wildlife response to climate change</td>
<td>Fish</td>
</tr>
<tr>
<td>Forest resilience</td>
<td>Fores</td>
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<tr>
<td>Geological carbon sequestration</td>
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<td>Glacier retreat</td>
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<td>Invasive species</td>
<td>Invas</td>
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<td>Native</td>
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<tr>
<td>Protection of Trust Species</td>
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<tr>
<td>Water availability and quality for humans and ecosystems</td>
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Issue based two-mode factions

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Density Matrix

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5.3 The GNLCC’s role in facilitating transformation

This study contends that the LCC programme is indicative of a transformation in North American conservation, consistent with challenges posed by contemporary environmental change. As shown in Chapter 3, the GNLCC represents a significant departure from preceding conservation strategies in the Great Northern region, being designed as an adaptive and collaborative response to complex socio-ecological realities and challenges. But this broad view—identifying the presence of an emerging adaptive co-management arrangement (which would be analogous to concluding points in much preceding bridging organizations research)—is insufficient to inform practical actions and is perhaps no longer
germane to the advancement of scholarly understanding of the role bridging organizations play in facilitating transformation. In response, the following two sections unpack exactly ‘how’ the GNLCC is facilitating transformation as well as the ‘extent’ to which its actions are tipping conservation towards more ecologically and socially tenable conditions.

Before proceeding, however, it is necessary to interrogate the fact that the GNLCC is a federally led approach to landscape-scale conservation. For example, it can be argued that the GNLCC is consistent with what Miller and Rose (1990) call ‘government at a distance’. In this view governments, through “calculations at one place and actions in another”, discretely produce ‘environmental subjects’ modelled in the image of premeditated government preferences (via funding criteria, etc.) (Agrawal, 2005 p. 178). This criticism—consistent with the conservation and control theme in political ecology—suggests that the GNLCC’s network building could be a government vehicle for bringing conservation actors into line with government land management preferences (as opposed to promoting genuine adaptive co-management) (Robbins, 2012; Thornton, 2002). Though elements of this seem evident in the forthcoming discussion, in general terms regional conservation actors refuted this interpretation by indicating that the GNLCC was a forthcoming organization and a welcome development (i.e. federal government finally attempting to do socially and ecologically tenable conservation) (e.g. key informants G, July 16, 2012; H, August 27, 2012; J, July 5, 2012). Thus, though the GNLCC plays a lead role in facilitating socio-ecological transformation, it is not perceived as a nefarious organization.

5.3.1 How transformation is being facilitated

Federal support has given the GNLCC access to the scientific, financial, and technological capacity needed to operate at spatial scales previously unapproachable by conservation organizations in the region. Building from this foundation, the GNLCC has utilized the ‘window of opportunity’ (Folke et al., 2010) created by cross-cutting concern over climate change to justify regional action on landscape-scale stressors (an approach inherited
from Secretarial Order 3289). Because climate change is such a far-reaching issue, utilizing it as a central narrative has provided programme cohesion and a heuristic framework to initiate discussions about additional, often related, landscape-scale stressors. Climate change has also provided an effective impetus for advocating transboundary collaboration because political and institutional boundaries must be transcended to effectively respond to climate change. Importantly, the GNLCC highlights the ecological and human dimensions of landscape-scale stressors, a notable departure from lands management grounded primarily in the natural sciences. Thus, the GNLCC has used federal support and a common theme to strategically open a door to hitherto insufficiently considered regional conservation issues (including climate change itself) (key informant B, July 16, 2012).

Another major reason the GNLCC is taking root is its departure from exclusive, top-down, command and control approaches to environmental management. Actively inviting actors of diverse affiliation types (including Canadian organizations and tribal groups) to participate in landscape-scale planning (e.g. participation in Steering Committee) has had the effect of building trust and interest in the GNLCC (key informant J, July 5, 2012). Perhaps most significantly, the GNLCC (through its four constitutive wings) provides a forum for discussing landscape-scale stressors and developing shared norms for understanding and addressing them (details below). In this role it is consequential that the GNLCC is a non-regulatory organization. The author posits that the GNLCC’s lack of regulatory capability increases participation, namely because the organization is not perceived as a (major) threat to the autonomy of conservation actors (informed by discussions with key informants B, July 3, 2012 and C, July 16, 2012).

It is evident that the work of GNLCC staff is facilitating high levels of contact among Steering Committee organizations (GNLCC node level betweeness score = 22.26), leading to the development of an identifiable network of inter-organizational interaction (network density = 66.7%) (Table 2). This network is quite robust and closely knit, with good levels of
connectivity (4), no cut points (0), and a maximum link distance of 2 (1 = 66.7%, 2 = 33.3%) (Table 2). Development of this overarching social network has provided the basis from which the GNLCC can inform and support collaborative landscape-scale conservation (key informants B, July 3, 2012 and H, August 27, 2012). In practice, it was observed that inter-organizational interaction, via conference calls and in-person meetings, is an essential component of how organizations work on landscape-scale stressors.

The GNLCC, alone and through the aforementioned network, is improving access to information on landscape-scale stressors (GNLCC node level betweeness = 92.23; network density = 36.8%) (Table 3), an important activity given that time constraints (89%) and lack of expertise (17%) were identified by questionnaire respondents as barriers to organizational action on landscape-scale stressors. As a stand-alone organization, the GNLCC is a recognized storehouse of information on regional landscape-scale stressors (GNLCC node level centrality in degree = 13); via the network of actors it has cultivated, it reduces transaction costs for inter-organizational information sharing (e.g. data, expertise, lessons learned) (average link distance 1.8; 90% of connections no more than 2 links away) (Table 3). In a related manner, the GNLCC helps to improve organizations’ scientific capacity. The GNLCC compiles relevant scientific information and provides data and assistance when requested (key informant E, July 3, 2012); its social network provides a forum for pooling organizations’ individual science capacity and organizing collaborative research (key informants B, July 16, 2012 and D, July 17, 2012).

Limited financial capability (exacerbated by present-day budgetary contraction trends) was cited by 61% of questionnaire respondents as a barrier to their organization’s work on landscape-scale stressors. In response, the GNLCC provides funding and other material resources as an additional mechanism to facilitate transformation (GNLCC node level centrality out degree = 12) (Table 4). Funding figures are presented in Chapter 3. Moreover, its social network provides a setting wherein conservation actors can identify shared funding
needs and more efficiently allocate resources to address landscape-scale stressors (key informant B, July 3, 2012), as observed in Steering Committee and Partner Forum conference calls. The seemingly low density of the funding network (17.3%) should not mislead; the GNLCC has facilitated the development of a network with 47 funding relationships (among 17 organizations, $\bar{x} \sim 3$ each) directly related to landscape-scale stressors (Table 4).

Through purposeful but modest leadership, the GNLCC is establishing itself as a prominent conservation actor in the Great Northern region (GNLCC node level in degree = 12) (Table 5). However, GNLCC staff recognize that they alone cannot effectively bridge diverse epistemologies, issues-specific programmes, and political impediments (key informants B, July 3, 2012; D, July 17, 2012; F, July 16, 2012). Rather, a transformation towards tenable landscape-scale conservation requires the development of shared norms (even if discordant) by and among regional conservation actors (informed by Gregory, 1996). Importantly, through norm development, regulatory approaches to implementing landscape-scale conservation may become less critical because organizations participate of their own volition (key informant B, July 16, 2012). The GNLCC sees its key role, then, as providing the conditions for the emergence of a ‘community of practice’ (Wenger, 1998) wherein repeated interaction supports social learning, norm development, and collective action with respect to shared interests (informed by Ostrom, 1990). If inter-organizational influence is viewed as indicative of such conditions, it is evident that the GNLCC’s networking approach is facilitating the advent of a community of practice around landscape-scale conservation (network density = 39.7%) (Table 5). Notwithstanding, GNLCC staff realize that being an influential leader in its social network helps ensure its vision is adopted and advanced (key informants B, July 3, 2012 and D, July 3, 2012); its node level betweenness score (67.26) confirms that it is effectively positioned in this regard (Table 5).

Together, the capacity, strategy (e.g. climate change theme), and various activities of the GNLCC are initiating a collective action process that is tipping regional conservation
thinking and action towards more ecologically sound and socially inclusive landscape-scale conservation. In particular, through its (non-regulatory) influence, the development of shared landscape-scale conservation norms, and the provision of relevant information, scientific capacity, and funding, the GNLCC is helping to resolve problems of institutional fit (e.g. by enabling regional conservation actors to learn about, obtain resources for, and better incorporate landscape-scale conservation) and organizational path dependence (e.g. by providing fora wherein historically entrenched conservation thought and practice can be reconsidered and recast) in the Great Northern region. Of course, identifying the degree to which this is happening (and why) is essential for understanding the GNLCC’s efficacy as a bridging organization.

5.3.2 To what extent is transformation being facilitated?

Understanding among regional conservation actors about the role of the GNLCC, its staff, and its four wings is beginning to emerge, with fairly high levels of interest and involvement in landscape-scale conservation in evidence. For example, at all multi-organization GNLCC events observed (e.g. Steering Committee meeting), participants were engaged and generally positive about the GNLCC and its efforts. That such a diverse group of conservation actors are coming together to work on landscape-scale stressors at this early stage in the GNLCC’s development is a testament to the organization’s efficacy in advocating and facilitating a collaborative approach to landscape-scale conservation. Notwithstanding, it is illuminating to examine the composition (including omissions) of the GNLCC’s social network as well as the barriers to and implications of the GNLCC’s networking actions.

Section 5.3.1 indicated that the Steering Committee interaction network (Table 2; Figure 7) is quite dense, robust, and closely knit (an important foundation for collaboration), but the network measures presented only speak to average network conditions. Closer inspection reveals that the network is comprised disproportionally of US federal agencies (37%) that interact with each other much more frequently than with other affiliation types
(group weighted density = 62) (Table 2). State agencies also exhibit disproportionately high frequencies of within group interaction (group weighted density = 10) (Table 2). Consequently, the interaction network is quite clustered along affiliation type lines (network clustering = 71%) with evidence of hierarchical patterns of interaction present (hierarchy = 1, 0, 0.16, 1) (Table 2). Thus, despite intending to be a collaboration of equal conservation partners, it is clear that issues of unequal representation and organizational stratification persist within the Steering Committee interaction network. This said, observed interactions among organizations were all respectful, supportive, and inclusive.

Organizational involvement in the GNLCC may not be entirely attributable to the pursuit of interest in landscape scale stressors (key informant J, July 5, 2012). For example, DOI agencies within the Great Northern region are required (Secretarial Order 3289) to participate in the programme; only one non-DOI federal agency is on the Steering Committee (i.e. US Forest Service - Northern Region, Department of Agriculture (DOA)). As well, access to GNLCC funds has been identified as a major pull for state agencies, especially (key informants B, July 3, 2012 and D, July 3, 2012). The GNLCC recognizes this, but emphasizes that getting organizations into a collaborative discussion, whatever their incentives, is a prerequisite for the possible emergence of a community of landscape-scale conservation practice (ibid.).

Compared to earlier conservation approaches in the Great Northern region, it is highly progressive that the GNLCC involves federal (US and Canada), state, provincial, tribal, and non-governmental groups in planning for landscape-scale stressors. However, from a procedural justice perspective, understanding why unequal representation exists and identifying who is not (yet) involved with the GNLCC (and why) helps reveal the extent to which genuine ‘co-management’ is developing.

Though federal agencies are the most represented affiliation type in the GNLCC network, inter-agency politics are limiting the participation of relevant government bodies
For example, at the national level the DOI is considered junior to the DOA (especially in terms of annual budget) (ibid.). The LCC Director and GNLCC Coordinator suggested that these inter-agency politics are the reason the DOA has not directed its agencies (e.g. the Forest Service) to become formal participants in the GNLCC (however, at the regional level, DOA staff do participate in GNLCC meetings, showing a demonstrated interest in the programme) (ibid.; key informant A, June 29, 2012).

State involvement has been sometimes difficult to secure for (at least) two reasons. States were not involved in the development of the LCC programme, leading some to be resistant to the GNLCC; the ideological legacy of the state-centric North American Model of Wildlife Conservation has also been a barrier to engagement (ibid.; Jacobson et al., 2010).

Consequently, a number of relevant state agencies (e.g. Oregon Department of Fish and Wildlife) have yet to buy into the GNLCC’s efforts. A number of tribal groups have been invited to participate in the GNLCC; however, despite additional federal funds to support their involvement (e.g. payment of travel cost), not all have chosen to engage (key informants B, July 3, 2012; C, July 16, 2012; D, July 3, 2012). Here historically embedded trust issues and divergent cultural models of conservation appear to be consequential. For example, despite good knowledge of golden eagle (Aquila chrysaetos) nest locations at the landscape-scale, the knowledge holding tribal group is reticent about sharing this information with the GNLCC (viewed ostensibly as another federal conservation program which may limit their land or resource use). And although the conservation of cultural resources is a stated focus of the GNLCC, treatment of cultural resources (e.g. First Foods) as an issue to be managed through technocratic means is not always consistent with First Nations’ conceptions of what ‘conservation’ is or how it should be done (Hunn et al., 2003; key informant J, July 5, 2012). Many non-governmental conservation groups (and other stakeholders) are not considered significant landscape-scale actors by the GNLCC; only those with landscape-scale expertise or claims are invited to participate (this exclusion criteria was identified by GNLCC staff as a
practical reality for effective collaboration at the landscape scale) (key informant B, July 13, 2012). Canadian representation is relatively good, but sovereignty concerns (i.e. GNLCC boundaries in Canadian territory) have required diplomacy regarding justifications for transboundary demarcations (key informants B, July 3, 2012 and H, August 27, 2012). A general barrier to participation noted by questionnaire respondents was concern about the GNLCC’s permanence (28%), especially in light of upcoming US presidential elections.

At present, a number of key actors are not involved with the GNLCC. Given that large-scale habitat degradation is a central concern of the GNLCC, it is an impediment to its conservation goals that private, state, and federal energy and transportation organizations are absent from the discussion (informed by Turner et al., 2010). Many involved with the GNLCC suggested that it does not yet have the political clout to bring these actors to the table (e.g. key informants B, July 16, 2012 and F, July 16, 2012), a situation that could change through further diffusion of the GNLCC’s influence (key informant J, July 5, 2012). The general lack of engagement with the private sector and organizations with expertise in the human dimensions of conservation, are omissions that further impede socio-ecological transformation (ibid.). Finally, the lack of some tribal groups’ involvement reduces available knowledge of landscape-scale dynamics and presents the possibility of unintended tenure subordination (informed by Thornton, 2012).

Though all relevant organizations are not yet involved with the GNLCC, the extent to which the organization has facilitated collaboration among regional conservation actors since 2010 is impressive. Through counterfactual analysis of the Steering Committee interaction network (Table 2), for example, it is evident that the GNLCC’s efforts have increased the frequency of inter-organization interaction regarding landscape-scale stressors (network density 66.7% vs. 63.1% without GNLCC); increased the robustness of the interaction network (minimum point connectivity = 4 vs. 3 without GNLCC); and reduced the overall
inequality in interaction relations (network level betweeness = 5.61 vs. 7.29 without GNLCC). Key informants echoed counterfactual findings (especially Canadian actors).

There are indicators, in addition to overarching inter-organizational interaction dynamics, through which the extent of the GNLCC’s efficacy as a bridging organization can be assessed. As shown, the GNLCC—itself and through the network of actors it has cultivated—is an important repository for information related to landscape-scale stressors. Notwithstanding, the GNLCC is still refining tools for data integration and access (e.g. LC Map), with understandably limited stakeholder utilization of these tools to date (the situation presently limits the capacity of regional conservationists to ‘do’ landscape-scale conservation) (key informant F, July 16, 2012). Significantly, very little socio-economic/political data about the human dimensions of conservation is being sought or provided (informed by content analysis and discussions with key informant B, July 3, 2012). It is notable, too, that most data being complied by the GNLCC is from government sources (for the practical reason that landscape-scale research is often conducted or funded by government agencies) (key informant F, July 16, 2012). This leads to the persistence of a western scientific knowledge paradigm, which key informant J (July 5, 2012) suggested may be driving some of the aforementioned lack of involvement. At the same time, it is commendable that the GNLCC is attempting to collect and apply the best available scientific knowledge to landscape-scale conservation. The situation provides an opportunity to work across discordant ways of knowing, as the GNLCC has recognized (key informant B, July 13, 2012). Better inclusion of TEK in landscape planning is one way the organization is hoping to become more pluralistic.

While SNA provides a novel tool for investigating counterfactual situations (to the author’s knowledge this is the first such use of SNA), it must be noted that results do not reflect a perfect counterfactual situation. Removing the GNLCC for analysis excludes its direct influence from network measure results. However, it does not remove the influence the GNLCC has had in facilitating network development in the first place. If the total influence of the GNLCC on network structure could be removed, differences in the complete and counterfactual networks would almost certainly be more pronounced. Thus, counterfactual analysis only gives an indication of the direction and magnitude (attenuated) of the GNLCC’s influence on networks.
(though insufficient social science expertise may be an impediment to this objective (Jacobson, in review)) (ibid.).

At the network level, despite notable inter-organizational information seeking (average number of ties = 5.89), it is evident that US federal and state agencies have a tendency to pursue intra-group information (group density = 2.6 federal, 2 state) (Table 3). Information seeking patterns are also relatively hierarchical (hierarchy = 1, 0.12, 0.55, 1), with some organizations in quite marginal positions (link distances up to 4) (Table 3). Faction analysis reveals that all Canadian agencies and First Nations groups exhibit information seeking characteristics that are structurally dissimilar from other organizations (e.g. number of ties sought, within group vs. outside of group information seeking). Overall, then, the information seeking network is a utilized forum, but one that is currently dominated by information seeking sub-structures that may reduce the potential for social learning.

As a funding body, the GNLCC has been very effective at lowering financial barriers to landscape-scale conservation. Counterfactual analysis shows that it alone has been responsible for a 16% increase in the number of funding allocations to Steering Committee organizations (in addition to funding various other non-Steering Committee organizations and facilitating a broader funding network for work on landscape-scale conservation). The capacity to provide financial incentives appears to be a key element of the GNLCC’s success in initiating collaboration (e.g. engaging states). An ongoing issue (as for most federal conservation programmes), however, is uncertainty about the GNLCC’s annual budget and thus the degree to which it can continue to be a key funding agency (key informant B, July 3, 2012). A related challenge is that programme funding is partially linked to performance (ibid.). Because the GNLCC has struggled to develop progress metrics, its funding is quite vulnerable to performance-based financing criteria (ibid.). Finally, it was suggested that Office of Management and Budget (White House) funding standards can make it difficult for the GNLCC to secure funding for projects inconsistent with the federal government’s
epistemological perspective (e.g. TEK integration programme) (key informant J, July 5, 2012).

Section 5.3.1 suggested that the GNLCC is becoming an influential conservation actor in the Great Northern region. Questionnaire responses from Steering Committee members help illustrate the extent to which this is the case. When asked how significant an influence the GNLCC had been on the importance their organization gives to landscape-scale stressors, 17% said very significant and 56% said moderately significant. In terms of influencing their organization’s willingness to participate in collaborative approaches to managing landscape-scale stressors, 22% said the GNLCC had been a very significant influence, 28% said it had been moderately influential. For both questions, the GNLCC was never said to have had no influence. Further investigation revealed that the GNLCC has already influenced concrete changes in Steering Committee organizations in relation to landscape-scale stressors (Figure 12). Despite this, it was repeatedly stated that the GNLCC will have a greater influence if it is able to demonstrate that it is adding value (in a tangible sense) to regional conservation efforts (e.g. key informants G, July 16, 2012 and I, July 27, 2012).

Figure 12: Concrete changes in organizations as a result of the GNLCC’s influence

At the network level it is evident that, despite their involvement in the Steering Committee network, federal agencies are mostly influenced by other federal agencies (group
weighted density = 27) (Table 5). In addition to being evidence of persistent groupthink, social relational theory suggests that very dense, strong relations reduce the possibilities for innovation because intra-group knowledge is often redundant and uncontested (Granovetter, 1973). Because federal agencies have disproportionate Steering Committee representation, federal groupthink may pose a barrier to the emergence of an inclusive and inventive community of practice. Moreover, it is indicative of embedded power dynamics (e.g. preexisting influence, knowledge, and resources) driving conservation decisions and outcomes, a situation considered problematic by many scholars of social and environmental justice (e.g. Peet and Watts, 2004; Robbins, 2012). Consensus-based decision-making may help attenuate these issues to some degree.

Finally, it is necessary to assess whether the GNLCC’s efforts are in fact facilitating conservation that is consistent with key principles of non-equilibrium and landscape ecology (i.e. the extent to which its actions support its conservation goals). Though measurable ecological outcomes are not yet available, the GNLCC is supporting a number of projects working to fill collectively recognized landscape-scale threats to ecological integrity and resilience (through data provisioning, guidance, networking, funding, etc.). However, the legacy of focal-species based thinking (which often favours iconic generalist species (e.g. grizzly bear) to the detriment of specialist species) is still pervasive in discussion within GNLCC fora (see Lindenmayer et al., 2002 for critique of focal-species approach). GNLCC Coordinators recognize this issue, but indicate that the political inertia behind focal species approaches has led them to be accommodating in an effort to increase organizational participation (key informant D, July 17, 2012). It is evident, then, that GNLCC is facing (and accepting) a tradeoff in consistency with ecological thought for organizational involvement. At an operational level, the GNLCC is facing a challenge implicit in any adaptive co-management approach: how to maintain requisite organizational flexibility (for learning and
adaptability vis-à-vis complex and dynamic landscape-scale stressors) while being consolidated enough to function as a coherent organization (key informant B, July 13, 2012).

The GNLCC and its network of conservation actors have identified twelve priority issues for recovering and/or maintaining ecological integrity and resilience (Table 6). Collectively the Steering Committee works on all relevant issues, however, the relative distribution of work on issues is highly unequal (Figures 11 and 13). A two-mode faction analysis reveals that strong collective action among the Steering Committee is occurring in relation to ecosystem restoration, invasive species, wildland fire, water availability and quality, fish and wildlife responses to climate change, and the protection of Trust (i.e. endangered) species (see upper left box) (Table 6). However, the network is much less focused on the remaining priority issues (right side boxes). Though the number of organizations working on an issue is not necessarily an indication of the extent to which an issue is being sufficiently addressed, unequal issue coverage may indicate that the network is not yet capable of sufficiently engaging with priority issues. Notwithstanding the aforementioned points, it is evident that the GNLCC plays a lead role in facilitating mature (if sometimes imperfect) action on regionally significant landscape-scale stressors.
The foregoing discussion presented a careful assessment of the extent to which the GNLCC is facilitating transformation towards tenable landscape-scale conservation; it identified areas of significant progress as well as noteworthy impediments to change. Though it is difficult to summarize the overall extent to which the GNLCC is helping to overcome problems of institutional fit and path dependence, it is interesting that 61% of Steering Committee members indicated that their organizations view the GNLCC as facilitating a transformation in the way landscape-scale stressors are being managed (72% personally viewed the GNLCC as transformative). Despite such promising figures, GNLCC staff are realistic about the socio-economic/political context within which the organization is embedded (key informants B, July 16, 2012 and F, July 16, 2012); they have nonetheless demonstrated commendable spirit-for-cause as well as an eagerness to learn about how the GNLCC’s capacity to facilitate transformation can be improved.

Figure 13: Distribution of work on landscape-scale conservation priorities
5.4 Recommendations for GNLCC

The preceding two sections identified a number of change-hindering issues, which, if addressed, may improve GNLCC’s ability to facilitate socio-ecological transformation in the Great Northern region. The following recommendations are offered for consideration:

1. Actively encourage more inter-affiliation type interaction among conservation partners

2. Commit time and resources to engaging relevant but currently underrepresented organizations as well as consequentially unrepresented sectors, including energy and transportation

3. Work to identify how diverse epistemological perspectives and expertise can be brought together in practice to obtain the range of knowledge needed to understand and address landscape-scale stressors

4. Ensure that a greater emphasis is placed on the human dimensions of conservation, with relevant data, staff, and conservation partners included to advise organizational thought and practice

5. Focus on identifying and communicating clear examples of how the GNLCC is adding value to regional conservation efforts

6. Assess the degree to which landscape-scale conservation priorities can be sufficiently addressed by the current network of conservation actors; work to include or cultivate additional expertise as needed

7. Remain inclusive, flexible, and adaptable as an organization despite the practical appeal of consolidation and rigidity

8. Consider utilizing SNA as a performance metric for quantifying progress on facilitating collaborative responses to landscape-scale stressors

5.5 Study limitations

Despite being able to identify important aspects of how and to what extent the GNLCC is facilitating transformation, the study’s cogence may have been affected by (at least) four important issues: limited fieldwork time for conducting the institutional ethnography, selection of the target population for the SNA, achieving a sub-100% questionnaire response rate, and the limited capacity of SNA to reveal network dynamics. The fact that the author is not a SNA expert could also have influenced results.
Limited fieldwork time may have reduced the extent to which socio-economic/political context was sufficiently understood; a specific limitation being the inability to conduct key informant interviews with all Steering Committee members. However, given the need to allocate time to other aspects of the methodology and high levels of participant engagement while at GNLCC headquarters, limited fieldwork time was a planned component of the study that is not considered to have had a major detrimental effect. Demarcating the Steering Committee as the basis for the SNA necessarily implied that potentially relevant actors, their relationships with other actors, and the patterns and implications of their interactions were not included in the study. However, in the context of a study of the GNLCC as an emerging bridging organization, analysis of a relatively formalized and well-defined network made practical sense. And because the Steering Committee represents actors that must be engaged and supportive for a transformation towards landscape-scale conservation to proceed, it was also justifiable for theoretical reasons. Sub-100% response rate for a full network SNA implies that results can only be indicative of social entities’ relationships with other actors. Consequentially, then, this study was unable to speak definitively about the exact nature and implications of social relational structures among the Steering Committee. Notwithstanding, goodness of fit tests suggested that the effect of missing data was not significant. Because SNA does not lend itself to dynamic network analysis, the study’s SNA does not capture the process of transformational change (it only provides a snapshot). Institutional ethnography was utilized to better understand temporal dimension not examinable through the SNA. Because the author is not a SNA expert, it is possible that the study has not garnered all of the benefits of SNA and that some methodological limitations have not been fully appreciated.

Future research on the GNLCC utilizing similar methods might benefit from extended field time and the inclusion of follow up interviews with as many questionnaire respondents as possible. As the GNLCC network becomes more established, it may be feasible to conduct
a comprehensive SNA (i.e. Steering Committee, Advisory Team, Science Community, and Partner Community). Complementing this with a stakeholder identification analysis (see Prell et al., 2009) could enable explicit examination of structural relations between those involved and not involved with the GNLCC. Such a comprehensive study could provide very interesting practical and scholarly insights. Spending more time in the Great Northern region and establishing more personal contacts with respondents and/or their organizations would likely result in a higher questionnaire response rate. Temporal SNA techniques are being developed (Laura Keating, personal communication, June 19, 2012) and could be productively applied in future studies. Alternatively, the SNA results presented herein could be used as a baseline against which future studies could assess transformational change.

5.6 Study contributions

Notwithstanding its limitations, it is believed that this study represents a modest but salient contribution to the socio-ecological resilience literature aimed at understanding factors that facilitate socio-ecological transformations. Not only were new conceptual and methodological approaches developed and applied (which addressed identified limitations of existing bridging organization research), but, utilizing these approaches, the study was able to unveil detailed and specific information about how the GNLCC and the network of conservation actors it has cultivated are addressing problems of poor institutional fit and path dependence in the Great Northern region. The extent to which these efforts are consistent with the GNLCC’s adaptive co-management aspirations was made evident in complementary qualitative and (structurally explicit) quantitative terms, representing a potentially important methodological step forward for bridging organizations research. To this end, the study provided nuanced insights about the socio-economic/political dimensions of bridging organizations’ role in transformative change, therefore, helping to advance understanding of barriers to and implications of bridging organizations’ efforts. Finally, the study highlighted the importance of interrogating bridging organizations’ motivations (because bridging
organizations are not simply passive hubs connecting network actors). Though participants did not perceive the GNLCC as a nefarious organization (nor were any disingenuous activities observed), the potential for abuses of power suggest that critical examination of network-building organizations should be considered a requisite feature of cogent bridging organization research.
Chapter 6: Conclusion

This dissertation began by identifying a pressing environmental change and management dilemma: How to conserve esteemed and ecologically vital components of the biosphere in light of environmental changes occurring at scales, rates, and levels of complexity that often transcend the scientific and operational capacity of conservation institutions. Taking direction from contemporary ecological insights and socio-ecological resilience literature on bridging organizations and transformational change, the study focused on how and to what extent the GNLCC (in its role as a bridging organization) is facilitating a transformation towards tenable landscape-scale conservation in the Great Northern region. The study linked complementary theoretical perspectives via a novel mixed method approach to advance strategies for analysing bridging organizations and the networks they cultivate (after arguing that previous approaches have been inadequate). This interdisciplinary foundation was used to critically examine the GNLCC, the nature of relationships among actors in the social network it is developing, and how those relations are improving or inhibiting transformation. Eight practical ways in which the GNLCC might improve its bridging efforts were offered for consideration. By way of these efforts, the study achieved its stated aims while meeting its broader objective of contributing to the socio-ecological resilience literature concerned with understanding factors that facilitate socio-ecological transformations. In so doing, this dissertation provides practical and scholarly insights relevant to the broader environmental change and management dilemma identified at the outset.

This study demonstrated that the GNLCC, through network building and endogenous financial, scientific, and technological capacity, is playing a key role in tipping conservation efforts in the Great Northern region towards more ecologically and socially tenable conditions (albeit with considerable challenges yet to be overcome). However, a key insight from the study is that interactions among actors (or lack thereof) in co-management arrangements can
produce multifaceted outcomes where perceived benefits of collaboration can obscure procedural justice and efficacy issues—transformation is not a homogeneous process. Notwithstanding, the findings presented are largely congruent with previous socio-ecological resilience literature, which suggests that bridging organizations can play a key role in facilitating socio-ecological transformations. Thus, while the study’s results add credence to the relevance of bridging organizations research, they also point up a pressing need for greater attention to potential justice and effectiveness issues, which can emerge from and be obscured by the process of network building. The conceptual and methodological approaches developed and applied herein provide a preliminary blueprint for this more conscientious approach to bridging organizations research.
References


DOI (2011) Landscape Conservation Cooperatives and Climate Science Centers: Implementation Guidance. DOI, Washington DC.


GNLCC (2011b) GNLCC Quarterly Newsletter. GNLCC, Bozeman.

GNLCC (2011c) The Great Northern Landscape Conservation Cooperative: Conservation partners working toward a collective landscape vision and conservation goals for building landscape resilience. GNLCC, Bozeman.


ORDER NO. 3289

Subject: Addressing the Impacts of Climate Change on America’s Water, Land, and Other Natural and Cultural Resources

Sec. 1 Purpose and Background. Secretarial Order No. 3285, issued on March 11, 2009, made production and transmission of renewable energy on public lands a priority for the Department. This Order establishes a Department-wide approach for applying scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts on tribes and on the land, water, ocean, fish and wildlife, and cultural heritage resources that the Department manages. This Order replaces Secretarial Order No. 3226, Amendment No. 1, issued on January 16, 2009, and reinstates the provisions of Secretarial Order No. 3226, issued on January 19, 2001.

To fulfill our nation’s vision for a clean energy economy, Interior is now managing America’s public lands and oceans not just for balanced oil, natural gas, and coal development, but also – for the first time ever – to promote environmentally responsible renewable energy development. Sun, wind, biomass, and geothermal energy from our public and tribal lands is creating new jobs and will power millions of American homes and electric vehicles.

The Department is also taking the lead in protecting our country’s water, land, fish and wildlife, and cultural heritage and tribal lands and resources from the dramatic effects of climate change that are already occurring – from the Arctic to the Everglades. The realities of climate change require us to change how we manage the land, water, fish and wildlife, and cultural heritage and tribal lands and resources we oversee. For example:

- New water management imperatives associated with climate change may require restoration of natural systems and construction of new infrastructure to reduce new flood risks or to capture early run-off.
- Strategies to address sea level rise may require acquisition of upland habitat and creation of wetlands and other natural filters and barriers to protect against sea level rise and storm surges. It may be necessary to relocate certain iconic and culturally historic structures.
- Shifting wildlife and habitat populations may require investments in new wildlife corridors.
- New invasions of exotic species and new wildland fire threats due to longer fire seasons and more severe droughts will require innovation and more effective ways of managing the Department’s resources.
The Department of the Interior, with its 67,000 employees and scientific and resource management expertise, is responsible for helping protect the nation from the impacts of climate change. In particular the Department must:

- Adapt its water management strategies to address the possibility of shrinking water supplies and more frequent and extended droughts to continue to supply drinking water to more than 31 million people and irrigation water to 140,000 farmers.
- Wisely manage millions of acres of parks, refuges and other public lands, and prudently exercise its shared responsibility for managing the 1.7 billion acres of the U.S. outer continental shelf.
- Conserve and manage fish and wildlife resources, including over 800 native migratory bird species and nearly 2,000 federally listed threatened and endangered species.
- Protect cultural and archaeological resources and iconic structures that may be affected by climate change.
- Address the impacts of climate change on American Indians and Alaska Natives, for whom the Department holds trust responsibilities on behalf of the Federal government.
- Continue to provide state-of-the-art science to better understand the impacts of climate change and to develop science-based adaptive management strategies for natural and cultural resource managers.
- Continue its work to quantify the amount of carbon stored in our forests, wetlands, and grasslands, identifying areas where carbon dioxide can be safely stored underground, and ways to reduce the Department's carbon footprint.

Sec. 2 Authority. This Order is issued under the authority of Section 2 of Reorganization Plan No. 3 of 1950 (64 Stat. 1262), as amended.

Sec. 3 Coordinating the Department’s Response to Climate Change Impacts on Our Resources. This Order establishes a Climate Change Response Council within the Office of the Secretary that will execute a coordinated Department-wide strategy to increase scientific understanding of and development of effective adaptive management tools to address the impacts of climate change on our natural and cultural resources. The Climate Change Response Council will be composed of the Secretary (Chair), Deputy Secretary (Vice-Chair), Counselor to the Secretary (Vice-Chair), Assistant Secretaries, Bureau Directors and the Solicitor. The Council will help coordinate activities within and among the Department’s agencies and bureaus to develop and implement an integrated strategy for responding to climate change impacts involving the resources managed by the Department. The Department’s Climate Change Response Council will also coordinate its climate change activities with all relevant Federal Departments and agencies including, but not limited to, the Council on Environmental Quality, the Office of Energy and Climate Change, the Office of Science and Technology Policy, the National Science and Technology Council, the Department of Agriculture, the Department of Commerce, the Department of Defense, and the Environmental Protection Agency.

The Climate Change Response Council will implement Department-specific climate change activities through the following mechanisms:

(a) Climate Change Response Planning Requirements. Each bureau and office of the Department must consider and analyze potential climate change impacts when undertaking long-
range planning exercises, setting priorities for scientific research and investigations, developing multi-year management plans, and making major decisions regarding potential use of resources under the Department’s purview. These requirements were set forth in Secretarial Order No. 3226, and remain in effect. The organizational changes made by this Order will enable the bureaus and agencies to fulfill these planning requirements.

(b) DOI Regional Climate Change Response Centers. Management decisions made in response to climate change impacts must be informed by science and require that scientists work in tandem with those managers who are confronting climate change impacts and evaluating options to respond to such impacts. Pursuant to P.L. 110-161, the United States Geological Survey (USGS) has been developing regional science centers to provide climate change impact data and analysis geared to the needs of fish and wildlife managers as they develop adaptation strategies in response to climate change. These centers are currently known as “regional hubs” of the National Climate Change and Wildlife Science Center, and are being developed in close collaboration with Interior agencies and other federal, state, university, and non-governmental partners.

The Climate Change Response Council will work with USGS and other Department bureaus to rename these regional science centers as Regional Climate Change Response Centers and broaden their mandate to encompass other climate-change-related impacts on Departmental resources. These eight Response Centers will synthesize and integrate climate change impact data and develop tools that the Department’s managers and partners can use when managing the Department’s land, water, fish and wildlife, and cultural heritage resources.

(c) Landscape Conservation Cooperatives. Given the broad impacts of climate change, management responses to such impacts must be coordinated on a landscape-level basis. For example, wildlife migration and related needs for new wildlife corridors, the spread of invasive species and wildfire risks, typically will extend beyond the borders of National Wildlife Refuges, BLM lands, or National Parks. Additionally, some bureau responsibilities (e.g., Fish and Wildlife Service migratory bird and threatened and endangered species responsibilities) extend nationally and globally. Because of the unprecedented scope of affected landscapes, Interior bureaus and agencies must work together, and with other federal, state, tribal and local governments, and private landowner partners, to develop landscape-level strategies for understanding and responding to climate change impacts. Interior bureaus and agencies, guided by the Climate Response Council, will work to stimulate the development of a network of collaborative “Landscape Conservation Cooperatives.” These cooperatives, which already have been formed in some regions, will work interactively with the relevant DOI Regional Climate Change Response Center(s) and help coordinate adaptation efforts in the region.

Sec. 4 Additional Departmental Action to Mitigate Climate Change. In accordance with Secretarial Order No. 3285, the Department has prioritized development of renewable energy on public lands and offshore waters to reduce our dependence on foreign oil and to reduce greenhouse gas pollution. This Order establishes two additional projects to mitigate climate change: the DOI Carbon Storage Project, and the DOI Carbon Footprint Project. Additional mitigation projects will be encouraged and supported by the Climate Change Response Council.
(a) **The DOI Carbon Storage Project.** This project is being implemented under P.L. 110-140, "The Energy Independence and Security Act of 2007," which gives the Department statutory responsibility to develop carbon sequestration methodologies for geological (i.e., underground) and biological (e.g., forests and rangelands) carbon storage. The USGS has the lead in administering the Carbon Storage Project, but will work closely with other bureaus and agencies in the Department and external partners to enhance carbon storage in geologic formations and in plants and soils in a manner consistent with the Department's responsibility to provide comprehensive, long-term stewardship of its resources. The DOI Carbon Storage Project is vital for successful domestic and global geological and biological carbon sequestration efforts.

(b) **The DOI Carbon Footprint Project.** The project will develop a unified greenhouse gas emission reduction program, including setting a baseline and reduction goal for the Department's greenhouse gas emissions and energy use. The Assistant Secretary for Policy, Management and Budget will have the lead in administering the DOI Carbon Footprint Project, with the cooperation of all of the Department's agencies and bureaus.

Sec. 5 **American Indians and Alaska Natives.** Climate change may disproportionately affect tribes and their lands because they are heavily dependent on their natural resources for economic and cultural identity. As the Department has the primary trust responsibility for the Federal government for American Indians, Alaska Natives, and tribal lands and resources, the Department will ensure consistent and in-depth government-to-government consultation with tribes and Alaska Natives on the Department's climate change initiatives. Tribal values are critical to determining what is to be protected, why, and how to protect the interests of their communities. The Department will support the use of the best available science, including traditional ecological knowledge, in formulating policy pertaining to climate change. The Department will also support substantive participation by tribes in deliberations on climate-related mechanisms, agreements, rules, and regulations.

Sec. 6 **Implementation.** The Deputy Secretary is responsible for ensuring implementation of all aspects of this Order. This responsibility may be delegated as appropriate. This Order does not alter or affect any existing duty or authority of individual bureaus.

Sec. 7 **Effective Date.** This Order is effective immediately and will remain in effect until its provisions are converted to the Departmental Manual or until it is amended, superseded, or revoked, whichever occurs first.

Date:  **SEP 14 2009**

[Signature]

Secretary of the Interior
Appendix B: GNLCC Questionnaire, Study Design, and Data Analysis

Questionnaire:

**Instruction:** This questionnaire is comprised of four sections: Respondent Information, Organization Information, Relational Information, and Organizational Perspective. Please enter your answers in the grey shaded boxes (as text or an X as appropriate). These boxes are formatted to expand to accommodate text if needed. Please do not make entries or changes outside of the grey boxes. When you have finished the questionnaire, email this document to: graham.mcdowell@linacre.ox.ac.uk Key terminology is defined below.

**Landscape-scale stressors** = Natural or human caused/exacerbated phenomenon that affect large portions of terrestrial and/or aquatic ecosystems in potentially adverse ways; often transcend political and jurisdictional boundaries; examples include land-use change, climate change, and invasive species.

**Organization** = A group of persons organized for a particular purpose. Examples include federal, state, and provincial agencies, Tribal and First Nation groups, and non-governmental conservation partnerships.

Section 1: Respondent Information

1.1 - Please enter your full name.

1.2 - What is your present position in your organization?

1.3 - How long have you been working in your organization (years)?
Section 2: Organization information

In this section you will be asked about your organization and its perspective on landscape-scale stressors.

2.1 - Which issue area best describes your organization’s main focus? Please enter an X in the appropriate box. If no suitable choice, write in suitable descriptor.

<table>
<thead>
<tr>
<th>Fish and wildlife</th>
<th>Science development</th>
<th>Cultural resources</th>
<th>Multi-use management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate Change or other landscape stressors</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.2 - How would you rate the importance your organization gives to addressing landscape-scale stressors? Please enter an X in the appropriate box.

<table>
<thead>
<tr>
<th>Very important</th>
<th>Moderately important</th>
<th>Not very important</th>
<th>Not important</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.3 - How would you rate your organization’s willingness to participate in collaborative approaches to managing landscape-scale stressors (i.e. working with other federal, state, provincial, Tribal/First Nation, and non-governmental groups)? Please enter an X in the appropriate box.

<table>
<thead>
<tr>
<th>Very willing</th>
<th>Moderately willing</th>
<th>Not very willing</th>
<th>Not willing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

2.4 Does your organization work on any of the following issues? Please enter an X next to all that apply.

<table>
<thead>
<tr>
<th>Biological carbon sequestration</th>
<th>Climate impacts on agriculture and grazing</th>
<th>Ecosystem restoration</th>
<th>Fish and wildlife response to climate change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest resilience</td>
<td>Geological carbon sequestration</td>
<td>Glacier retreat</td>
<td>Invasive species</td>
</tr>
<tr>
<td>Protection of Native American cultural resources</td>
<td>Protection of Trust Species</td>
<td>Water availability and quality for humans and ecosystems</td>
<td>Wildland fire</td>
</tr>
</tbody>
</table>
Section 3: Relational Information

In this section you will be asked questions about your organization’s relationships with other organizations.

3.1 - Which of the following organizations does your organization interact with directly on issues related to landscape-scale stressors?  Regular interaction = five or more interactions per year, infrequent = less than five interactions per year. Please enter an X in the appropriate box. Leave blank if no interaction.

<table>
<thead>
<tr>
<th>Involvement Level</th>
<th>Organization Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular</td>
<td>Alberta Parks Division</td>
</tr>
<tr>
<td></td>
<td>Alberta Environment and Sustainable Resource Development</td>
</tr>
<tr>
<td></td>
<td>B.C. Ministry of Environment</td>
</tr>
<tr>
<td></td>
<td>B.C. Ministry of Forest, Lands, and Natural Resource Operations</td>
</tr>
<tr>
<td></td>
<td>Bureau of Land Management – Montana State Office</td>
</tr>
<tr>
<td></td>
<td>Canadian Wildlife Service, Environment Canada</td>
</tr>
<tr>
<td></td>
<td>Columbia Basin Federal Caucus</td>
</tr>
<tr>
<td></td>
<td>Confederated Salish-Kootenai Tribes</td>
</tr>
<tr>
<td></td>
<td>Confederated Tribes of the Umatilla Indian Reservation</td>
</tr>
<tr>
<td></td>
<td>Heart of the Rockies Initiative</td>
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<td></td>
<td>Great Northern Landscape Conservation Cooperative</td>
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<td>Idaho Fish and Game</td>
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<td>Intermountain West Joint Venture</td>
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<td>Montana Fish, Wildlife, and Parks</td>
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<td></td>
<td>National Oceanic and Atmospheric Administration</td>
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<td>National Park Service</td>
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<td>Natural Resource Conservation Service</td>
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<td></td>
<td>US Fish and Wildlife Service - Mountain-Prairie</td>
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<td></td>
<td>US Fish and Wildlife Service - Pacific</td>
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<tr>
<td></td>
<td>US Forest Service - Intermountain (R4)</td>
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<td></td>
<td>US Forest Service - Northern Region (R1)</td>
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<td></td>
<td>US Geological Survey</td>
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<td>Washington Department of Fish and Wildlife</td>
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<td></td>
<td>Wildlife Conservation Society</td>
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<td></td>
<td>Wyoming Game and Fish</td>
</tr>
</tbody>
</table>


3.2 - Are there any other organizations not listed above that your organization interacts with directly on issues related to landscape-scale stressors? Please list up to five, indicating the frequency of interaction with an X in the appropriate box.

<table>
<thead>
<tr>
<th>Regular</th>
<th>Infrequent</th>
<th>Organization’s name</th>
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</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>
From which of the following organizations does your organization directly obtain information about landscape-scale stressors? Information may include data, advice, perspective, etc. Please enter an X next to all that apply.

<table>
<thead>
<tr>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta Parks Division</td>
</tr>
<tr>
<td>Alberta Environment and Sustainable Resource Development</td>
</tr>
<tr>
<td>B.C. Ministry of Environment</td>
</tr>
<tr>
<td>B.C. Ministry of Forest, Lands, and Natural Resource Operations</td>
</tr>
<tr>
<td>Bureau of Land Management – Montana State Office</td>
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<tr>
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<tr>
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<tr>
<td>Wildlife Conservation Society</td>
</tr>
<tr>
<td>Wyoming Game and Fish</td>
</tr>
</tbody>
</table>
3.4 - Are there any other organizations not listed above that your organization directly obtains information about landscape-scale stressors from? Please list up to five.

<table>
<thead>
<tr>
<th>Organization’s name</th>
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<tbody>
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</tbody>
</table>
3.5 - Which of the following organizations have directly influenced your organization’s perspective on landscape-scale stressors? Please indicate the strength of the influence in the appropriate box with an X. Leave blank for organizations that do not influence your organization’s work on these issues.

<table>
<thead>
<tr>
<th>Strong</th>
<th>Moderate</th>
<th>Weak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta Parks Division</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alberta Environment and Sustainable Resource Development</td>
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<tr>
<td>Wyoming Game and Fish</td>
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</tbody>
</table>
3.6 - Are there any other organizations not listed above that have directly influenced your organization’s perspective on landscape-scale stressors? Please list up to five, marking with an X their level of influence on your organization.

<table>
<thead>
<tr>
<th>Strong</th>
<th>Moderate</th>
<th>Weak</th>
<th>Organization’s name</th>
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<tbody>
<tr>
<td></td>
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</tbody>
</table>
Which of the following organizations have provided funding or other tangible resources to assist your organization’s work on landscape-scale stressors? Please enter an X next to all that apply.

<table>
<thead>
<tr>
<th>Alberta Parks Division</th>
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<tr>
<td>Alberta Environment and Sustainable Resource Development</td>
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<tr>
<td>Wyoming Game and Fish</td>
</tr>
</tbody>
</table>
3.8 - Are there any other organizations not listed above that have provided funding to assist your organization’s work on landscape-scale stressors? Please list up to five.

<table>
<thead>
<tr>
<th>Organization’s name</th>
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3.9 - On average, how frequently does your organization interact with the GNLCC per month (for example, phone calls with GNLCC coordinators)?

<p>| |</p>
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3.10 - Of the thirteen GNLCC Steering Committee meetings/conference calls that have been convened, how may have your organization participated in?

<p>| |</p>
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</table>

3.11 - Are there any organizations that you think should be represented on the Steering Committee, but are not. Please list up to five.

<table>
<thead>
<tr>
<th>Organization’s name</th>
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Section 4: Organizational Perspective

In this section you will be asked questions about your organization’s perspective of the GNLCC as well as the influence of the GNLCC on your organization.

4.1 - How would you rate the GNLCC’s progress on its core objectives? Please answer for each objective, placing X in the most appropriate box.

<table>
<thead>
<tr>
<th>Making significant progress</th>
<th>Making some progress</th>
<th>Not making progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supporting Science Development: Identifying and facilitating the development, integration, and application of scientific information needed to inform water, land, fish, wildlife, and cultural heritage management decisions.</td>
<td></td>
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</tr>
<tr>
<td>Effecting Coordination: Supporting coordination and integration of conservation science and actions across ecosystems at the landscape scale, leveraging the capabilities of various organizations and providing real time situational awareness of on going conservation efforts.</td>
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</tr>
<tr>
<td>Informing Conservation Action: Promoting conservation actions at the unit and ecosystem level by providing scientific information and decision support tools and by informing conservation action that support resource resilience.</td>
<td></td>
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<tr>
<td>Monitoring and Evaluating: Supporting efforts to monitor landscape scale indicators, test scientific assumptions, and evaluate effectiveness of conservation actions to inform adaptive management decision-making.</td>
<td></td>
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<tr>
<td>Communicating and Educating: Communicating relevant science information and GNLCC activities and opportunities to partners and users. Advocating for collaborative conservation and seeking to leverage capabilities and support.</td>
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</table>

4.2 – How significant an influence has the GNLCC been on the importance your organization gives to addressing landscape-scale stressors? Please enter an X in the appropriate box.

<table>
<thead>
<tr>
<th>Very significant</th>
<th>Moderately significant</th>
<th>Not very significant</th>
<th>Not significant</th>
</tr>
</thead>
</table>

4.3 - How significant an influence has the GNLCC been on your organization’s willingness to participate in collaborative approaches to managing landscape-scale stressors? Please enter an X in the appropriate box.

<table>
<thead>
<tr>
<th>Very significant</th>
<th>Moderately significant</th>
<th>Not very significant</th>
<th>Not significant</th>
</tr>
</thead>
</table>
4.4 - Has the GNLCC influenced any concrete changes in your organization with regard to landscape-scale stressors? Please enter an X next to all that apply. Type in additional changes if relevant.

| New goals related to landscape-scale stressors |
| New collaborations related to landscape-scale stressors |
| New research programmes related to landscape-scale stressors |
| New specialized staff working on landscape-scale stressors |

4.5 - What factors limit your organization’s ability to fully engage with the GNLCC’s collaborative approach to managing landscape-scale stressors? Please enter an X next to all that apply. Type in additional factors if relevant.

| Lack of public support |
| Lack of expertise - staff/individuals |
| Time constraints - staff/individuals |
| Incompatible organizational goals |
| Lack interests in/perceived non-importance of landscape-scale stressors |
| Organizational/institutional inflexibility |
| Lack of leadership |
| Funding constraints |
| Technological limitations |
| Political tension between organizations |
| Concern about the GNLCC’s permanence |
| Concern about the GNLCC’s collaborative management approach |
4.6 - What factors increase your organization’s ability to engage with the GNLCC’s collaborative approach to managing landscape-scale stressors? Please enter an X next to all that apply. Type in additional factors if relevant.

<table>
<thead>
<tr>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public support</td>
</tr>
<tr>
<td>Informed staff/individuals</td>
</tr>
<tr>
<td>Time availability - staff/individuals</td>
</tr>
<tr>
<td>Compatible organizational goals</td>
</tr>
<tr>
<td>Interests in/perceived importance of landscape-scale stressors</td>
</tr>
<tr>
<td>Organizational/institutional flexibility</td>
</tr>
<tr>
<td>Strong leadership</td>
</tr>
<tr>
<td>New funding opportunities</td>
</tr>
<tr>
<td>Technological capacity</td>
</tr>
<tr>
<td>Lack of political tension between organizations</td>
</tr>
<tr>
<td>Confidence in the GNLCC’s permanence</td>
</tr>
<tr>
<td>Confidence in the GNLCC’s collaborative management approach</td>
</tr>
</tbody>
</table>

4.7 - Overall, does your organization view the GNLCC as an organization that is adding value to existing conservation efforts? Please enter an X in the appropriate box.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

4.8 - Do you think your organization views the GNLCC’s collaborative approach as facilitating a transformation in the way landscape-scale stressors are being managed? Please enter an X in the appropriate box.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

4.9 - Do YOU view the GNLCC’s collaborative approach as facilitating a transformation in the way landscape-scale stressors are being managed? Please enter an X in the appropriate box.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

4.10 - Are there any additional comments you would like to make?
Study Design (detail for section 4.2.2):

The aim of this study was to obtain responses from all twenty-four Steering Committee members (i.e. sample population = target population), with the organization being the unit of analysis. Sampling a sub-group of members was not pursued for two reasons: 1) SNA is not suited to statistical techniques for inference from a sample population to a target population; the data are necessarily ‘dependent’ and therefore in conflict with key preconditions for inferential statistics and 2) SNA is sensitive to missing data so obtaining information from as many actors as possible in a given network is a necessary objective.

A current list of Steering Committee members and contact details was compiled with the assistance of the Coordinator and Landscape Coordinator of the GNLCC. This information was entered into a sample records keeping spreadsheet in Excel for tracking questionnaire responses and additional data relevant to each Steering Committee representative or organization. A personalized email containing a cover letter explaining the study, a consent form, and the questionnaire was sent to every Steering Committee member; an initial ‘respond by’ date was indicated. After the initial response date had passed, all who had not replied were sent reminder emails. Following this, remaining non-respondents were called at their offices to ask for their participation. Cognizant of potential anonymity concerns (e.g. respondents not wishing to be identified as sources of information about their organizations), information was decoupled from respondents’ names and instead attributed to their respective organization (per justification described in section 4.2.1). Completed questionnaires, data, and analysis results are stored on a password-protected computer.

Data Analysis (detail for section 4.3):

Qualitative information obtained using ethnographic methods was documented in Excel or saved in digital file folders (for content analysis materials); it was analysed for manifest and latent content relating to key principles in non-equilibrium/ landscape ecology, theories of bridging organizations and transformative change, and the five dominant themes in political ecology. The questionnaire provided quantitative non-relational and relational data; each required separate analysis techniques. Data from non-relational questions were entered into Excel whereafter question-specific summary statistics and data visualizations were performed. Relational data (i.e. that used for SNA) was analysed using the software package UCINET (version 6.402). Five question-specific matrix datasets (required for SNA) were built in Excel then imported to UCINET. Four one-mode matrices represented ties among organizations; a two-mode matrix represented organizations’ ties to specific issues of concern in the Great Northern region. Fifteen SNA measures were selected as most relevant to the study’s research question and aims; they were calculated for each one-mode dataset (measures explained in Appendix E). Two-mode data structures permit fewer analysis options; one measure (i.e. two-mode faction analysis) was conducted for the two-mode matrix. Networks were visualized using the SNA package NetDraw (version 2.120). Actors were classified by affiliation: US federal agencies (blue), US state agencies (bright green), Canadian federal agencies (red), Canadian provincial agencies (dark aqua), tribal groups (yellow), NGOs (pink), and existing multi-organization partnerships (light grey). Tie directions (i.e. directed or reciprocal) were indicated with arrows and, where relevant, stronger ties were denoted through colour hierarchies. Organizational interaction networks were visualized using multi-dimensional scaling (i.e. nodes’ position as a function of the strength of relationships among them). The remaining two-mode network visualization was not weighted. Qualitative information derived from the questionnaire’s open-ended response options (e.g. “Are there any additional comments you would like to make?”) was classified and analysed as per ethnography-based information.
### Appendix C: Research Outcomes

#### Outcome of rapid institutional ethnography

<table>
<thead>
<tr>
<th>Technique</th>
<th>Action</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content analysis</td>
<td>Collect and analyse all (known) materials by or about LCC/GNLCC</td>
<td>N/A</td>
</tr>
<tr>
<td>Key informant</td>
<td>LCC National Director</td>
<td>1</td>
</tr>
<tr>
<td>interviews</td>
<td>GNLCC Coordinator</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>GNLCC Landscape Coordinator</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>GNLCC Canadian Coordinator</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>GNLCC Science Coordinator A</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>GNLCC Science Coordinator B</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Steering Committee Member (multiple; US and Canadian)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Advisory Team Member</td>
<td>1</td>
</tr>
<tr>
<td>Participant</td>
<td>Activities at GNLCC headquarters (including various non-formal</td>
<td>15</td>
</tr>
<tr>
<td>observation</td>
<td>interviews)</td>
<td>(days)</td>
</tr>
<tr>
<td></td>
<td>Steering Committee meeting</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Partner Forum meeting</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Conference calls (various purposes)</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Key Informant Citation Guide

<table>
<thead>
<tr>
<th>Key Informant</th>
<th>Role/Affiliation</th>
<th>Interview Date(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Informant A</td>
<td>LCC National Director</td>
<td>June 29, 2012</td>
</tr>
<tr>
<td>Key Informant B</td>
<td>GNLCC Coordinator</td>
<td>July 3, 13, 16 &amp; 17, 2012</td>
</tr>
<tr>
<td>Key Informant C</td>
<td>GNLCC Coordinator (Canadian)</td>
<td>July 16 &amp; August 27, 2012</td>
</tr>
<tr>
<td>Key Informant D</td>
<td>GNLCC Landscape Coordinator</td>
<td>July 3, 9 &amp; 17, 2012</td>
</tr>
<tr>
<td>Key Informant E</td>
<td>GNLCC Science Coordinator A</td>
<td>July 3 &amp; 10, 2012</td>
</tr>
<tr>
<td>Key Informant F</td>
<td>GNLCC Science Coordinator B</td>
<td>July 16, 2012</td>
</tr>
<tr>
<td>Key Informant G</td>
<td>Steering Committee member</td>
<td>July 16, 2012</td>
</tr>
<tr>
<td>Key Informant H</td>
<td>Steering Committee member (Canadian)</td>
<td>August 27, 2012</td>
</tr>
<tr>
<td>Key Informant I</td>
<td>Steering Committee member (Canadian)</td>
<td>August 27, 2012</td>
</tr>
<tr>
<td>Key Informant J</td>
<td>Advisory Team member</td>
<td>July 5, 2012</td>
</tr>
<tr>
<td>Steering Committee Organization</td>
<td>Acronym</td>
<td>Response</td>
</tr>
<tr>
<td>---------------------------------------------------------------------</td>
<td>-----------</td>
<td>----------</td>
</tr>
<tr>
<td>Alberta Parks Division</td>
<td>APD</td>
<td>Yes</td>
</tr>
<tr>
<td>Alberta Environment and Sustainable Resource Development</td>
<td>AESRD</td>
<td>Yes</td>
</tr>
<tr>
<td>B.C. Ministry of Environment</td>
<td>BCME</td>
<td>☒</td>
</tr>
<tr>
<td>B.C. Ministry of Forest, Lands, and Natural Resource Operations</td>
<td>BCMFLNRO</td>
<td>☒</td>
</tr>
<tr>
<td>Bureau of Land Management – Montana State Office</td>
<td>BLMM</td>
<td>☒</td>
</tr>
<tr>
<td>Canadian Wildlife Service, Environment Canada</td>
<td>CWSEC</td>
<td>Yes</td>
</tr>
<tr>
<td>Columbia Basin Federal Caucus</td>
<td>CBFC</td>
<td>Yes</td>
</tr>
<tr>
<td>Confederated Salish-Kootenai Tribes</td>
<td>CSKT</td>
<td>☒</td>
</tr>
<tr>
<td>Confederated Tribes of the Umatilla Indian Reservation</td>
<td>CTUIR</td>
<td>Yes</td>
</tr>
<tr>
<td>Heart of the Rockies Initiative</td>
<td>HRI</td>
<td>Yes</td>
</tr>
<tr>
<td>Idaho Fish and Game</td>
<td>IFG</td>
<td>☒</td>
</tr>
<tr>
<td>Intermountain West Joint Venture</td>
<td>IWJV</td>
<td>Yes</td>
</tr>
<tr>
<td>Montana Fish, Wildlife, and Parks</td>
<td>MFWP</td>
<td>Yes</td>
</tr>
<tr>
<td>National Oceanic and Atmospheric Administration</td>
<td>NOAA</td>
<td>Yes</td>
</tr>
<tr>
<td>National Park Service</td>
<td>NPS</td>
<td>Yes</td>
</tr>
<tr>
<td>Natural Resource Conservation Service</td>
<td>NRCS</td>
<td>Yes</td>
</tr>
<tr>
<td>US Fish and Wildlife Service - Mountain-Prairie</td>
<td>USFWSMP</td>
<td>☒</td>
</tr>
<tr>
<td>US Fish and Wildlife Service - Pacific</td>
<td>USFWSP</td>
<td>Yes</td>
</tr>
<tr>
<td>US Forest Service - Northern Region (R1)</td>
<td>USFSNR</td>
<td>Yes</td>
</tr>
<tr>
<td>US Geological Survey</td>
<td>USGS</td>
<td>Yes</td>
</tr>
<tr>
<td>Washington Department of Fish and Wildlife</td>
<td>WDFW</td>
<td>Yes</td>
</tr>
<tr>
<td>Waterton Lakes NP, Parks Canada</td>
<td>WNPC</td>
<td>Yes</td>
</tr>
<tr>
<td>Wildlife Conservation Society</td>
<td>WCS</td>
<td>Yes</td>
</tr>
<tr>
<td>Wyoming Game and Fish</td>
<td>WGF</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Appendix D: Summary Statistics

Note: Question numbers correspond with the questionnaire. All percentages rounded to the nearest tenth.

1.3 - How long have you worked for your organization?

Total years of experience = 341 years

Average experience = 19 years

SD = 12.051

2.1 - Which issue area best describes your organization’s main focus?

<table>
<thead>
<tr>
<th>Issue Area</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish and wildlife</td>
<td>56%</td>
</tr>
<tr>
<td>Science development</td>
<td>39%</td>
</tr>
<tr>
<td>Cultural resources</td>
<td>11%</td>
</tr>
<tr>
<td>Multi-use management</td>
<td>33%</td>
</tr>
<tr>
<td>Climate Change or other landscape stressors</td>
<td>22%</td>
</tr>
<tr>
<td>Other</td>
<td>22%</td>
</tr>
</tbody>
</table>

Non-Cumulative = category totals are non-cumulative since any given article may be classified into multiple non-exclusive categories
2.2 - How would you rate the importance your organization gives to addressing landscape-scale stressors?

<table>
<thead>
<tr>
<th>Importance Level</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very important (1)</td>
<td>56%</td>
</tr>
<tr>
<td>Moderately important (2)</td>
<td>39%</td>
</tr>
<tr>
<td>Not very important (3)</td>
<td>6%</td>
</tr>
<tr>
<td>Not important (4)</td>
<td>0%</td>
</tr>
</tbody>
</table>

Average importance = 1.5 (Moderately to very important)
2.3 - How would you rate your organization’s willingness to participate in collaborative approaches to managing landscape-scale stressors?

<table>
<thead>
<tr>
<th></th>
<th>Very willing (1)</th>
<th>Moderately willing (2)</th>
<th>Not very willing (3)</th>
<th>Not willing (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Percentage</strong></td>
<td>72%</td>
<td>22%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Note: non-response accounts for sub 100% totals

Average importance = 1.2 (Moderately to very willing)
2.4 - Does your organization work on any of the following issues?

<table>
<thead>
<tr>
<th>Issue</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological carbon sequestration</td>
<td>22%</td>
</tr>
<tr>
<td>Climate impacts on agriculture and grazing</td>
<td>33%</td>
</tr>
<tr>
<td>Ecosystem restoration</td>
<td>100%</td>
</tr>
<tr>
<td>Fish and wildlife response to climate change</td>
<td>67%</td>
</tr>
<tr>
<td>Forest resilience</td>
<td>56%</td>
</tr>
<tr>
<td>Geological carbon sequestration</td>
<td>11%</td>
</tr>
<tr>
<td>Glacier retreat</td>
<td>28%</td>
</tr>
<tr>
<td>Invasive species</td>
<td>83%</td>
</tr>
<tr>
<td>Protection of Native American cultural resources</td>
<td>56%</td>
</tr>
<tr>
<td>Protection of Trust Species</td>
<td>61%</td>
</tr>
<tr>
<td>Water availability and quality for humans and ecosystems</td>
<td>72%</td>
</tr>
<tr>
<td>Wildland fire</td>
<td>78%</td>
</tr>
</tbody>
</table>

Non-Cumulative = category totals are non-cumulative since any given article may be classified into multiple non-exclusive categories.
3.2 - Are there any other organizations not listed above that your organization interacts with directly on issues related to landscape-scale stressors?

Frequent: Oregon Department of Fish and Wildlife; Western Governors Association; Association of Fish and Wildlife Agencies; Interagency Grizzly Bear Committee; Alberta Environment; Blood Tribe; Audubon; Wyoming Governor’s Office; Wyoming Stockgrowers, Woolgrowers, Farm Bureau; Ducks Unlimited Canada; Nature Conservancy of Canada; Nature Trust of BC; Ducks Unlimited; Mule Deer Foundation; The Nature Conservancy; Audubon; ConocoPhillips Company; Montana Association of Conservation Districts; Montana Department of Natural Resources and Conservation; Yellowstone to Yukon Initiative; Bureau of Land Management, Idaho State Office; Bureau of Land Management, Wyoming State Office

Infrequent: Blackfeet Tribe; Wind River Band, Shoshone Tribe; Trout Unlimited; other Joint Venture Partners; Western Governor’s Association - each federal caucus agency has treaty and trust responsibilities for tribal resources within their jurisdiction. There are 15 Indian Tribes with trust and treaty rights in the Columbia Basin

3.4 - Are there any other organizations not listed above that your organization directly obtains information about landscape-scale stressors from?

Alberta Environment; Ducks Unlimited Canada; Ducks Unlimited; The Nature Conservancy; University of Washington (Climate Impacts Group); Oregon State University (Oregon Climate Change Research Institute); USGS-Climate Science Centers (Pacific Islands and Pacific Northwest)

3.6 - Are there any other organizations not listed above that have directly influenced your organization’s perspective on landscape-scale stressors?

Strong: National Fish, Wildlife, and Plants Climate Adaptation Strategy; Arctic Goose Joint Venture; Ducks Unlimited Canada; Nature Trust of BC; Ducks Unlimited; The Nature Conservancy

Moderate: Interagency Grizzly Bear Committee; Ducks Unlimited; Western Governor’s Association; Alberta Environment; The Nature Conservancy of Canada; The Nature Conservancy; Arid Lands Initiative; Washington Habitat Connectivity Workgroup

Weak: none
3.8 - Are there any other organizations not listed above that have provided funding to assist your organization’s work on landscape-scale stressors?

Association of Fish and Wildlife Agencies; Ducks Unlimited; Wilburforce Foundation; Kresge Foundation; Turner Foundation; Alberta Environment; Western Governor's Association; North American Waterfowl Conservation Act; USFWS; Bonneville Power Administration; The Nature Conservancy; Mule Deer Foundation; ConocoPhillips Company; PacifiCorps; Bureau of Land Management, Idaho

3.9 - On average, how frequently does your organization interact with the GNLCC per month?

Total contacts per month = 75

Average contacts per organization per month = 4

SD = 6.992

3.10 - Of the thirteen GNLCC Steering Committee meetings/conference calls that have been convened, how may have your organization participated in?

Average number of SC meetings attended = 8

SD = 4.004

3.11 - Are there any organizations that you think should be represented on the Steering Committee, but are not.

Canada First Nations; Yellowstone to Yukon Initiative; Canada Park and Wilderness Society; Ducks Unlimited; The Nature Conservancy; Bureau of Land Management, Idaho and Wyoming
4.1 - How would you rate the GNLCC’s progress on its core objectives?

<table>
<thead>
<tr>
<th>Making significant progress</th>
<th>Making some progress</th>
<th>Not making progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>39%</td>
<td>28%</td>
<td>0%</td>
</tr>
<tr>
<td>Supporting Science Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28%</td>
<td>39%</td>
<td>0%</td>
</tr>
<tr>
<td>Effecting Coordination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0%</td>
<td>56%</td>
<td>6%</td>
</tr>
<tr>
<td>Informing Conservation action</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17%</td>
<td>44%</td>
<td>0%</td>
</tr>
<tr>
<td>Monitoring and Evaluating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39%</td>
<td>28%</td>
<td>0%</td>
</tr>
<tr>
<td>Communicating and Educating</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: non-responses account for sub 100% totals

**Supporting Science Development (Below)**

![Supporting Science Development Chart]

**Effecting Coordination (Below)**

![Effecting Coordination Chart]
Informing Conservation Action (Below)

Monitoring and Evaluating (Below)
Communicating and Educating (Below)

4.2 - How significant an influence has the GNLCC been on the importance your organization gives to addressing landscape-scale stressors?

<table>
<thead>
<tr>
<th>Significance Level</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very significant (1)</td>
<td>17%</td>
</tr>
<tr>
<td>Moderately significant (2)</td>
<td>56%</td>
</tr>
<tr>
<td>Not very significant (3)</td>
<td>17%</td>
</tr>
<tr>
<td>Not significant (4)</td>
<td>0%</td>
</tr>
</tbody>
</table>

Note: non-responses account for sub 100% totals

Average significance = 2 (Moderately significant)
4.3 - How significant an influence has the GNLCC been on your organization’s willingness to participate in collaborative approaches to managing landscape-scale stressors?

<table>
<thead>
<tr>
<th>Very significant (1)</th>
<th>Moderately significant (2)</th>
<th>Not very significant (3)</th>
<th>Not significant (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>22%</td>
<td>28%</td>
<td>33%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Note: non-responses account for sub 100% totals

Average significance = 2.1 (Moderately significant)
4.4 - Has the GNLCC influenced any concrete changes in your organization with regard to landscape-scale stressors?

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>17%</td>
<td>New goals related to landscape-scale stressors</td>
</tr>
<tr>
<td>56%</td>
<td>New collaborations related to landscape-scale stressors</td>
</tr>
<tr>
<td>39%</td>
<td>New research programmes related to landscape-scale stressors</td>
</tr>
<tr>
<td>11%</td>
<td>New specialized staff working on landscape-scale stressors</td>
</tr>
</tbody>
</table>

Non-Cumulative = category totals are non-cumulative since any given article may be classified into multiple non-exclusive categories
4.5 - What factors limit your organization’s ability to fully engage with the GNLCC’s collaborative approach to managing landscape-scale stressors?

<table>
<thead>
<tr>
<th>Factor</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of public support</td>
<td>6%</td>
</tr>
<tr>
<td>Lack of expertise - staff/individuals</td>
<td>17%</td>
</tr>
<tr>
<td>Time constraints - staff/individuals</td>
<td>89%</td>
</tr>
<tr>
<td>Incompatible organizational goals</td>
<td>0%</td>
</tr>
<tr>
<td>Lack interests in/perceived non-importance of landscape-scale stressors</td>
<td>6%</td>
</tr>
<tr>
<td>Organizational/institutional inflexibility</td>
<td>0%</td>
</tr>
<tr>
<td>Lack of leadership</td>
<td>61%</td>
</tr>
<tr>
<td>Funding constraints</td>
<td>0%</td>
</tr>
<tr>
<td>Technological limitations</td>
<td>0%</td>
</tr>
<tr>
<td>Political tension between organizations</td>
<td>0%</td>
</tr>
<tr>
<td>Concern about the GNLCC’s permanence</td>
<td>28%</td>
</tr>
<tr>
<td>Concern about the GNLCC’s collaborative management approach</td>
<td>0%</td>
</tr>
</tbody>
</table>

Non-Cumulative = category totals are non-cumulative since any given article may be classified into multiple non-exclusive categories.
4.6 - What factors increase your organization’s ability to engage with the GNLCC’s collaborative approach to managing landscape-scale stressors?

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>6%</td>
<td>Public support</td>
</tr>
<tr>
<td>44%</td>
<td>Informed staff/individuals</td>
</tr>
<tr>
<td>67%</td>
<td>Time availability - staff/individuals</td>
</tr>
<tr>
<td>28%</td>
<td>Compatible organizational goals</td>
</tr>
<tr>
<td>44%</td>
<td>Interests in/perceived importance of landscape-scale stressors</td>
</tr>
<tr>
<td>39%</td>
<td>Organizational/institutional flexibility</td>
</tr>
<tr>
<td>22%</td>
<td>Strong leadership</td>
</tr>
<tr>
<td>67%</td>
<td>New funding opportunities</td>
</tr>
<tr>
<td>22%</td>
<td>Technological capacity</td>
</tr>
<tr>
<td>17%</td>
<td>Lack of political tension between organizations</td>
</tr>
<tr>
<td>28%</td>
<td>Confidence in the GNLCC’s permanence</td>
</tr>
<tr>
<td>39%</td>
<td>Confidence in the GNLCC’s collaborative management approach</td>
</tr>
</tbody>
</table>

Non-Cumulative = category totals are non-cumulative since any given article may be classified into multiple non-exclusive categories

4.7 - Overall, does your organization view the GNLCC as an organization that is adding value to existing conservation efforts?

Yes = 83%, No = 6%, No answer = 11%

4.8 - Do you think your organization views the GNLCC’s collaborative approach as facilitating a transformation in the way landscape-scale stressors are being managed?

Yes = 61%, No = 33%, No answer = 6%
4.9 - Do YOU view the GNLCC’s collaborative approach as facilitating a transformation in the way landscape-scale stressors are being managed?

Yes = 72%, No = 28%
Appendix E: Social Network Analysis Measures

Types of ties:

- **Binary**: 1 (a tie exists) or 0 (a tie does not exist)
- **Weighted**: A valued tie strength (e.g. weak/strong)
- **Non-directed**: A tie shared by two nodes
- **Directed**: A tie originating from one node and received by another node (can be binary or weighted)

**Density (network level)**: The percentage of actual ties relative to all possible ties. Density gives insight into phenomena such as the speed at which information is able to diffuse through a network.

*Interpretation*: Higher percentage values indicate greater density.

**Density (groups)**: As above, but assessed in relation to groups within a network.

*Interpretation*: Higher percentage values indicate greater within-group density.

**Density (groups weighted)**: The sum of actual tie strengths within a group relative to the theoretical maximum sum of strengths. Provides an indication of how strongly groups are connected.

*Interpretation*: Higher percentage values indicate stronger intra-group relations.

**Connectivity (minimum point connectivity)**: Indicates the number of connections that would have to be removed to isolate a node from the network. Provides an indication of dependency and vulnerability within a network.

*Interpretation*: Higher values imply less dependency and vulnerability. Reported score is the lowest in each respective network.

**Centrality (node level)**: ‘In degree’ is a measure of how many ties are received by a node. ‘Out degree’ is a measure of how many ties originate from a node. In degree provides an indication of a node’s prestige, out degree provides an indication of a node’s influence.

*Interpretation*: High values indicate more ties and greater influence or prestige.

**Centrality (network level)**: An expression of the overall inequality or variance (i.e. overall distribution of high influence and prestige nodes relative to low influence and prestige nodes) in a network. Given as a percentage of a perfectly unequal network.

*Interpretation*: Higher percentage is an indication of greater inequality or variance.

**Betweenness (node level)**: Is a measure of whether or not a node lies on the shortest path between two other nodes. It provides an indication of the degree to which a node is a broker of e.g. information. Such intermediaries are considered to be in a powerful/influential position vis-à-vis divided nodes.
**Interpretation:** Values given as a count of the number of times a node holds a position of ‘betweenness’.

**Betweenness (network level):** Gives an overall indication of the distribution of nodes holding positions of ‘betweenness’ relative to those not in such positions. Provides an indication of relative inequality in control of e.g. information flow within a network.

**Interpretation:** Higher percentage is an indication of greater power inequality in a network.

**Distance (geodesic):** Measure the distribution of shortest paths between nodes. Provides an indication of the overall dispersion or density of ties. A greater number of short ties suggest easier transmission of e.g. information. The largest geodesic distance in a network is used to characterize the network’s diameter, a short hand for the ease or difficulty of e.g. information diffusion in a network.

**Interpretation:** All shortest paths within the network are reported as counts and percentages. Larger link distances imply greater difficulty in e.g. information diffusion, while counts/percentages give an indication of the distribution of tie length in the network.

**Reciprocity (hybrid) (network level):** Measures whether or not ties from nodes are reciprocated (i.e. are undirected). Networks with high levels of reciprocity are thought to be more equal or stable where as low reciprocity is indicative of greater hierarchy in a network.

**Interpretation:** Higher percentage values indicate higher levels of reciprocated ties.

**Clustering (network level):** Measures the density of all nodes’ local neighbourhood, then takes the average density of all neighbourhoods as an indication of the presence of localized clusters within the network.

**Interpretation:** Higher percentages indicate a higher degree of clustering within a network.

**Hierarchy (network level):** Measures vertical differentiation in a network as a function of node ‘connectedness’, reciprocal relations (‘hierarchy’), superior/subordinate connections (‘efficiency’), and the presence of high out degree nodes (‘Least Upper Bound’).

**Interpretation:** Values for each component are reported. Values approaching 1 indicate higher levels of hierarchy. There is no composite score for the four factors.

**Factions:** Identifies factions as a function of maximum similarity (or dissimilarity) in interactions between actors. Provides an indication of stratification in a network.

**Interpretation:** Organizations listed as belonging to one of two factions.

**Two mode factions:** Applies to two mode networks. Identifies factions based on maximum similarity in interactions of actors vis-à-vis a second variable.

**Interpretation:** Presented as a similarity/dissimilarity matrix.

**Cut Points:** Provides an indication of whether or not nodes exist that, if removed, would cause a network to become divided.

**Interpretation:** Reported as number of cut points in network.
Multi-dimensional scaling (MDS) (network level): Applies to network visualization. Positions nodes in space as a function of the strength of relationships among them.

*Interpretation:* Nodes with shorter geodesic distances are located closer in space.