

DISSERTATION

THE STATE OF COLLABORATION: AN ANALYSIS OF FORM AND FUNCTION IN
COLORADO'S NATURAL RESOURCE COLLABORATIVES

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ABSTRACT

THE STATE OF COLLABORATION: AN ANALYSIS OF FORM AND FUNCTION IN COLORADO'S NATURAL RESOURCE COLLABORATIVES

Collaboration remains an important and commonly advocated approach to address increasingly complex, expensive, widespread and contentious problems. Research on collaborative initiatives (henceforth collaboratives) has generated many insights about watershed partnerships, forest collaboratives, and other 'kinds' of collaboratives, often using a small number of cases. Large sample studies and those that compare across collaboratives working in diverse natural resources sectors are much rarer. Few studies assess collaboration at the state level in the United States. I address these gaps by asking the following overarching research questions about collaboratives across the state of Colorado:

- 1) What does the landscape of collaboration look like in terms of the number and location of collaboratives, the problems they address, and their formation, strategies and membership?
- 2) Are there patterns in the underlying natural resource problems that collaboratives arise to address, and how do these problems relate to the other conditions that drive collaboration?
- 3) In what ways are the problems and initial conditions that drive collaboration related to characteristics of collaborative membership characteristics (like breadth and composition), and strategies for collaboratives to achieve their social and ecological goals?

I used a mixed methods, exploratory sequential research design, beginning with qualitative content analysis of documents describing each collaborative to develop codes, followed by qualitative data generation and then quantitative data analysis. I define a collaborative as arrangements of autonomous

actors representing different interests and/or organizational affiliations coming together to pool their resources and create shared goals, processes, and structures to support their joint work.

Following the introduction and literature review in Chapter 1, Chapter 2 presents a descriptive inventory of Colorado's collaboratives. Colorado is rich with collaboratives, with at least 183 having formed between mid-1970s through 2015, with 157 still active as of 2018. Distribution of collaboratives is uneven throughout the state. They use different kinds of boundaries, and range in size from a few square kilometers to multi-state regions, of which Colorado is only a part. In addition to primary natural resource issues (namely fish and wildlife conservation, water quality, forest ecosystem health, wetlands ecosystem health, land use, or water supply), most addresses multiple natural resource, ecological and social sub-issues. Initiating leaders representing upper-level government (tribal/state/federal), local government, non-government, or mixed government/non-government leadership, start collaboratives in similar proportions. Policy related catalysts have driven the majority of collaboratives, but catalysts involving shared risks and crises, as well as non-government incentives, have been on the rise in the last 10-15 years. A rudimentary comparison with other inventories suggests that the composition of collaboratives in Colorado is not remarkably different from other western states, but additional state-level studies will facilitate more robust comparisons.

The focus of Chapter 3 is on initial conditions, or near-term circumstances and issues leading to collaborative formation. Initial conditions include initiating leadership, catalyzing events, the kind of interdependence that brings stakeholders together, and the nature of the problem requiring collaboration. Existing comprehensive frameworks addressing initial conditions are difficult to apply to large sample studies. To address this practical challenge, I integrate insights and assumptions from the literature into a conceptual model relating initial conditions to one another, then develop and test a set of propositions using empirical data from 123 collaboratives in Colorado. Certain catalysts are more likely to trigger collaboration around different natural resource issues and at different spatial scales.

Regulatory concerns and mandates are important catalysts for collaboratives that address strongly regulated natural resource issues, particularly for fish and wildlife, but also for water quality and water supply. Opportunities and incentives play a big role in catalyzing collaboratives focused on forest and wetlands ecosystem health. Catalysts involving risks of future crisis or actual crises do not necessarily correspond to intense localized events—they may unfold over a larger area and longer timescale, but still pose a shared risk that galvanizes collaboration. There are stark differences between collaboratives with collective and competing interdependence, particularly with regard to the social sub-issues they address. Patterns in initial conditions such as those revealed in this Chapter are valuable to consider when planning for or evaluating collaboration. This is because they indirectly influence the ability of collaboratives to achieve successful outcomes via their direct influence on the ability of a group to mobilize, pool, and leverage various kinds of resources and assets (including people) to develop and carry out effective strategies.

Building on this premise, Chapter 4 examines relationships between initial conditions, characteristics of membership, and collaborative strategies. The initial conditions that drive the formation of collaboratives make a difference in the kinds, quantities, and composition of members, as well as for the kinds of strategies they pursue. Increasing scope, scale and complexity of natural resource issues and sub-issues translate to significantly broader representation and larger membership, and decreased likelihood of focusing on action-level strategies like project implementation or monitoring. Primary natural resources shape membership composition, with wetland ecosystem health issues attracting greater non-government participation, water quality and water supply issues attracting greater local government participation, and fish and wildlife issues involving more upper-level government members. Grassroots and local government initiators are similar in that the collaboratives they bring together are often smaller and collectively oriented, and member composition is more likely to reflect the level of the initiator (non-government for grassroots initiators, local government for local government initiators).

Bridging and upper-level government initiators drive collaboratives with broader and larger membership, and they are both more likely to recruit university representatives as members (not just partners). Patterns suggest that water supply, fish and wildlife conservation, and land use may be particularly complex due to their tendency to address a larger scope of issues and to include issues that often involve competing interdependence, such as property rights. Stakeholder analysis and assessment of the context and situation prior to convening collaboratives (while always recommended), may be even more important for these issues. I conclude with reflections on the diversity of collaborative form and function resulting from initial conditions, and the implications of this diversity for theory, practice, and policy.

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DEDICATION

I dedicate this work to my mother Cynthia, the brains of the operation; to my father Jorge, the cloth from which I was cut; and to Turpana Molina, corazón de mi vida.

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CHAPTER 1. INTRODUCTION

Background

In the United States, collaborative approaches to environmental management and governance began to emerge in the 1970s and 1980s, and rose to prominence in the 1990s (Griffin, 1999; Lubell et al., 2002). They arose in part as natural resource managers and decision makers realized that the scale of many conservation and natural resources problems was misaligned with the governance systems in place to manage those problems (Meffe, Nielsen, Knight & Schenborn, 2002). Their rise was also in part due to the public's increasing dissatisfaction with the concentration of control over resources and a desire for a bigger role for the public in natural resource decision-making (McKinney & Harmon, 2004).

Collaboration and collaborative initiatives (hereafter collaboratives) continue to be a commonly advocated and practiced approach for addressing increasingly complex, expensive, widespread and contentious social-ecological problems (Bodin, 2017).

Research on this important phenomenon has generated many important insights, but there is still a need for large sample studies that integrate theory and test assumptions and propositions in the literature (Margerum, Robinson & Genskow, 2016; Poteete & Ostrom, 2008). There is also a need to compare collaboratives operating in different natural resource settings, engaging different kinds of members, and pursuing different kinds of strategies to achieve their mutual goals (Bryson et al., 2015; Koontz, 2016; Moore & Koontz, 2003; Margerum, 2008). The *overarching purpose of this research* is to address these gaps by first qualitatively analyzing 123 collaboratives that formed to work on six different natural resource sectors in the state of Colorado (as found by the end of 2017), and then quantitatively assessing relationships between several attributes that describe them. Using the state as a scale of inquiry is valuable for two reasons. First, there are relatively few studies that focus on diverse kinds of collaborative initiatives at the state level (see Table 1.1 in the literature review). Second, the state

provides a reasonably large sample to explore differences, while reducing the variability of the social and political context from one state to another within which collaboratives operate (Moore & Koontz, 2003). In this large-N study, I explore three overarching questions about Colorado's collaboratives:

Chapter 1: What does the landscape of collaboration look like in terms of the number and location of collaboratives, the problems they address, and their formation, strategies and membership?

Chapter 2: Are there patterns to the underlying natural resource problems that collaboratives arise to address? How are these problems and other initial conditions that drive collaboration related to one another?

Chapter 3: What are the relationships between the initial conditions of collaborative formation, membership characteristics (like breadth and composition), and strategies for achieving social and ecological goals?

Some gaps in our knowledge about collaborative governance

Variations in the arrangements and purposes of collaboratives have proliferated as they have emerged to address new and different kinds of problems (Mandell & Steelman, 2003). Early research on environmental collaboratives tended to present each new 'kind' of collaborative arrangement as a new innovation within a sector of natural resource management, without connecting the dots to collaborative arrangements in other sectors (Koontz, 2016). This makes sense as a necessary step in the field of collaboration research, as it helped define "species" of collaboration and generate theory about each.

For example, watershed organizations have been the focus of great deal of research since the 1990s and continuing through today (see, for example, Diaz-Kope & Miller-Stevens, 2014; Griffin, 1999; Hardy & Koontz, 2009; Imperial, 2005; Koontz & Newig, 2014; Leach & Pelkey, 2001; Lubell et al., 2002; Sabatier et al., 2005; Scott, 2015). Watershed groups range from loose networks to formal organizations linking

public, private, and non-profit stakeholders working together with the intent of improving the condition of water and water-related issues within a localized area, usually defined within a watershed boundary (Clark, Burkhardt, & King, 2005; Diaz-Kope & Miller-Stevens, 2014; Kenney, McAllister, Caile & Peckham, 2000; Ryan & Bidwell, 2006). Forest collaboratives are usually described within a framework of community forestry, an idea that link forest ecosystem health with social-economic wellbeing (Sample & Cheng, 2004). In Colorado, where most of the forested land is on federally owned public lands, forest collaboratives are organizations or coalitions (which may include public, tribal, private, non-profit organizations, timber or non-timber forest products industry representatives, and individuals) working on shared goals to complement the work of public land management agencies like the U.S. Forest Service (Charnley & Poe, 2007; Cheng, Danks & Allred, 2011). Forest collaboratives are often described as having a rural focus with a goal of poverty alleviation (Charnley & Poe, 2007). However, these collaboratives are increasingly focusing on wildfire risk, particularly in areas experiencing growth into the wildland urban interface, or WUI (Paveglio et al., 2015).

Differences in the nature of the problem that collaboratives form to address can lead to quite different permutations of collaborative solutions (Mandell & Steelman, 2003). Characteristics of formative problems influence the likelihood of collaboration (Poteete, Janssen & Ostrom, 2010); as well as a collaborative's purpose, membership, and structural characteristics once formed (Bryson et al., 2006; Emerson, Nabatchi & Balogh, 2012; Huxham, 2000; Imperial & Koontz, 2007; Lober, 1997; Poteete et al., 2010). That said, there is little cohesion in the literature related to defining the nature of the problem. Some authors emphasize biophysical characteristics of the problem and subsequent implications for property regimes and problem framing (Hinkel et al. 2015; Ostrom, 2007; Ostrom & Cox, 2010). Others focus on scalar characteristics of the natural resource problem, like the spatial and temporal scale at which they emerge or are defined (Cumming et al., 2015; Emerson & Nabatchi, 2015); or the scales from which demands are placed on the resource or at which jurisdiction over the resource lies (Adger, Brown

& Tompkins, 2005). Others focus more on ways in which the issues are salient to different stakeholders (Koontz & Bonnell, 2007; Lober, 1997; Selin & Chavez, 1995). Several authors have pointed to the need to understand how aspects of collaboration differ across problem contexts (Bodin, 2017; Bryson et al., 2015), but to do so requires greater clarity in defining the nature of the problems that collaboratives form to address (Emerson & Nabatchi, 2015).

There are now several comprehensive frameworks available that provide the “intellectual scaffolding” to specify sets of concepts or variables and relate them to one another (e.g. Ansell & Gash, 2008; Emerson et al., 2012), as well typologies and taxonomies of collaboratives (e.g. Cheng & Daniels, 2005) that help define attributes, and classify and compare cases across diverse settings (Koontz, 2003; Koontz, 2016). One gap in our knowledge (Margerum, Robinson & Gensow, 2016) is a better integration of the insights generated by typologies and frameworks. This will improve our ability to identify patterns across diverse settings and to add "rigor and systematization to loose collections of lessons learned" (Koontz, 2016, p.72).

Decades of case study and small sample research on the phenomenon of collaboration and its organizational manifestations have generated theories, assumptions, and propositions about how collaboration works. However, Poteete and Ostrom (2008) call for more large sample empirical research studies, which are valuable for testing these ideas about how aspects of collaboration differ across problem contexts (Bodin, 2017; Bryson et al., 2015; Emerson & Nabatchi, 2015). Contrasting a broader set of collaboratives could contribute to “a richer understanding of the various permutations of interorganizational arrangements, as well as a better map of the interorganizational landscape," (Mandell and Steelman, 2003, p. 199). When I began this research effort in 2014, there were few examples of studies contrasting large samples of different kinds of collaboratives, and there are still relatively few examples (discussed further in the literature review below).

Literature review

This literature review begins with a description of collaboration, collective action, and collaborative governance, emphasizing definitions (as this is an important aspect of this study). It then provides a review of findings from other large sample studies of collaboration; followed by theories about collaborative formation, initial conditions, and how they influence membership and strategies.

Collaboration, collective action, common pool resources and common property regimes

Collaboration brings autonomous stakeholders in a problem domain together to explore, deliberate on, and possibly implement solutions that they develop through a process structured by rules and norms (Gray, 1989, Wood & Gray, 1991). The creation of formal and informal rules to guide collective behavior result in what Imperial and Koontz (2007) call second order organizations, “whose membership includes other organizations and possibly individuals with no organizational affiliation” (p. 5). While these intensive processes can be ephemeral (such as temporary task forces), the arrangements they generate can also give rise to more durable collaborative initiatives (henceforth collaboratives), such as long-term partnerships, councils, or coalitions (Imperial & Koontz, 2007; Mandell & Steelman, 2003). These arrangements also help collaborators overcome the problems caused when natural resources require collective action to be solved. Collective action is challenging because of the “increased transaction costs in negotiating solutions as the number of parties increases. At a certain point, it’s simply too difficult to reach consensus agreement” (Rasband, Salzman & Squillace, 2009, p. 40). Transaction costs are non-monetary costs of interaction among stakeholders of collective action that might arise from the need to negotiate, gather information, monitor or sanction behavior (Sabatier et al., 2005).

Scholars studying common pool resources have generated a great deal of theory and insights about collaboration in natural resource management (Cox, Arnold & Tomás, 2010; Imperial, 1999; Ostrom, 2008). Common pool resources are natural resources where it is difficult for users to ‘exclude’ each

other from using a natural resource. Joint use causes resource users to diminish the availability of the resource for the next user, also known as 'subtractability' problems (Ostrom, 1990). Appropriation problems refer to these combined excludability and subtractability problems. People create common property regimes (systems of ownership and access rights) to address appropriation problems, by controlling access and creating rules to deal with differences between individual and collective motivations (Berkes, Folke & Colding 2000).

These common property regimes are a system of rules of access and use among a set of actors in an ownership group (Cole & Ostrom, 2012). Ostrom (1990) proposed eight "design principles" that essentially pose a set of theorems for explaining the conditions under which collective action solutions to common pool resource problems can be maintained. I highlight the first three, which are related to the nature of the problems that lead to collective action. The first is the condition that boundaries are clearly identified for the resource system and include within them the actors that enjoy the right to access and extract the resource units within the system. The second principle prescribes alignment between the mechanisms of appropriation and provision. That is, the rules related to how much of the resource can be taken (as well as when and how it can be harvested) should be reflected by the rules associated with maintaining the resource and its delivery, so as to avoid waste, over-extraction, and other inefficiencies. Additionally, these rules should be appropriate for local conditions. The third principle pertains to the ability of resource users (those affected by appropriation and provision rules) to access and influence the processes through which those rules are made (Ostrom, 1990).

Like common pool resources, public good resources are resources with low excludability, but they also have low subtractability, which creates a different kind of problem. *Provisioning problems* are those in which incentives must be developed to prevent individuals in a group from free-riding on the efforts of others who are trying to collectively provide, maintain, or improve a public good. Regimes for managing public goods (when they exist) often involve government regulation to protect or subsidize their

provision, since their benefits may otherwise be underproduced or inadequately captured by markets (Doremus, 2003). Government regulations and incentives are critical for the provision of public goods, and often spur collaborative initiatives to form either as a complement to their efforts or as attempts to prevent or delay government intervention. The majority of collaboratives in Colorado are addressing provisioning problems rather than appropriation problems.

Community based natural resource management and collaborative conservation

Collective action and common pool resource theory (as well as social capital theory) inform much of the literature on community-based natural resource management (CBNRM). CBNRM is a management system in which some level of authority has been devolved to local-level entities consisting of resource users or stakeholders, allowing them to manage resources in a way that benefits their livelihoods by sustaining health of the resource (Bixler, 2014; Fernández-Giménez, Batkhishig, Batbuyan & Ulambayar, 2015). Such groups may feature representation from higher levels of authority, but not necessarily. Those that do may fall into the category of co-management, which according to Cash et al. (2006) is “a continuum of arrangements that rely on various degrees of power and responsibility sharing between governments and local communities” (p. 8). Like other forms of collaboration, they are voluntary efforts to influence provision or appropriation of a resource or resource system, and some measure of breadth of representation is anticipated (though this may depend on the nature of the situation). Dukes et al. (2011) add a criterion that CBNRM initiatives must be initiated from within the local community, though examples of externally initiated CBNRM groups can be found in the literature (for example, see Fernández-Giménez et al., 2015).

Collaborative conservation is a process or series of efforts to bring stakeholders who may hold diverse, adversarial or opposing views on an issue of concern together to work toward solutions to intractable problems that link the social well-being with environmental conditions or outcomes (Barker et al., 2003;

Brick, Snow & Van de Wetering, 2001; Sousa & Klyza, 2007;). It is generally thought of as a movement that emerged in the western United States after protracted conflict with the federal government over public lands management, though the study of collaborative conservation shares academic roots with CBNRM in international participatory development strategies (Conley & Moote, 2001; Sousa & Klyza, 2007). It draws on theories of Jeffersonian or participatory democracy, collaboration theory, alternative dispute resolution, environmental conflict resolution, New Federalism, second generation public policy, ecosystem management, and adaptive management (Conley & Moote, 2001; Nie, 2008).

Collaborative conservation is closely associated with collaborative environmental governance and management, which emphasize collaboration as a particular approach to influencing public policy related to the environment (in contrast to, for example, litigation, public outreach campaigns, or the creation of market-based or behavioral incentives). To clarify, management involves operational decision-making to achieve specific outcomes, whereas governance refers to the broader processes and institutions that societies employ to make decisions that affect the environment. They are not mutually exclusive concepts—management interventions can be thought of as nested within policy and policy within governance. They all involve uncertainty, negotiation, deliberation, and sensitivity to social-ecological dynamics at different scales (Armitage, Loe & Plummer, 2012).

Collaborative governance initiatives are "public policy or service oriented, cross-organizational systems involving a range of autonomous [entities] representing different interests and/or jurisdictions (as opposed to like-minded coalitions)" (Emerson & Gerlak, 2014, p. 769). While authors in this field often acknowledge an important role for local, community-level stakeholders, the focus is often on cross-sector collaboration between representatives of governments and non-government or private sector organizations. For example, in their definition of collaborative governance (i.e., processes that formally engage combinations of actors from public, private, and civic arenas to deliberate collectively on decisions), Ansell and Gash (2008) emphasize that such fora are initiated by public agencies or

institutions, and that the ultimate aim is consensus. Emerson et al. (2012), are less restrictive in their definition of collaborative governance, but do stress that the processes cut across jurisdictional boundaries and levels.

Margerum (2008) draws on several authors to develop his definition of collaborative environmental management, which is a "paradigm of environmental planning and management" involving a broad and inclusive stakeholder base engaged in an intensive and sustained process of problem solving to achieve consensus on environmental goals. The importance of consensus as a core element of collaborative enterprises is inconsistent and contentious in the literature. Consensus, at least as a goal, is emphasized by authors like Gray (1989) and Wondolleck and Yaffee (2000), but others deliberately avoid the consensus criterion. Daniels and Walker (2001) developed the collaborative learning concept based on the predicates that conflict is inevitable but manageable, that collaboration is required to deal with complexity and 'wicked problems', that the greatest value of collaborative processes are the opportunities they provide for learning, and the decision-making process should be understood as a learning process if appropriate decisions are to be made in complex settings. It takes a more pluralistic approach to collaboration and does not demand consensus. It also differs from other approaches in the collaboration family in that it strives for improvement and targets progress in a given situation, rather than an ultimate solution. With roots in public deliberation and grounding in theories of learning, conflict management, and systems thinking, collaborative learning seeks to balance the conflicting demands of social legitimacy, that is, the expectation of rational and technically sound decisions on the one hand, and on the other adequate opportunity for those who may be affected by public policy to substantively weigh in on its content.

Findings from other large-sample studies of collaboratives in the U.S.

This large sample study is unique (so far, and to the best of my knowledge) in its scale of analysis (state-level) and in the variety of natural resources areas it compares across (water quality; water supply and

administration; wetland and riparian ecosystem health; forest ecosystem health; land use; and fish and wildlife conservation). In preparing for this study I encountered several excellent inventory studies (in both the gray and white literature) that analyzed large samples of more narrowly defined varieties of collaboration, such as watershed groups (Clark, Burkhardt, & King, 2005; Kenney et al., 2000; Scott, 2015); forest and public lands groups (Schuett, Selin & Carr, 2001); rangeland stewardship collaboratives and weed cooperatives (Davis et al., 2017; Fernández-Giménez, Le Febre, Conley & Tendick, 2004; Hershdorfer, Fernández-Giménez & Howery, 2007); large landscape collaboratives (McKinney & Johnson, 2013); and community-based natural resource organizations (Abrams, David & Mosely, 2016; Davis et al., 2012; Mosely et al., 2011) (Table 1.1).

There are several state wide studies, but they focus on examples of collaboration within a particular natural resource sector in each state, and one focuses on organizations that are in environmental advocacy, rather than collaborative governance (see methods section in Chapter 2 for a detailed definition of collaboratives). For example, a report by Davis et al. (2012) identified and compared collaborative capacity of 18 community-based natural resource management organizations (not including watershed councils) in Oregon. Moore and Koontz (2003) surveyed 64 watershed groups (i.e., collaboratives defined at the watershed scale) in the state of Ohio, and Bidwell & Ryan (2006) studied 29 watershed groups in Oregon. The only published example found that incorporates a similarly inclusive set of collaboratives to ours identified 107 rangeland-focused collaboratives in Arizona, including ranch planning teams, landscape-level coordinating groups, agency-initiated planning teams, advisory groups, and weed management groups (Fernández-Giménez et al., 2004). Andrews and Edwards (2005) identified organizational characteristics for 738 environmental advocacy organizations in North Carolina.

Table 1.1. Examples of large sample studies and inventories of collaborative initiatives in the US, the focus of each study, the type of document reporting the study, focal region within the U.S., and the number of groups included in the study. “PRJ” = peer-reviewed journal article, “WPR” = working paper or report.

Reference	Focus of Study	Document	Focal Region	# Groups
Andrews & Edwards, 2005	Environmental Advocacy Organizations	PRJ	North Carolina	738
Belton and Jackson-Smith, 2010	Sage-grouse Local Working Groups	PRJ	U.S. West	53
Clark, Burkardt, & King, 2005	Watershed groups	PRJ	U.S.	211
Coughlin et al. 1999	Collaborative Partnerships	WPR	U.S.	450+ identified, 10 analyzed
Davis et al., 2012	CBNRM Organizations	WPR	Oregon	18
Davis et al., 2017	Rangeland Fire Protection Associations	WPR	Oregon and Idaho	31
Fernández-Giménez et al., 2004	Rangeland stewardship collaboratives	PRJ	Arizona	107
Hershendorfer, Fernández-Giménez & Howery, 2007	Weed management groups	PRJ	U.S. Southwest	53
Kenney et al., 2000	Watershed partnerships	WPR	U.S. West	346 identified, 118 analyzed
Lubell et al., 2002	Watershed partnerships	PRJ	U.S.	958
McKinney & Johnson, 2013	Large landscape collaboratives	WPR	U.S. West	71
Moore & Koontz, 2003	Watershed Groups	PRJ	Ohio	64
Mosely et al., 2011	CBNRM Organizations	WPR	U.S. West	92
Schuett, Selin & Carr, 2001	Forest and Public Lands Collaboratives	PRJ	U.S.	30
Scott, 2015	Watershed Groups	PRJ	U.S.	357
Yaffee et al. 1996	Ecosystem Management Projects	WPR	U.S.	619 identified, 105 analyzed

There are several studies that look at collaboratives at a U.S. national level, focusing on specific natural resource problem sectors and examining different characteristics of collaboratives. Clark et al. (2005) conducted a survey of watershed management organizations to assess characteristics similar to those assessed here (such as catalysts and membership attributes), yielding a sample size of 211. Their findings revealed significant differences between groups in the eastern and western U.S., with western groups having later years of inception, higher operating budgets, smaller membership size, and greater proportion of state and federal representatives within membership. Belton and Jackson-Smith (2010) assessed 53 sage-grouse local working groups in the western U.S., and found that successful groups had

local authority to implement plans, a neutral facilitator, early stage accomplishments (like improving relationship and developing a management plan), and a sense of participant ownership. Scott (2015) assessed the effectiveness of collaborative watershed management on environmental outcomes in 357 watersheds across the continental U.S., and then analyzed how outcomes related to the design and implementation characteristics of those watershed groups. This study showed that watershed groups achieved reductions in chemical pollutants and turbidity, and improved in-stream habitat complexity. Groups with formal management authority (i.e., decision-making, permitting, and enforcement) were more effective at achieving environmental outcomes than those that only did planning or coordination.

There are also large-sample national or regional-level studies presented outside of peer-reviewed journal articles in reports and working papers. For example, Kenney et al. (2000) identified 346 watershed partnerships (multi-stakeholder groups focused on water-related issues) in the western U.S. Of these, they collected survey data for 118 cases (17 from Colorado) to describe attributes such as year of formation, initiator, issues, member characteristics, activities, and organizational characteristics. Two studies compare across natural resource problem sectors that do not include a water resources focus. Yaffee et al. (1996) identified over 600 ecosystem management projects across the U.S. (characterized as landscape scale efforts to protect ecosystem health that also address economic issues and emphasize building trust between stakeholders). They used interviews and surveys to collect data on 105 cases, and described attributes including year of formation, catalysts, membership and organizational characteristics. Moseley et al. (2011) surveyed 92 community-based collaborative organizations in the western U.S., which they defined as groups with locally-oriented missions that incorporate natural resource issues, including both nonprofits and informal collaborative groups. Their assessment included issues, strategies, spatial scale, and some membership attributes, but primarily focused on indicators of capacity, like number of paid staff and budget characteristics (for example, they found that most of

these groups operate with low staff capacity and funding). I contrast some of these large sample studies to my own findings in the next chapter.

Why and how collaboratives form

Collaboration arises when context- and time-dependent factors align to motivate collective action. A well-established body of theory points to several key antecedents to collaboration (Bryson et al., 2006; Kingdon, 1984), which can be roughly grouped as 1) contextual characteristics that might make collaboration a more likely solution than other arrangements or public policy solutions, and 2) near-term initial conditions that trigger collaboration.

Contextual factors set the scene for collaboration. Contextual factors are conditions related to the environment in which the initiative is embedded, such resource conditions, policy and legal frameworks, history of conflict, socio-economic and cultural conditions, network connectedness, and power relations (Bryson et al., 2006; Lober, 1997; Emerson et al., 2012). Early conceptual frameworks used information-rich cases to trace convergences of 'streams' of contextual factors to explain why collaboration happens. The collaborative forming model (Lober 1997), adapted from the policy windows model of Kingdon, (1984), describes a *problem stream* as some undesirable state that must first manifest (through scientific observation, crisis, issue salience, or by otherwise drawing attention) before it can trigger collaboration. The problem stream exists alongside other streams that contribute to the overall likelihood of collaboration: the policy stream (relevant policies and institutions that guide behavior related to the problem stream); the organizational stream (such as trends in cooperation or willingness to address the problem); and the social/political/economic stream (such as trends in public opinion regarding the problem). In this model, a *collaborative window* opens up when these four streams converge, and collaboration can occur *if* there is a collaborative *entrepreneur* with the necessary resources and networks that recognizes the window of opportunity and acts upon it by mobilizing others to collaborate

(Lober, 1997). In addition to influencing the likelihood of collaboration by presenting general opportunities and constraints, context can continue to influence collaborative interactions and outcomes as new opportunities and constraints arise (Emerson et al., 2011).

On the other hand, *initial conditions* are more proximate circumstances that are essential to collaborative formation (Bryson, Crosby & Stone, 2015; Coughlin et al., 1999). This analysis focuses on initial conditions rather than on contextual factors that lead to collaboration (as described above), because initial conditions are more measurable across a large number of cases, as used here. The Integrative Framework for Collaborative Governance Regimes (CGR Framework, Figure 1.1) (Emerson et al., 2011; Emerson & Nabatchi, 2015) synthesized a large body of research on the necessary pre-conditions of collaboration and grouped them into four broad categories of what they refer to as “drivers”: uncertainty, interdependence, consequential incentives, and initiating leadership. It is important to note that the meaning of the term driver differs across disciplines. Drivers in social-ecological systems are variables that originate at higher scales outside the system (however that system is defined) (Walker et al., 2012). I use the term *initial conditions* because its definition is broad enough to accommodate actual drivers as well as system properties and relationships theorized to be essential to the formation of collaboratives. However, the location of drivers within the CGR Framework (linking the external system context to the internal system of collaborative governance and feeding directly into collaboration dynamics, Figure 1.1), is where I situate initial conditions. Before briefly touching on the other elements of the framework (which are relevant but not central to this study), I describe the initial conditions (Figure 1.1).

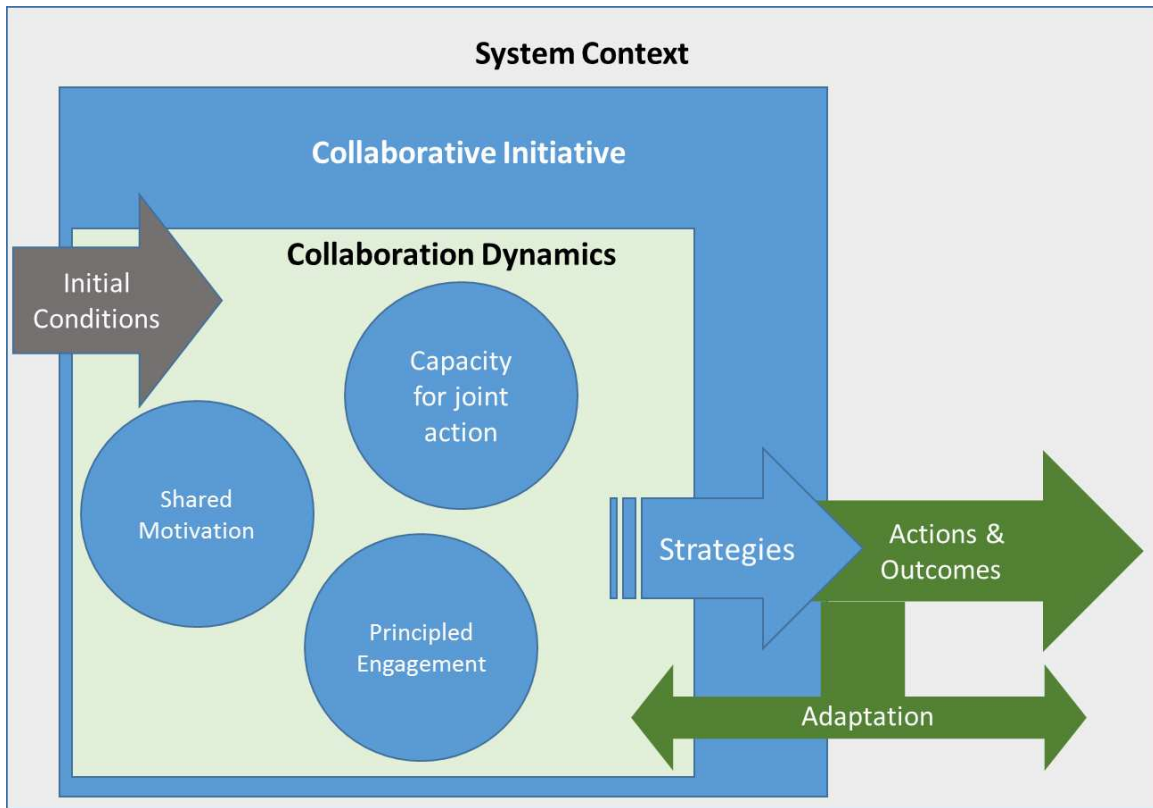


Figure 1.1. The Integrative Framework for Collaborative Governance (or CGR Framework, adapted from Emerson, Nabatchi & Balogh 2012; Emerson & Nabatchi 2015). The authors’ original term “drivers” is changed in this study to “initial conditions,” and “strategies” is added as a precursor to actions and outcomes.

Uncertainty (also described as turbulence in the institutional or organizational environment in early research on collaboration, see Gray, 1989) can drive collaboration when it serves to reduce, diffuse, or share risk or improve information. A similar concept included in the Diagnostic Social-Ecological Systems Framework is the “unpredictability” of patterns associated with resource flows, which has been found to influence the likelihood of collective action (Poteete et al., 2010). I acknowledge the importance of uncertainty as driver of collaboration, but I did not include this dimension in my model, as it was difficult to assess using my methodology.

Interdependence between stakeholders increases the likelihood of collaboration (Gray, 1989), as when collaborators must rely on one another to access information, funding, or other resources (Huxham,

2000); when other independent solutions have failed (Bryson et al., 2006); or when key actors recognize that the challenge cannot be addressed individually and requires joint action (Emerson et al., 2011). This latter aspect of interdependence has also been interpreted as general agreement on the problem, the theory being that general agreement clarifies stakeholder interests and lowers barriers to collaboration (Gray, 1989; Bryson et al., 2006).

Scholars at the nexus of social network and game theory lend more clarity to the concept of interdependence by examining differences in the relationships between actors in high or low risk situations (meaning risk of defection by actors in collective action settings, rather than risks presented by the environment). In terms of network components, these relationships are ties linking different nodes (individuals or organizations) in the network. Relationships between nodes belonging to different groups (out-group linkages) are called bridging ties, while within-group relationships are called bonding ties. Bridging ties are theoretically weak, but facilitate the efficient transmission of novel information and innovation. Bonding ties tend to be stronger, facilitating the flow of redundant information that builds trust and credibility over time (Granovetter, 1973). Network theorists distinguish between two categories of problems regarding the nature of interdependence that motivates collective action: coordination and cooperation problems (Berardo, 2014; Berardo & Scholz, 2010; Bodin, 2017). In coordination problems, stakeholders more or less agree on what they want to accomplish together, and collaboration arises from the need to align goals, actions, resources, and so forth. Theory suggests that, in these scenarios, risk of defection is lower because stakeholders share interests, and that the formation of bridging ties to share information efficiently will predominate (Berardo & Scholz, 2010). In cooperation problems, stakeholders have different interests, and reaching agreement requires some negotiation and even potential tradeoffs. Hence, the risk of defection is higher, and theory posits that greater emphasis will be placed on developing bonding ties, since they can deter defection through “reputational costs” (Berardo, 2014, p. 240).

While I did not have enough information for each collaborative to apply social network analysis techniques, I did borrow this typology of coordination or cooperation problems to characterize observations that emerged from the data about the nature of the **interdependence** between stakeholders that motivated collaboration. I use the terms **collective** and **competing** to refer to these differences between interdependence rooted in ‘coordination’ and ‘cooperation’ to avoid conflation with overlapping terminology in related literature. Namely, coordination and cooperation can also refer to distinct governance arrangements along a continuum of ‘ways of working together’ (i.e., competition, coordination, cooperation, collaboration, and consolidation) presented in Keast’s (2015) framework of inter-organizational working arrangements. The terms are also common descriptions of collaborative strategies or activities (e.g., Margerum, 2008), which I address throughout this study. Collaboratives with collective interdependence come together to meet shared needs and achieve mutually beneficial results; stakeholders may disagree on other points, but agreement is usually higher early on about problem definition. Collaboratives with competing orientation cooperate across divergent or conflicting interests and needs, and a partial aim of collaboration may be to resolve differences in values or perceptions of the problem, build trust, or to negotiate tradeoffs between stakeholders. Competitively-oriented stakeholders may recognize their interdependence to the extent that collaboration is initiated, but their differences (lack of shared interests) can increase transaction costs of collaboration (Poteete et al., 2010).

In the CGR Framework, **initiating leadership** drives collaboration when one or more individuals recognize the presence of the other drivers and motivate other players to coordinate and come together to address the problem (Emerson et al., 2012). This concept is similar to collaborative or policy *entrepreneurs* (Lober, 1997; Kingdon, 1984) and *champions* (Selin & Chavez, 1995). Some of the proposed characteristics of actors that serve as initiating leaders pertain to individual skills and traits, like vision, energy, and charisma (Selin & Chavez, 1995). However, the ability to recognize the opening of

a collaborative window or the confluence of other drivers also depends to some extent on the position of the individual(s) relative to the problem. That position may be defined by their jurisdictional responsibilities and authority, vested or official interests, knowledge and expertise, professional networks, ability to absorb high transaction costs and provide the necessary resources to get collaboration off the ground (Takahashi & Smutny, 2002; Lober, 1997; Purdy, 2012). These characteristics can also be thought of as scale-dependent comparative advantages (Cash & Moser, 2000) of actors at different levels on jurisdictional, management, knowledge, network, or spatial scales, depending on the nature of the problem (Cash et al., 2006).

Collaboration is usually triggered in response to events or situations, called **catalysts** (Prokopy et al., 2014). Catalysts focus attention on the problem as stakeholders recognize the salience and relevance of the problem to their interests (also called policy or collaborative windows (Kingdon, 1984; Lober, 1997)). It may be a biophysical crisis (fire or flood) or threat of future crisis (dying forests) that drives partners to action; or it may be conflict or uncertainty in the social, political, or economic environment (Gray, 1989) that gets people to the table. However, there are cases when collaboration may be a good fit for a problem, but for whatever reasons collaboration does not self-organize. In these instances, mandates, recommendations, and incentives play a bigger role in catalyzing collaboration. In either case, a sense of urgency is still considered an important ingredient for catalyzing collaboration (Wondolleck & Lurie, 2016). In the CGR Framework, catalysts are part of what the authors call “consequential incentives,” defined as “external (situational or institutional crises, threats, or opportunities) drivers for collaborative action,” (Emerson et al., 2011, p. 9).

The other aspect of consequential incentives involve “internal...problems, resource needs, interests, or opportunities,” (Emerson et al., 2011, p. 9), which is my point of departure for developing the **nature of the problem** concept. Scholars across disciplines acknowledge that biophysical and social characteristics of the natural resource problem influence the likelihood of collaboration, as well as its eventual form

and function (Bodin, 2017; Bryson et al., 2015; Kingdon, 1984; Koontz et al., 2004; Poteete et al., 2010; Ostrom, 1990). As noted earlier, however, the concept still lacks clarity. For example, Emerson and Nabatchi (2015), describe ‘the nature of the policy challenge’ as problems or undesired conditions that give rise to collaborative initiatives. The authors characterize the policy challenges as a function of the “range and intensity of their outcomes” (p. 165), which they label as acute, complex, or extensive. An acute policy challenge is a localized problem that is experienced by a diverse but narrow set of stakeholders “in extreme and severe ways” (p. 165). A complex policy challenge is experienced by a broader set of stakeholders with a more varied set of perspectives, and is thus prone to greater contention. An extensive challenge is experienced repeatedly or across multiple settings such that it “warrants similar approaches for policy and governance” (165). While intuitively appealing, the authors provide little guidance for consistent classification or measurement of these challenges (in part because the typology is intended for broad use across disciplines). Thus, for this dissertation, I had to clarify and operationalize this concept as the ‘nature of the problem,’ which I describe in the following paragraphs.

Social-ecological systems (SES) scholarship provides some excellent examples of highly specific frameworks for describing and comparing the nature of the problem. Perhaps best known is the Diagnostic SES Framework (Ostrom 2007, 2009), developed to describe and compare cases of complex SES addressing common pool and collective goods problems. The SES Framework incorporates elements of the Institutional Analysis and Development Framework (namely, “action arena,” which consists of interactions between an action situation, or game, and its participants) with interactions and outcomes into a focal ‘action situation’ and divides the SES into four interacting core subsystems: the resource system, resource units, the governance system, and the system’s resource users. Each subsystem consists of nested, multi-tiered variables that used to describe and compare variations in interdependencies between actors and their environment, as mediated through biophysical, social, and institutional parameters (Hinkel, Cox, Schlüter, Binder & Falk, 2015). In their comparison of 12

frameworks for analyzing social-ecological systems, Binder et al. (2013) found the Diagnostic SES Framework (Ostrom, 2007; 2009) was best suited for consistent collection and sharing of data, that it did a better job of treating the social and ecological in relatively equal depth, that it is flexible and provides a mechanism for developing different degrees of specificity, and that it has potential for wide application. For these reasons, the SES Framework was influential in the conceptualization and shaping of the ideas underlying much of this research. However, the unit of analysis at the center of this framework is an action situation within the SES, and not an institutional or organizational unit like a collaborative initiative. The action situation consists of seven working parts ranging from the set of actors and their allowable actions to the set of potential outcomes and amount of information available to actors (Ostrom & Cox, 2010). A collaborative initiative defined in this way consists of multiple action situations over time, each with its own set of parameters. This, combined with the number of potential variables contained within each sub-system needed to adequately characterize a social-ecological system, make it challenging to apply to a large number of cases. Still, the Framework synthesizes many factors that can also be applied to describe natural resource organizations, which I draw upon for my own models throughout this study. From this framework, I adapt the core elements of the nature of the problem: **boundaries**, **spatial extent**, and **primary natural resource issues**.

The first element of the nature of the problem is geographic **boundaries**, which define the collaborative's 'territory' and resources of concern. I use the area within the boundary to characterize the second element, **spatial extent (in acres or whatever unit you used)**, which a proxy for the target spatial scale that the collaborative has agreed to work within. Boundary definition is a political process that may reflect power relations, group identity, and even the values of concern to the collaborative (Cheng & Daniels, 2005; Cumming, Cumming & Redman, 2006). The definition may be decided by initiating leaders (as with some collaboratives catalyzed by mandate, like the Resource Advisory Councils

and Basin Roundtables), or may be negotiated and shaped during the collaborative process through the collaborative (Emerson & Nabatchi, 2015).

Collaboration to achieve environmental management, governance, and conservation objectives is undertaken at many spatial scales, from local or community level to trans-national. Increasing extent may improve the ability of collaboration to 'fit' the scale of the problem, which is one of the benefits of collaboration over earlier, jurisdiction-based management approaches (Cash et al., 2006; Griffin, 1999). However, increasing the level of spatial scale at which collaboration takes place can also increase barriers to diverse participation in collaboration by simultaneously increasing heterogeneity of values, economies and politics represented by participants, which require the accommodation of appropriately scaled decision-making structures (Heikkila & Gerlak, 2005; Kark et al., 2015). This tension between fit and participation has been called the paradox of scale in collaboration (Cheng & Daniels, 2005).

The term **issues**, the third element of the nature of the problem, is quite broad, which is helpful for this study given the diversity of collaboratives analyzed and variety of ways they frame the problems they are addressing. For example, collaboratives may describe targets or physical elements of the ecosystem or social-ecological system of concern; or the values, threats, and concerns they have prioritized; or their collective goals or desired changes in environmental or social conditions. To help classify broadly defined problems, I categorize issues into three types: natural resource issues, social sub-issues, and ecological sub-issues.

The third element in the nature of the problem, primary resource issue, is often defined by the natural resource sector. These sectors differ in terms of the kinds of management challenges they face (Rasband, Salzman & Squillace, 2009; Guerrero, Mcallister, Bodin & Wilson, 2015). For example, extractive renewable resources like timber or surface and groundwater involve challenges of sustaining yield, avoiding over-appropriation, or allocating fairly among users. Ecosystem services (or non-

extractive renewable resources like water quality, habitat and biodiversity, and the avoided costs generated by healthy forest and riparian ecosystems) face market failures when the positive externalities (values) they generate are not captured by the market. They often have weak or non-existent legal protection and involve problems of scale presented by jurisdictional boundaries. Intrinsic, recreational and aesthetic values provided by public lands and community open spaces face problems of congestion and ensuring use and equitable access to resources at levels that can sustain the value of the experience (Rasband et al., 2009). In reality, resource problems are usually an aggregate of several sub-problems, and many collaboratives address multiple issues of varying complexity (Bodin, 2017).

I adapted the initial conditions concepts described above, along with theory about the nature of the problem that collaboratives form to address, into a conceptual model (Figure 1.2) with measurable variables to guide my inquiry for the third chapter (described below).

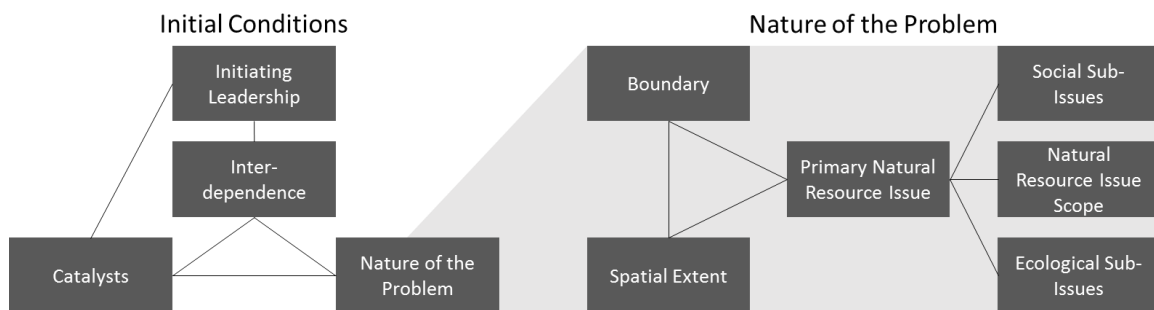


Figure 1.2. Conceptual model of: 1) the initial conditions that characterize the formation of collaboratives (left), and 2) the variables related to one of the initial conditions concepts, ‘the nature of the problem’ (right). Links indicate relationships analyzed.

How initial conditions influence membership and strategies

The final analytical question of this dissertation is concerned with relationships between the initial conditions described above and two important aspects of collaboration: membership and strategies (and their relationship to one another, as illustrated in Figure 1.3).

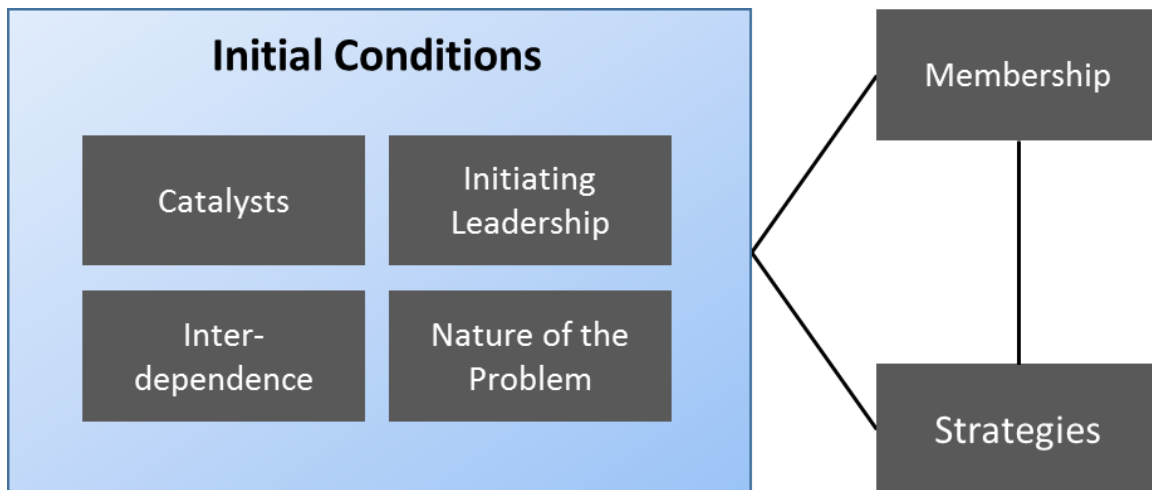


Figure 1.3. Conceptual model of relationships between initial conditions, membership, and strategies. Connecting links indicate relationships of interest.

In order to explain the theoretical processes behind these relationships, I return to some of the concepts presented in Figure 1.1. Emerson et al. (2012) elaborate three rather comprehensive key components of collaborative dynamics (presented as three blue circles within Figure 1.1). The authors refer to the first component as *principled engagement*, comprised of four broad processes. The first is *discovery*, which involves the “revealing of individual and shared interests, concerns and values, as well as to the identification and analysis of relevant and significant information and its implications”. The next, *definition*, involves “the continuous efforts to build shared meaning by articulating common purpose and objectives; agreeing on the concepts and terminology participants will use to describe and discuss problems and opportunities; clarifying and adjusting tasks and expectations of one another; and setting forth shared criteria with which to assess information and alternatives”. *Deliberation* involves “candid and reasoned communication...” whose quality “depends on both the skillful advocacy of individual and represented interests and the effectiveness of conflict resolution strategies and interventions.” Finally, *determination* includes “procedural decisions, e.g. setting agendas, tabling a discussion, assigning a work group, and substantive determinations, e.g. reaching agreements on action items or final recommendations” (Emerson et al., 2012, p. 12). These are the processes through which CGRs develop

their collective sense of purpose and their *shared theory of change* for achieving that purpose. The shared theory of change (sometimes called the shared theory of action) can be described as a more or (often) less formal/explicit logic model connecting the substance of shared goals to the strategies for achieving desired outcomes, incorporating their shared purpose and the proposed solution as negotiated by stakeholders and tacitly or explicitly revealed in their authoritative texts (Emerson & Nabatchi, 2015; Koschmann et al., 2011). I will return to the topic of strategies shortly.

The second domain described by Emerson and Nabatchi (2015) is *shared motivation*, conceptualized as interacting and self-reinforcing elements of mutual trust, understanding, internal legitimacy, and commitment. These elements are reminiscent of Ostrom's conceptualization of the context and feedbacks of trust and reciprocity in repeated social dilemmas (Ostrom, 2009). It is also reminiscent of the interdependence concept, but I chose to separate these concepts in order to avoid confusing initial conditions with ongoing process dynamics, and so did not use the shared motivation concept in this study.

The third domain of collaboration dynamics is *capacity for joint action*, which the authors define as "a collection of cross-functional elements that come together to create the potential for taking effective action and serve as the link between strategy and performance" (Emerson et al., 2012, p. 14). These include elements like the procedural and institutional arrangements that structure interaction, as well as important resources and capitals, including leadership and knowledge, similar to the framework for collaborative capacity developed by Cheng & Sturtevant (2012). It is within this arena, which includes both structural properties and assets, that **membership** is commonly analyzed. This is because it is participants and members who usually determine the structural and institutional arrangements of collaboration, and who contribute their skills and resources to the collaborative effort.

Membership in collaboratives

Emerson and Nabatchi (2015) define participants as those that have committed to being at the table to work on the issue of shared concern or interdependence. I use the terms **members** and **membership** to refer to those individuals or organizations that play a consistent, central, and/or decision-making role within the collaborative. This definition is necessarily broad to capture the range of formal and informal arrangements, and varying definitions of 'members' presented by collaboratives. Members can be notoriously ambiguous and fluid in their level of commitment (casual or consistent), their centrality to decision-making, and their affiliation (whether they are representing themselves or an affiliated interest) (Huxham, 2000). Membership often changes over time as broader membership being more appropriate during some stages than others in the organizational development of a collaborative (Imperial & Koontz, 2007).

Collaboratives may be broad or narrow in the diversity of kinds of interests and affiliations represented in their membership, and they can be very small (e.g., a five member board) or very large (hundreds of stakeholders engaged during a particular phase of collaboration) in terms of their membership size. The composition of membership reflects the proportion of members representing non-government individuals or organizations, or government agency representatives (Moore & Koontz, 2003). Diversity of represented interests theoretically enhances 'collaborative advantage' in generating synergistic and innovative solutions to shared problems (Gray, 1989; Huxham, 2000; Margerum & Robinson, 2015). The importance of representation and inclusiveness to collaboration is reflected by their frequent inclusion as metrics in the collaboration evaluation literature (Blackstock et al., 2007; Conley & Moote, 2003). While theories of participation usually focus on quality of participation and collaborative process (Blackstock et al., 2007; Fung, 2006; Reed, 2008), membership is usually incorporated into theories about collaborative governance structures and institutional arrangements (Emerson & Nabatchi, 2015; Hardy & Koontz, 2009; Imperial & Koontz, 2007). It may also be analyzed as an aspect of collaborative

capacity and capacity for joint action (Cheng & Sturtevant, 2012; Emerson & Gerlak, 2014; Emerson et al., 2012).

Membership defined by formal or informal rules or norms defining who can be members and who can makes decisions (discussed further below) (Hardy & Koontz, 2009). For example, many collaboratives have open membership rules, meaning that membership is open to all who are interested and willing to commit to the process (Fung, 2006). In such an arrangement, individuals or organizations weigh their stake in the problem against the time and effort of collaboration, and self-select as members if they feel it is in their best interest. The resulting mix of members may be professional stakeholders (representing their agency or organization, and possibly compensated for their time), or lay ('grassroots') stakeholders with the resources and interest to participate regularly (and who are often wealthier and better educated than the general public¹) (Diaz-Kope & Miller-Stevens, 2014; Fung, 2006; Koontz, 2016). Other membership selection rules include electing members; recruiting, appointing, or selecting members; or paid membership.

Members bring skills and resources to collaboration that might include funding; time; technical and logistical support; administrative and organizational assistance; requisite skills for analysis or implementation; and needed expertise. These assets affect the collaborative's ability to obtain additional human, technical, and financial resources, and to achieve its strategic purpose (Bryson, Crosby, and Stone 2006; Cheng & Sturtevant, 2012; Emerson et al., 2012).

¹ The ability to access and participate in collaboration governance or partnership has important implications for social justice. For example, Lubell et al. (2002) found that watershed partnerships in the U.S. were more likely to be found in watersheds that correspond to higher per capita income and were less likely to be found in watersheds with high percentages of minority populations. The authors conclude that the benefits of watershed partnerships can suffer from social justice problems "associated with command-and-control approaches—benefits accrue primarily to those who are already better off," (p.159). While I cannot address this theme within the scope of my study, it is important to acknowledge.

Strategies of collaboratives

Strategies are developed as members of the collaborative generate a shared theory of change (described above) as an output of dynamic engagement processes, and help define the purpose and function of the collaborative (Emerson et al., 2012; Imperial & Koontz, 2007; Margerum, 2008. Emerson and Nabatchi (2015) describe four general functions of collaboratives as operational (managing internal growth); developmental (revenue generation to sustain itself and its members); network functions (to build external legitimacy); and substantive functions related to their social and environmental goals. The first three kinds of functions focus internally, the fourth is directed externally, and the strategies of interest in this study fall within this substantive function of collaboratives.

The term **strategy** describes sets of actions that collaborators agree to work on together to achieve desired changes in the system as they have defined it (Conservation Measures Partnership, 2013). Strategies are *actions* or *accomplishments* that are *implemented*. Implementation “generally refers to the actions taken by public and private entities at multiple levels of authority directed at attaining objectives, and includes the strategic mobilization and application of human, financial, and technological resources to alter routines” (Cheng, Gerlak, Dale & Mattor, 2015 p. 1). The term *accomplishments* is also used. For example, Koontz and Johnson (2004) identified 13 types of *accomplishments* by watershed groups that are similar to the kinds of strategies that I identify in this dissertation (e.g. education and outreach; developing plans; changes to existing policy; influencing policy (through advocacy); land acquisition; restoration projects; research, monitoring; designation of protected resources; and changes to land use practice). Some use the term *outputs* synonymously with actions and accomplishments, as when Thomas & Koontz (2011) describe actions as either intermediate outputs (early products or services generated, such as a completed watershed plan) or end outputs (final products or services generated, such as an implemented restoration project). Ultimately, collaborative strategies and actions

are a means to an end, rather than an end in themselves, intended to lead to outcomes, impacts and adaptation (Emerson & Nabatchi, 2015; Thomas & Koontz, 2011).

While I do not analyze outcomes, impacts, or adaptation (the remaining elements of Figure 1.1), these concepts are part of the reason why this research is important, because it is these elements that are often used to evaluate the performance of collaboration (Emerson & Nabatchi, 2015b). My thesis is that initial conditions matter because they influence and shape the form and function of collaboratives. They affect the form of collaboration in part through their effects on the arrangements and composition of membership, and the resulting capacity for joint action available to the collaborative. Initial conditions influence function through their influence on problem definition and other principled engagement processes leading to their shared theory of change and strategies. These in turn influence the kinds of outcomes and impacts that affect the adaptive capacity of the social-ecological system they are trying to influence (Emerson & Nabatchi, 2015b), as well as their own capacity to adapt over time and with changing context (Cheng et al., 2015; Emerson & Gerlak, 2014).

Detailed research questions and organization of this dissertation

After this chapter introducing my dissertation, I follow with 4 more chapters (Chapters 2-5). Chapters 2-4 are based on data I collected about all the collaboratives I could find in the state of Colorado that work on some aspect of natural resources. The final chapter provides conclusions.

The second chapter of this dissertation is a descriptive overview of collaboratives in Colorado, which summarizes findings to the following questions:

- How many collaborative initiatives are in Colorado, and where are they?
- How do they define their boundaries and spatial extent?
- What kinds of issues do they address?
- When did they form, and why?
- What strategies do they use to achieve their shared goals?

- Who participates, and how are they organized?

The second chapter presents a picture of the landscape of environmental collaboration, and helps lay the foundation for future comparisons across states. A recent systematic review of cases of collaboration across the U.S. (Wilkins et al., in preparation) shows that collaboratives can be found in every state, but that Colorado is in the top three U.S. states in terms of numbers of groups documented in published case studies (along with California and Massachusetts).

In Chapter 3, I develop and test a set of propositions about the initial conditions, or the near-term situations, leaders, events, and problems, and that result in the formation of collaboratives. To develop propositions, I integrate theories and insights from common pool resources, social-ecological systems, environmental governance and public policy and administration. Using the conceptual model in Figure 1.2, I examine proposed and exploratory relationships between four particular initial conditions, elaborated above: the initiating leaders of collaboration; the catalysts that trigger collaboration (including incentives, perceived risks, crises, policy threats, and mandates); the collective or competing interdependence motivating collaboration; and the nature of the problem that collaboratives arise to address. Chapter 3 answers the following three specific questions: 1) can primary natural resource issues be characterized by their associations with scale, boundaries, the scope of their issues, and the substance of the social and ecological sub-issues? 2) Do the data support relationships between initial conditions proposed or implied in the literature? 3) What additional relationships between initial conditions, if any, can be identified?

In the fourth chapter of the dissertation, I turn my attention to the relationships between initial conditions and a) collaborative membership, and b) the strategies collaboratives use to achieve their shared goals. Throughout the chapter, I draw on several typologies of collaboration to structure to analysis and interpret my findings, reflecting on which aspects of the typologies work better than others. Using the conceptual model in Figure 1.3 to guide my investigation I ask: 1) how do initial conditions

(initiating leadership, catalysts, nature of the problem, and interdependence) correspond to differences in membership characteristics? Specifically, I consider five membership variables: the relative narrowness or breadth of membership (or the number of types of members represented); membership size (or the number of individual members); and the percentage of a) non-government, b) local government, and c) upper-level government members represented in total membership. 2) How is each initial condition related to strategies? 3) How are membership characteristics are related to the strategies that collaboratives work on together to achieve their shared objectives?

The final chapter (Chapter 5) summarizes the results of these three data chapters. There, I also discuss the theoretical, policy and practical implications of my findings.

CHAPTER 2. COLLABORATIVE CONSERVATION INITIATIVES IN COLORADO, USA: AN OVERVIEW OF FORM AND FUNCTION

Introduction

Collaborative initiatives (henceforth collaboratives) are arrangements of autonomous actors who represent different interests and/or organizational affiliations that come together to pool their resources and create shared goals, processes, and structures to support their joint work (Emerson, Nabatchi & Balogh, 2012; Margerum, 2008; Wood & Gray, 1991). While these intensive processes can be ephemeral (such as temporary task forces), the arrangements they generate can also give rise to more durable, second-order organizations, such as long-term partnerships, councils, or coalitions (Imperial & Koontz, 2007; Mandell & Steelman, 2003).

Collaborative approaches to environmental management and governance have been on the rise since the 1980s (Griffin, 1999; Lubell et al., 2002; Meffe, Nielsen, Knight & Schenborn, 2002), and collaboration continues to be a commonly advocated tool for addressing increasingly complex, expensive, widespread and contentious social-ecological problems (Bodin, 2017). Variations in the arrangements and purposes of collaboratives have proliferated as they have emerged to address new and different kinds of problems, which, according to Mandell and Steelman (2003), calls for "developing a richer understanding of the various permutations of interorganizational arrangements, as well as a better map of the interorganizational landscape" (p. 199).

Inventories and descriptive large sample studies of collaboratives and related phenomenon in the U.S. show that collaboratives have differences in attributes of distribution and spatial characteristics (McKinney & Johnson, 2013); structural and organizational characteristics (Andrews & Edwards, 2005), participation (Moore & Koontz, 2003), issues and activities (Kenney, McAllister, Caile & Peckham, 2000; Yaffee et al., 1996), capacity (Moseley et al., 2011), and outcomes (Belton & Jackson-Smith, 2010; Scott,

2015). Many of these studies have focused at the U.S. national level or multi-state regions (Table 2.1), and point to interesting regional differences, but are limited by small or uneven sample sizes from within each state (e.g. Clark, Burkardt, & King, 2005). I have found relatively few such studies conducted at the state level (with the exceptions of Arizona, North Carolina, Ohio and Oregon, Table 2.1). State-level studies may be less common because their findings are more difficult to generalize. For example, the munificence of natural resources in Colorado may translate to a greater abundance of natural resource collaboratives compared to other states. On the other hand, the state level of analysis has the benefit of “holding constant the statewide sociopolitical factors that affect partnership function and accomplishments” (Moore & Koontz, 2003, p. 454).

Table 2.1. Examples of large sample studies and inventories of collaborative initiatives in the US, the focus of each study, the type of document reporting the study, focal region within the U.S., and the number of groups included in the study. “PRJ” = peer-reviewed journal article, “WPR” = working paper or report.

Reference	Focus of Study	Document	Focal Region	# Groups
Andrews & Edwards, 2005	Environmental Advocacy Organizations	PRJ	North Carolina	738
Belton and Jackson-Smith, 2010	Sage-grouse Local Working Groups	PRJ	U.S. West	53
Clark, Burkardt, & King, 2005	Watershed groups	PRJ	U.S.	211
Coughlin, Hoben, Manskopf, Quesada, 1999	Collaborative Partnerships	WPR	U.S.	450+ identified, 10 analyzed
Davis et al., 2012	CBNRM Organizations	WPR	Oregon	18
Davis et al., 2017	Rangeland Fire Protection Associations	WPR	Oregon and Idaho	31
Fernández-Giménez et al., 2004	Rangeland stewardship collaboratives	PRJ	Arizona	107
Hershendorfer et al., 2007	Weed management groups	PRJ	U.S. Southwest	53
Kenney et al., 2000	Watershed partnerships	WPR	U.S. West	346 identified, 118 analyzed
Lubell et al., 2002	Watershed partnerships	PRJ	U.S.	958
McKinney & Johnson, 2013	Large landscape collaboratives	WPR	U.S. West	71
Moore & Koontz, 2003	Watershed Groups	PRJ	Ohio	64
Mosely et al., 2011	CBNRM Organizations	WPR	U.S. West	92
Schuett, Selin & Carr, 2001	Forest and Public Lands Collaboratives	PRJ	U.S.	30
Scott, 2015	Watershed Groups	PRJ	U.S.	357
Yaffee et al. 1996	Ecosystem Management Projects	WPR	U.S.	619 identified, 105 analyzed

Further, in most cases the unit of analysis is narrowly defined to focus on a particular natural resource problem, type of strategy, or level of focus. For example, watershed management organizations (Clark et al., 2005; Kenney et al., 2000; Lubell et al., 2002; Moore & Koontz, 2003; Scott, 2015); community-based natural resource management initiatives (Abrams, Davis & Mosely, 2015, Mosely et al., 2011); environmental advocacy organizations (Andrews & Edwards, 2005); ecosystem management/ large landscape initiatives (McKinney & Johnson, 2013; Yaffee et al., 1996); sage-grouse local working groups (Belton & Jackson-Smith, 2010); and rangeland health stewardship collaboratives (Davis et al., 2017; Fernández-Giménez, Le Febre, Conley & Tendick, 2004; Hershendorfer, Fernández-Giménez & Howery, 2007). In the discussion, I contrast the findings of some of these large-sample studies of collaboratives in the U.S. with my own (see Chapter 1 for a broader summary of findings from several of the studies in Table 2.1).

With this study, I attempt to address these gaps to help lay the foundation for future comparisons across states (which vary substantially in their political, social, economic, and ecological contexts) and across collaboratives addressing different kinds of environmental issues. My immediate aim is to contribute to the growing body of large-sample research with a more inclusive and representative dataset that allows us to compare attributes of collaboratives within a single state, Colorado. A recent systematic review of cases of collaboration across the U.S. (Wilkins et al., in preparation) shows that collaboratives can be found in every state, but that Colorado is in the top three U.S. states in terms of numbers of groups documented in published case studies (along with California and Massachusetts).

I developed a set of attributes to capture differences in collaboratives purpose based on the literature (described further below), and organized my exploratory inquiry around the following questions:

- How many collaborative initiatives are in Colorado, and where are they?
- How do they define their boundaries and spatial extent?
- What kinds of issues do they address?

- When did they form, and why?
- What strategies do they use to achieve their shared goals?
- Who participates, and how are they organized?

Theoretical background

Collaboration arises when context and conditions align to motivate collective action to address a shared problem (Bryson, Crosby & Middleton Stone, 2006; Gray, 1989; Kingdon, 1984; Emerson & Nabatchi, 2015). Many of the variables I measured for this study attempt to capture variation in conditions that characterize the formation of collaboratives, because theory suggests that these attributes influence later governance arrangements, as well as the purpose and function of collaboration (Adger, Brown & Tompkins, 2005; Cumming et al., 2015; Ostrom & Cox, 2010; Paveglio et al., 2015; Poteete, Janssen & Ostrom, 2010). I delve further into theories on how attributes of collaboration are related in the next two chapters.

Scholars across disciplines acknowledge that biophysical and social characteristics of the natural resource problem influence the likelihood of collaboration, as well as its eventual form and function (Bodin, 2017; Bryson, Crosby & Middleton Stone, 2015; Poteete et al., 2010, Kingdon, 1984; Emerson & Nabatchi, 2015). I explore the nature of the problem that collaboratives emerge in response to through the natural resource social, and ecological **issues** that collaborative address, as well as the **boundaries** they use to define where they work and the **spatial extent** of the area within those boundaries.

Each collaborative forms because of unique circumstances that trigger collaboration, or **catalysts**. Catalysts are events or series of events that motivate, incentivize, or lower the barriers to working together (Prokopy, Mullendore, Brasier & Floress, 2014). Problems that have built up over time may suddenly manifest through crises, which are commonly described drivers of collaboration in the literature (Emerson & Nabatchi, 2015; Gray, 1989; Prokopy et al., 2014; Selin & Chavez). In other cases, subtle or long-term systematic indicators of a problem may be perceived and eventually acted upon by

initiating leaders who recognize a *window of opportunity* when the problem converges with 1) the socio-political will to address it, and 2) the viability of collaboration as a solution (Kingdon, 1984; Lober, 1997).

Collaboration may not be the first choice to address the problem. Collaboration can be catalyzed by ‘carrots’ like grants or other incentives that encourage or necessitate collaboration, or ‘sticks’ like regulatory requirements or mandates to collaboratively address policy problems (Lubell et al., 2002; Prokopy et al., 2014).

Initiating leaders are the individuals, organizations, and/or government agency personnel who recognize that a problem exists that is amenable to a collaborative solution, and who then motivate people to collaborate (Emerson & Nabatchi, 2015). Leaders may spearhead collaboration from within local communities, encourage collaboration from governments or non-government organizations (NGOs) outside communities, or both, and they may or may not participate in the collaborative once it is established. Emerson & Nabatchi (2015) developed a formative typology that contrasts self-initiated, independently convened, and externally driven (by a higher-level government authority) in terms of the scale and complexity of the problems that they work on, which is explored further in the next chapter.

Interdependence can drive collaboration when collaborators must rely on one another to access information, funding, or other resources (Huxham, 2000); when other solutions have failed (Bryson et al., 2006); or when key actors recognize that the challenge cannot be addressed individually and requires joint action (Emerson et al., 2012). Sometimes stakeholders in the problem domain have shared interests and a common understanding of the problem in need of collaboration, and in other cases they come to the problem with divergent interests or different understanding of the problem (Gray, 1989; Selin & Chavez, 1995). Network theorists distinguish between two broad sources of **interdependence** that can motivate collaboration, coordination problems and cooperation problems (Berardo, 2010; Berardo & Scholz, 2010; Bodin, 2017). In coordination problems, stakeholders more or less agree on what they want to accomplish together, and collaboration arises from the need to align objectives,

actions, resources, and act collectively. To avoid conflation with similar terms referring to governance arrangements and strategies (Keats, 2015; Margerum, 2008), I refer to collaboratives with this orientation as **collective**. Collectively-oriented collaboratives come together to meet shared needs and achieve mutually beneficial results. This does not mean conflict is absent, but they often start early on with greater consensus about the problem they are addressing and what they want to achieve. In cooperation problems, stakeholders have different interests, and reaching agreement requires some negotiation and even potential tradeoffs. Collaboratives with this orientation, which I refer to as **competing**, emerge to resolve contested, conflicting, or competing needs among stakeholders, and thus have a lower agreement among stakeholders at the outset (but they are still interdependent on one another to resolve the issue). For these groups, at least a partial aim of collaboration is to build a shared understanding of the problem, build trust, and/or negotiate tradeoffs.

In this study, the term **strategy** is used to describe sets of actions that collaborators agree to work on together to achieve desired changes in the system as they have defined it (Conservation Measures Partnership, 2013). Strategies are developed as members of the collaborative generate a shared theory of change (also called shared theory of action) as an output of dynamic engagement processes. The shared theory of change can be described as a more or (often) less formal/explicit logic model connecting the substance of shared goals to the strategies for achieving desired outcomes, incorporating their shared purpose and the proposed solution as negotiated by stakeholders and tacitly or explicitly revealed in their authoritative texts (Emerson & Nabatchi, 2015; Koschmann, Kuhn & Pfarrer, 2012).

The idea of collaborative advantage (the ability of collaboratives to achieve objectives that could not be achieved alone) is rooted in aspects of participation, such as the kinds and diversity of interests

represented as **members** of collaboratives (Huxham, 2000). I use the terms members and membership to refer to those that play a consistent, central, and/or decision-making role within the collaborative.

Methods

Sampling

The criteria presented below were used to define, identify, and select collaboratives for inclusion in this study. Criteria 1-3 provide a broad definition of collaboratives to increase the variation of groups in the study (Creswell, 2013), because examining variation across cases is part of the purpose of the research (throughout this study, the term “case” refers to an individual collaborative). Criteria 4-6 define the population of 183. However, not all collaboratives in the population had sufficient documentation for analysis, so criterion 7 defines the units suitable for analysis. I attempted to obtain a census (meaning a complete count) of collaboratives meeting all seven criteria, but some were no doubt missed. I therefore refer to the 123 meeting all 7 criteria as a representative sample, explained further below. In addition to extensive internet searches, I also used chain referral sampling (Creswell, 2013), asking experts and individuals associated with collaboratives to add to a growing list; the same criteria were applied before they were finally included in the study. See the Appendix for the full list of Colorado collaboratives.

1. Members include a range of three or more of 11 possible categories of entities (see Table 2.2),
2. Members engage in a sustained process of interaction or consensus building lasting 2 or more years,
3. The initiative addresses the governance or management of one or more natural resources, ecosystem health, or conservation-related issues,
4. The collaborative emerged by or before 2015,
5. The initiative’s boundaries fall wholly or partially in Colorado,
6. Sufficient information about the initiative was available online to verify that the initiative met the above criteria,

7. Sufficient documentation was available to collect information about the initiative’s history, purpose, strategies, and membership on the internet and/or internet references to printed materials accessible through the university.

Table 2.2. Categories of individual and organizational affiliations used to code members and initiating leadership. Inclusion of three kinds of “member types” was a criterion for inclusion in the study.

Initiating Leadership	Member Types
Upper-level Government	<ul style="list-style-type: none"> • Tribal (like the Water Quality Division of the Ute Mountain Ute Tribe) • Federal (like Natural Resources Conservation Service, U.S. Forest Service, or Bureau of Reclamation) • State (like Colorado Parks & Wildlife, or the Colorado Water Conservation Board)
Local Government	<ul style="list-style-type: none"> • Local governments include regional, county and municipal governmental agencies, and quasi-government² organizations like soil conservation districts, water conservancy and conservation districts, utilities, ditch and reservoir companies, and other special districts
Non-Government	<ul style="list-style-type: none"> • Private industry and business (including trade and business associations) • Farmers, ranchers and large landowners (including agricultural associations) • Environmental and recreational nonprofits • Colleges and universities (including Extension) • Other organizations (like church groups or historical societies) • Other collaboratives • Individuals, private citizens, homeowners (including HOAs)
Mixed Government and Non-Government	<ul style="list-style-type: none"> • Includes non-government individuals or organizations plus local and/or upper level governments

In Chapter 1, I presented several definitions related to collaboration that informed my choices to include or exclude cases. There are many definitions of collaboration that are helpful for understanding the phenomenon, but that emphasize aspects of collaboration that are difficult to observe without in-depth analysis, and thus unhelpful as criteria for inclusion in the study. For example, early definitions emphasized stakeholders pooling resources (including information, labor, and money) to address a set of issues that could not be addressed individually, implying interdependence between actors (Selin & Chavez, 1995; Gray, 1989). Margerum (2008) drew on several authors to develop a definition of collaborative environment management that was more helpful for criterion development, describing it

² “Quasi-governments” are backed or supported by governments but managed privately or independently, and which provide some sort of service.

as a "paradigm of environmental planning and management" involving a broad and inclusive stakeholder base engaged in an intensive and sustained process of problem solving to achieve consensus on environmental goals (Margerum, 2008, p. 287).

The first criterion reflects the diverse membership element common to most definitions, that collaboration brings together otherwise autonomous or semi-autonomous actors (Selin & Chavez, 1995; Thompson & Perry, 2006; Wood & Gray, 1991). The categories of individual or organizational entities and affiliations in Table 2.2 were used to 1) determine whether a collaborative met the participant diversity criterion for inclusion; 2) code initiating leadership; and 3) code membership. This criterion biased the population and sample away from informal and/or community-based collaboratives that do not state member affiliations.

The interactive engagement process element is central to many definitions (Emerson et al., 2012; Gray, 1989; Margerum, 2008; Plummer & Fitzgibbon, 2004), and is reflected in the second criterion. The importance of consensus as a core element of collaborative enterprises is inconsistent and contentious in the literature. Consensus, at least as a goal, is emphasized by authors like Gray (1989) and Wondolleck and Yaffee (2000), but others deliberately avoid the consensus criterion. Daniels and Walker (2001) developed the collaborative learning concept based on the predicates that conflict is inevitable but manageable, that collaboration is required to deal with complexity and 'wicked problems,' that the greatest value of collaborative processes are the opportunities they provide for learning, and the decision-making process should be understood as a learning process if appropriate decisions are to be made in complex settings. It takes a more pluralistic approach to collaboration and does not demand consensus.

The third criterion restricted the focus of this study to collaboratives working on problems or situations involving environmental, natural resource, and conservation-related issues. While several of the

collaboratives I analyzed included issues related to agriculture and livestock production, I did not include collaboratives focused primarily on agriculture (in rural or urban centers). Collaboration is a well-researched phenomenon in other fields as well, such as corporate and organizational behavior (Lober, 1997) and health care (Takahashi & Smutny, 2002). An inventory-based study currently underway in Oregon, for example, includes health care collaboratives alongside environmental collaboratives (B. Cochran, National Policy Consensus Center, personal communication).

The fourth criterion introduces temporal criteria for the population, reflecting definitions that emphasize a sustained commitment to process (Coughlin et al., 1999; Margerum, 2008), as well as a cut-off point of 2015 to make coding more manageable for an individual. This eliminated some protracted planning processes, as well as some collaboratives that were initiated but disbanded early due to lack of momentum. The fifth criterion is spatial, introducing the geographic boundary of Colorado, which reflects the effort to address a scale gap in analysis of collaborative groups at the state level (as discussed earlier). Anecdotal evidence (during early design phases of the study) suggested that Colorado was particularly rich with collaboratives. Growing evidence supports this, such as the study by Wilkins et al. (in review) mentioned earlier.

The sixth and seventh criteria are important for distinguishing the population from the sample. Criterion six defines the population of 183 and represents initiatives that I was able to verify met the first five criteria, based on information found online. Some of these groups were identified through chain referral sampling, but some online information had to be available to check whether they fit my definition. The last criterion defines the sample of 123. There is an abundance of rich documentation available online for both active and inactive collaboratives, and in most cases this online information was sufficient to obtain the descriptive information of interest. In some cases where documentation was thin, there were references online to book chapters and reports that I was then able to access in hard copy format through the university.

The sample of 123 was treated as representative, because criteria 6 (the population) and 7 (the sample) are both biased in a similar way. They are both biased towards collaboratives that are (or were at some point) well established enough to have been documented with at least a baseline of information that was available on the internet. It should be noted, however, that this assumes that the volume and accessibility of documented information for analysis is randomly distributed throughout the population of 183. To check for representativeness, I analyzed attributes that are relatively easy to find with minimal documentation: primary environmental issue, location, active status, and year of formation. I present distinctions between the sample and the population in the findings.

Data collection, management, coding, and analysis

I used a mixed methods, exploratory sequential research design, beginning with qualitative content analysis to develop codes; then a more reductive phase of qualitative data generation; and finally quantitative data analysis (Creswell & Plano Clark, 2007). Content analysis is “a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use,” (Krippendorff, 2004, p. 18). Content analysis provides an epistemological framework for asking questions of texts and for understanding how meaning and data are generated from texts (both qualitatively and quantitatively). The questions outlined in the introduction guided my analysis of the documents, with theory playing a role (described below) in how I interpreted the meaning of the text. An important departure from traditional content analytic methods is my use of multiple kinds of documents as data sources, so I will return to the assumptions of content analysis and implications of this departure at the end of the methods section.

The following kinds of documents served as data sources, in order of preference:

- Strategic plans, bylaws/charters, resource management plans, member rosters, and maps
- Descriptions of the group and/or its activities produced by members or staff of the collaborative group and made available online via blogs and websites (particularly “about

us” pages), case studies or profiles authored by members, organizational (annual/budget) reports, brochures, and technical reports.

- Case studies from books, peer reviewed journal articles, and gray literature authored by third parties.
- Meeting minutes
- News articles containing interviews with core members

I analyzed material from more than 800 documents and websites to generate the data. When available, I relied primarily on *authoritative texts* (Koschmann et al., 2012), which have already been interpreted, negotiated, framed, and at least tacitly approved by initiative members, using other documents for triangulation. However, the volume and quality of documents varied substantially for each collaborative, and thus I relied more heavily on supplemental materials like news articles for some cases more than others. I collected documents primarily through web searches using the names, aliases, or former names of collaborative initiatives identified through the inventory. Many hard copy materials were scanned and stored with other digital documents in a password-protected cloud drive (lengthy reports and book chapters excluded). I developed a custom database for the project: each initiative has a record with notes fields for all attributes of interest to the study, which is where annotations were made about available documentation. I transferred pertinent website text into the appropriate notes field in the database for analysis.

I did content analysis in two phases. In the first phase, I abductively developed appropriate variable categories and metrics for a closed-ended coding protocol. I began by developing a tentative a priori coding scheme based on literature describing empirically identified attributes relevant to my research questions (such as collaborative strategies identified by Koontz & Johnson, 2004) or typologies and taxonomies of attributes (such as ‘threats,’ interpreted as issues and sub-issues, identified in Salafsky et al., 2008, to characterize the nature of the problem). I then selected a stratified, purposeful sample of 30 collaborative initiatives representing each of six primary natural resource issues and with abundant

and diverse document types available. I conducted attribute coding, memoing, and first-cycle coding directly in the notes section of the database, using text segments of varying length from available documents of interest (from a few sentences to a few pages), pasted or transcribed into the appropriate attribute notes section of the database. Codes were developed iteratively, beginning with the tentative a priori coding scheme, which was modified as new themes emerged. Codes were tracked and updated within the database using an autocomplete taxonomy feature of the database. The codebook (maintained along with coding instructions outside of the database) was repeatedly revised as documents were read and re-read several times over. In addition to developing the coding protocol, this phase allowed me to become familiar with the range of information quality, modes of presentation, and specialized language (jargon) of the diverse data sources. Coding was halted early in this process in order to conduct a gray literature review of relevant policies in natural resource sectors I was less familiar with—a necessary step in order to be able to make reliable inferences about latent textual meaning (Krippendorff, 2013).

This phase yielded the data collection protocol, in the form of multiple spreadsheets. I transformed my thematic categories into variables that could be analyzed quantitatively: continuous values (such as area in km²); categorical values (such as active, inactive, or unsure); and dichotomous values indicating whether documents indicated that evidence of an attribute was present (coded as “1”) or not present (coded as “0”). This is known as an *index* recording protocol (as opposed to a volumetric protocol, in which counts of words or other units are measured), and is common in content analysis studies (Vourvachis & Woodward, 2015). In the second phase of analysis, the protocol guided structured, closed-ended analysis of the documents available for each collaborative. A research assistant was hired and trained for over 80 hours to test intercoder reliability of 64 binary variables for 12 randomly selected cases (approximately 10%). Intercoder agreement was calculated using percent agreement, and ranged from 64% to 83% for a given case, with 77% overall agreement for all 12 cases, more than the

two-thirds suggested as adequate by Jauch, Osbourne, and Martin (1980). Following discussion between the two coders about differences in coding choices, the codebook and instructions were made more precise and some modifications to variable categories were made. I coded the remaining 111 cases alone. This was not ideal, as many sources recommend teams of coders for large numbers of cases (Bryson et al., 2015; Krippendorff, 2004; Poteete & Ostrom, 2008; Saldaña, 2009). However, one benefit of solo coding such diverse documents is that I could control consistency in organization, tolerance of ambiguity, and perseverance in finding information (Saldaña, 2009).

See Appendix for codes and category definitions and examples. Once coding was complete, I imported the data into SPSS for analysis. This chapter presents descriptive statistics only.

I now return to implications of my methodological departure from content analysis as defined and outlined by Krippendorff (2004). His definition is based on several epistemological assumptions about how meaning is derived from text: that meaning, and the data it generates, are not inherent to text, but emerge through interpretation by the reader. Texts can have multiple meanings that are not necessarily shared, and are sensitive to the context and purpose of the interpretation. In order to reduce the contextual variability of the texts they analyze (and increase the stability of their interpretation), content analysts often restrict their sampling units (data sources) to one kind of document, which serves as the units of analysis. For example, in their analysis of public participation in environmental decision-making processes, Beierle and Cayford (2002) used only peer-reviewed case studies representing individual public processes. This technique is thought to improve the replicability and validity of the findings derived from content analytic methods (Krippendorff, 2004). However, the unit of analysis in my study is not individual documents, but the collaborative initiative as described by a body of documents available for each one. This departure was a pragmatic decision given that the objective of the study was to describe characteristics of a geographically defined population, not just those that were described using a particular form of text. Selecting a single type of text to describe all collaboratives in my sample was

untenable because the documentation for collaboratives is inconsistent in quantity, quality, and format, and the information sought was usually heterogeneously distributed throughout multiple documents. (Collaboratives do not necessarily have the same capacity as formal organizations to generate comprehensive texts.) There is some support in the literature for using multiple data sources, however. A study on the application of content analysis in the field of social and environmental reporting research found that the number of content analysis studies drawing on multiple data sources per unit of analysis has been increasing since the 1990s, and the authors note that relying on a single type of document “benefits the comparability of the findings but raises concerns over the quality of the inferences drawn,” since there are multiple mediums through which organizations report their activities and behavior (Vourvachis & Woodward, 2015, p. 10).

Still, this methodological approach is novel and concerns about replicability and validity are justified, so I attempted to limit the potential problems arising from this departure in several ways. First, I focused the research questions on descriptive attributes of each collaborative with the intent of reducing the degree of subjective inference required for interpretation between coders as well as between different types of documents. I ordered the preference of document types (presented earlier) so that I moved down the list of preferred documentation to retrieve needed information, and annotated the sources used for different kinds of variables. I also spent a great deal of time early on clarifying and narrowing definitions in the codebook (through repeated readings of the same text, as well as the external gray literature review described earlier) before embarking on the closed-ended portion of content analysis.

Results

How many collaborative initiatives are in Colorado, and where are they?

As of 2018, there were 183 collaboratives in Colorado. This includes all collaboratives I found online, regardless of the quality of their documentation (Figure 2.1). Red points on the map below are the subset of 123 collaboratives I used for analysis; blue points are the 60 collaboratives without sufficient

documentation for further analysis. The location of each point is where each collaborative has their project sites, meeting locations, headquarters, or mailing addresses, depending on the information available. The population data layer is a global estimate of human population for 2015 created by ESRI, in which purple points represent concentrated rural populations (4-5% of people in Colorado), beige represents settled or suburban, and orange/red represent urban populations (Frye et al., 2018). Green are forested areas and gray is grassland/shrubland.

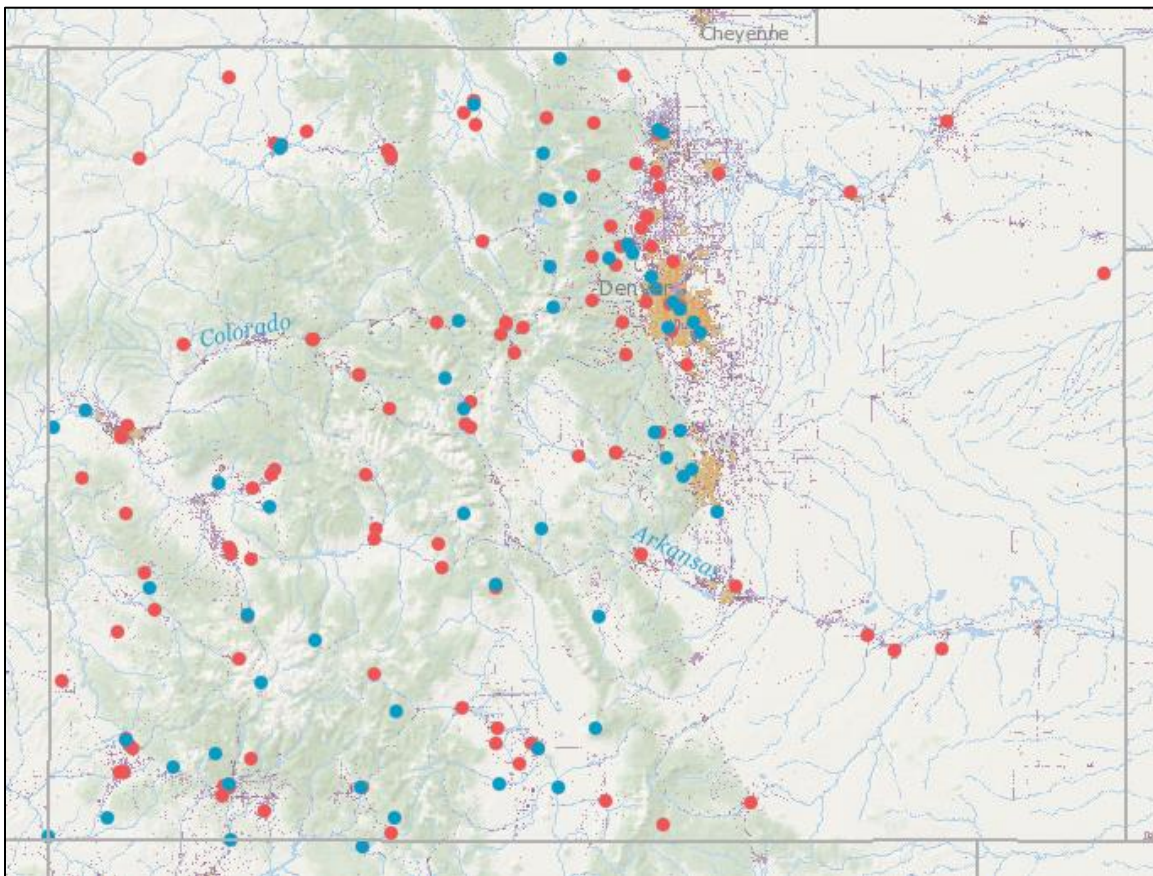


Figure 2.1. Map of Colorado collaboratives (n=183). Red points are collaboratives included in this study (n=123), blue points are those not included in this study (n=60). Waterways and population density as of 2015 are also shown. Basemap Sources: ESRI, GEBCO, NOAA, National Geographic, DeLorme, Geonames.org, and other contributors.

There is a high density of collaboratives along the Denver and Boulder metro corridor extending north to Fort Collins; from Durango west to the areas around Cortez and Dolores; and to a lesser extent the

southern part of the San Luis Valley. Less dense but still notable are the clusters from Walden to Craig, Denver to Breckenridge, Paonia to Montrose, Colorado Springs, and Grand Junction. Very few collaboratives are present in the eastern plains.

How do collaboratives define their boundaries and spatial extent?

Collaboratives differed in how they define where they work. The most common boundary types used by collaboratives were watershed boundaries (36%), delimited by topography and water drainage. Many groups defined their work areas by jurisdictional boundaries (29%), such as public lands or county lines, or other boundaries that indicated who has authority to make decisions within a given area. Sometimes they worked within a single public lands boundary or a single county, but they often wove together multiple kinds of properties and jurisdictions. Twenty-seven percent of collaboratives defined their boundaries by the ecological problem of concern, such as a migration corridor, a wildfire zone of concern, or an area affected by invasive species or pollution. A few collaboratives (8%) use a combination of boundary types to describe themselves.

Colorado's collaboratives also differed in the size of the area within their boundaries, ranging from a small polluted site (8 km²) to a large bird migration fly-way covering multiple states (1,966,731 km²). Both of these extremes were areas within problem-defined or ecological boundaries. Half of the collaboratives were less than 3,582 km² in extent, and 90% were less than 25,459 km². The median size was 3,670 km².

What kinds of issues do collaboratives address?

Natural resource issues are broad categories of environmental and natural resource problem areas or goals. Most collaboratives (93%) addressed more than one natural resource issue, so I distinguished between the primary resource issue (discussed later), and the set of all resource issues addressed (Figure 2.2), and a collaboratives scope of issues (the number of issues in the set). For example, a

collaborative may focus on water quality (its primary issue), but also actively address land use issues that affect water quality and conservation of fish populations affected by pollution (so its issue set includes water quality, land use, and fish and wildlife conservation, and the scope = 3). The mean issue scope was 3.3 (out of seven) (n = 123). Fish and wildlife issues (specifically, the conservation and management of fish and wildlife, including birds) were the most common natural resource issue addressed as part of a resource issue set (included by 72% of collaboratives). Wetland ecosystem health issues (wetlands and marshes, riparian areas, stream channels, or natural and artificial reservoirs) and water quality issues (pollution or poor water quality in flows of surface or subsurface waters, or surface and groundwater reservoirs) were also commonly included (by 64% and 54%, respectively). Forty-nine percent of collaboratives addressed land-use issues (including land-use change, ownership and access rights, and energy development), and 40% addressed water supply issues (including the administration of water quantity, water rights, water storage and infrastructure, and changing or redirecting water flows). Thirty percent of collaboratives addressed forest ecosystem health issues (including montane/sub-alpine forests and montane shrublands), and 29% address rangeland ecosystem health issues (pasture and grasslands, semi-desert shrublands, pinyon-juniper woodlands, or plains agricultural lands). Collaboratives also addressed more specific ecological sub-issues, which I discuss further below.

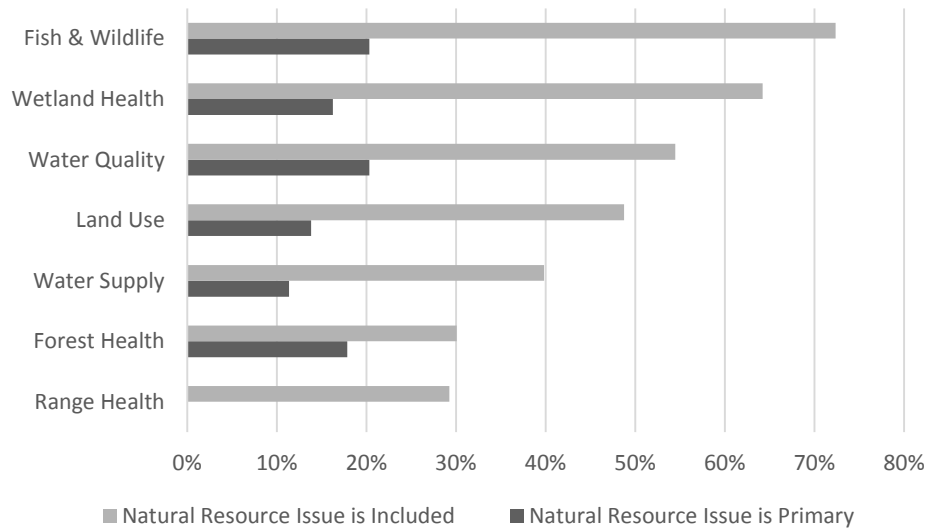


Figure 2.2. Kinds of natural resource issues addressed by collaborative initiatives in Colorado (n=123). Light gray are all issues addressed by a collaborative at any point in time, dark gray is the single most important issue that was the focus of collaboration for the first 1-2 years of collaborative formation.

In addition to the scope of natural resource issues addressed by each collaborative, I also analyzed the single, primary natural resource issue addressed by each collaborative (Figure 2.2). Since environmental issues change over time, I defined the primary issue as the category that best characterized the problem of concern to the collaborative within the first 1-2 years after the collaborative formed. The two most common primary issues were water quality and fish and wildlife (both 20%), followed by forest ecosystem health (18%) and wetland ecosystem health (16%). The two least common primary issues were land use (14%) and water supply (11%). There was considerable overlap between rangeland ecosystem health, land use, and fish and wildlife issues, so the few groups for which rangeland ecosystem health was identified as the primary issue (2.4% of cases) were re-assigned to other categories for the purpose of analysis.

In order to compare my sample population, I used what information was available for the cases not included in my sample to identify their primary issue (at any time, not necessarily immediately following formation, as historical information about most these groups was scarce). My findings contrasting

primary issues for the sample and population (Figure 2.3) suggest that my sample over-represents fish and wildlife and land use collaboratives.

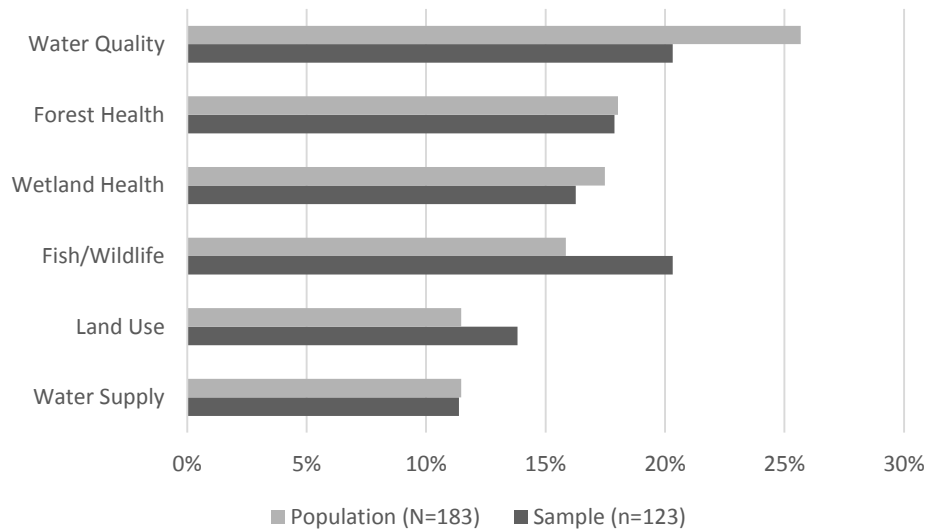


Figure 2.3. Comparison of primary natural resource issues addressed by collaborative initiatives in the sample (n=123), dark gray; and the population (n=183), light gray.

In addition to the natural resource issues described above, documents also described more specific biophysical problems or stressors that collaboratives targeted through their activities, which I call **ecological sub-issues**. I identified multiple ecological sub-issues for 95% of collaboratives (Figure 2.4), with a mean of 3.7 (out of eight). The most common ecological sub-issue was environmental degradation related to land use (such as overgrazing or recreation), addressed by 73% of collaboratives, followed by degradation caused by altered streamflows (such as sedimentation, vegetation loss, or sinking water tables caused by engineered hydrological modifications), addressed by (63%) This differs slightly from damage caused by water diversion or over-appropriation, which was grouped with longer-term impacts of drought and climate change) (48%). Less common (or less commonly cited) were negative impacts of wildlife, such as predation or overgrazing, or human-wildlife conflict issues (23%). See Appendix for explanations of each category.

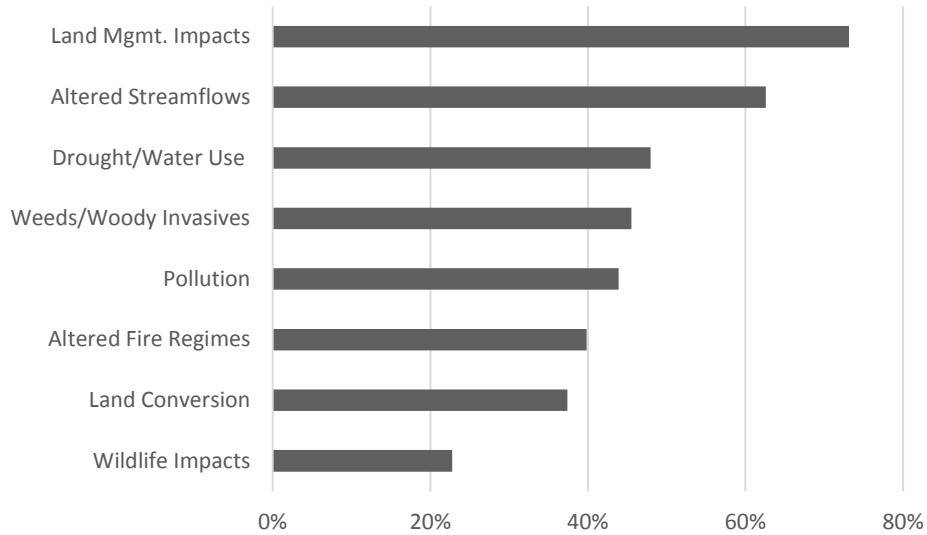


Figure 2.4. Ecological sub-issues addressed by Colorado’s collaboratives (n=123).

While collaboratives expressed collective concerns about numerous social, economic, and political issues, I focused on those **social sub-issues** (including economic and political sub-issues) that were articulated as targets in need of protection or change addressed by the collaborative. For example, some collaborative’s documents expressed concerns about rapid demographic change, but no collaboratives had goals or strategies related to slowing or altering demographic change per se, so this was not included. Almost all (98%) of collaboratives addressed one or more social sub-issues (Figure 2.5), with a mean of 3.6 (out of seven). The most common were issues related to economic conditions in need of improvement or economic interests in need of protection, usually associated with resource-based livelihoods like agriculture, ranching, logging, mining, or tourism (69% of collaboratives include these issues). Next most common were issues related to recreation opportunities, aesthetics or other cultural values associated with the environment (67%), such as enhancing river access for rafting, or protecting “viewsheds” and culturally significant landmarks. Forty-eight percent of collaboratives address infrastructure-related issues (concerns about water delivery mechanisms, power lines, reservoirs and canals, trails, or buildings) and 47% addressed property rights issues (concerns about land, water, or

sub-surface property rights). Fewer collaboratives were concerned about safety (concerns about health, life, or property) and vulnerability of human communities to disturbance events (43%), like floods or fires. Liability and compliance issues (including ability to comply with rules and regulations, extent of local control, and concerns about lawsuits) were least commonly included among the set of social-economic issues (41%).

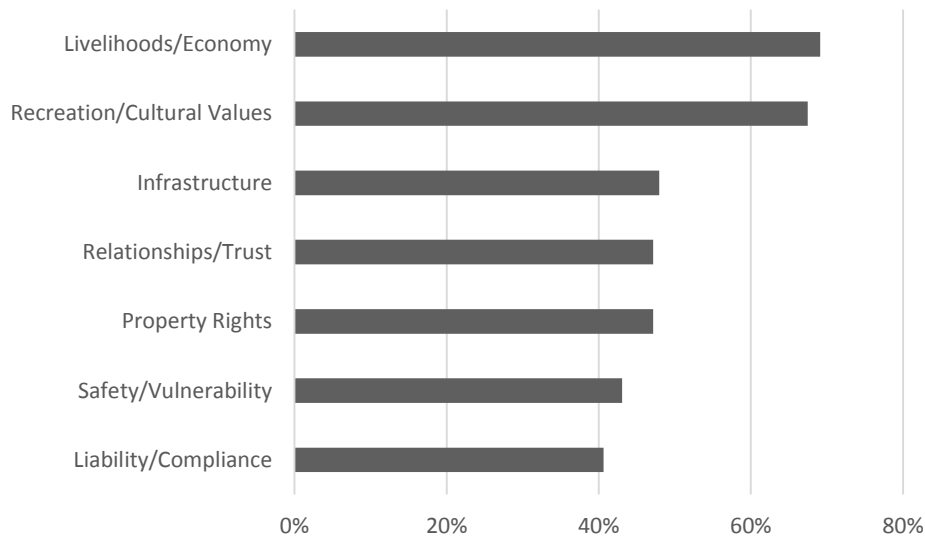


Figure 2.5. Social sub-issues addressed by Colorado collaboratives (n=123).

When did Colorado’s collaboratives form?

Colorado’s environmental collaboratives began in the 1970s, growing rapidly in number over time to the present (Figure 2.6). For the 123 collaboratives analyzed, the oldest was established in 1981 and the youngest in 2015. (The oldest collaborative in the population was poorly documented and thus not included in my analysis, but the information that was available suggested that they had formed by or before 1977). Trends in collaborative emergence are described further in the discussion.

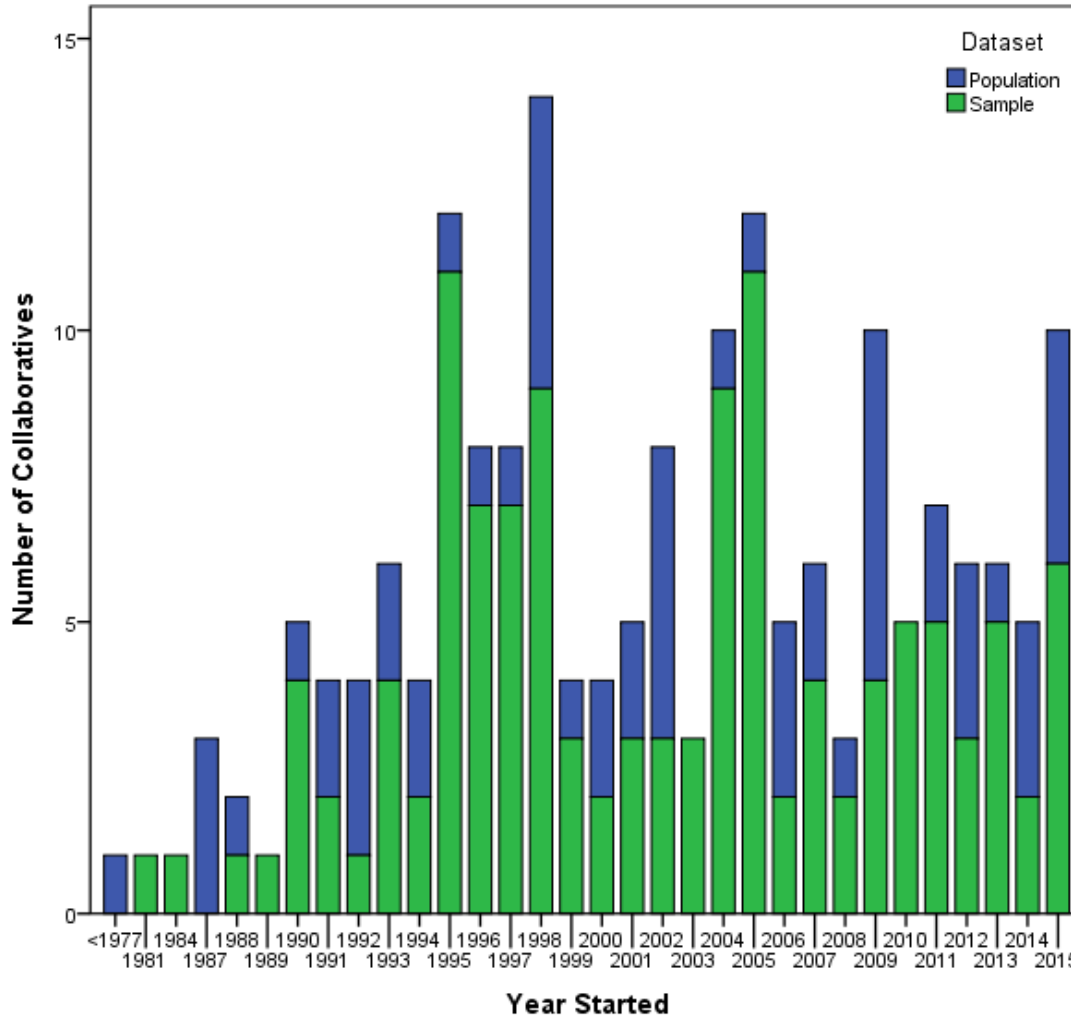


Figure 2.6. Timeline of formation for Colorado's population of collaboratives (N = 183), with those in my study highlighted in green (n = 123) (year of formation was one of the attributes analyzed for the full population). The start date of the first collaborative is unclear, but evidence suggests that it formed by 1977.

Why did Colorado's collaboratives form?

A wide variety of **catalysts** were identified in Colorado, which I group in this chapter by source:

government, non-government, or biophysical. Many collaboratives had more than one catalysts, so the categories described are not mutually exclusive.

Government policies, programs, and regulations directly or indirectly catalyzed at least 67% of Colorado's collaboratives (n=123). Sometimes just the threat of a policy's implications (like lawsuits,

concerns about private property rights, imposed standards, or penalties associated with non-compliance) motivated pre-emptive collaboration in Colorado. Policy-related threats or concerns (like lawsuits, concerns about private property rights, imposed standards, or penalties associated with non-compliance) were the most common of this kind of catalyst (29%). Governments also mandated or recommended the formation of a collaborative (21%), as when the Colorado Water for the 21st Century Act created nine Basin Roundtables throughout the state, or when Eagle County recommended the formation of the Eagle River Watershed Council to carry out strategies identified in a county-led watershed plan. In other cases (17%), government regulations, programs, or policies promoted collaboration by providing funding incentives to get collaborative projects off the ground, contract with a neutral facilitator, or support or coordinator position.

Non-government catalysts contributed to the formation of 41% of collaboratives (n = 123). The majority (35%) of non-government catalysts in Colorado were incentives and opportunities in the form of financial or human capital (like non-government grants or NGO-led projects that evolved into longer-term collaboration), or events (like bridging organization-led workshops intentionally designed to promote new collaborations, or collaboratives that ‘spinoff’ from earlier partnerships). The remaining catalysts of this type (6%) were land development pressures.

Localized biophysical degradation or events (and associated impacts on human well-being), were identified for 54% of Colorado’s collaboratives (n = 123). Collaboration is thought to be more likely when high severity problems manifest as crises (like floods, fires, or major contaminant spills), affecting well-being, life and property and lowering the transaction costs of collaboration (Prokopy et al., 2014, Selin & Chavez, 1995). However, less severe or slower manifesting events, such as algal blooms or beetle epidemics, also galvanize stakeholders to collaborate when they are highly visible to the public and present a risk to human health and wellbeing. Together, these medium and high severity events have

driven 21% of Colorado's collaboratives. Thirty-three percent of collaboratives were catalyzed in part by lower-severity biophysical catalysts, meaning the degraded environmental conditions they formed to address (e.g. extreme stream channel cutting or erosion), while bad enough to be widely recognized, had not yet reached the point of risk (to human well-being) or crisis. Of the collaboratives driven by low severity catalysts, 93% also had additional, non-biophysical catalysts (such as opportunities from government or non-government sources). This category does not include collaboratives that formed proactively prior to ecological damage to prevent future damage.

A wide variety of kinds of individuals, organizations, and government agencies were credited by collaboratives as founders or **initiating leaders** of Colorado's collaboratives. I grouped these affiliations into four broad categories (see Methods) and found that each of the four categories were about equally likely to serve in the role of instigating the formation of collaboratives: upper-level government (tribal, federal, and state) (28.5%), local government (22%), non-government (21%), and mixed government and non-government initiators (28.5%), (n = 123).

For 103 of Colorado's collaboratives (84%), I was able to distinguish between two kinds of **interdependence**: collective orientation among stakeholders (60%) and competing orientation between stakeholders with different interests (40%). Collaboratives coded as collectively oriented explicitly referenced shared interests in a problem or collective motivation for entering into a collaborative partnership, while those with competing orientation referenced the need to work through a period of disagreements about the nature of the problem, stakeholder conflict, or tradeoffs.

What strategies do they use?

Collaboratives develop shared strategies, which the Open Standards for the Practice of Conservation defines as "a set of actions with a common focus that work together to achieve specific goals and objectives..." (Conservation Measures Partnership, 2013). The categories (Figure 2.7) focus on strategies

for addressing their issues of interest, rather than internal deliberation and governance strategies (such as reaching consensus on goals), or organizational maintenance strategies (such as fundraising). See the Appendix for explanations of each category and examples. Since I did not have reports on the specific activities accomplished for all groups, this variable includes proposed as well as completed strategies.

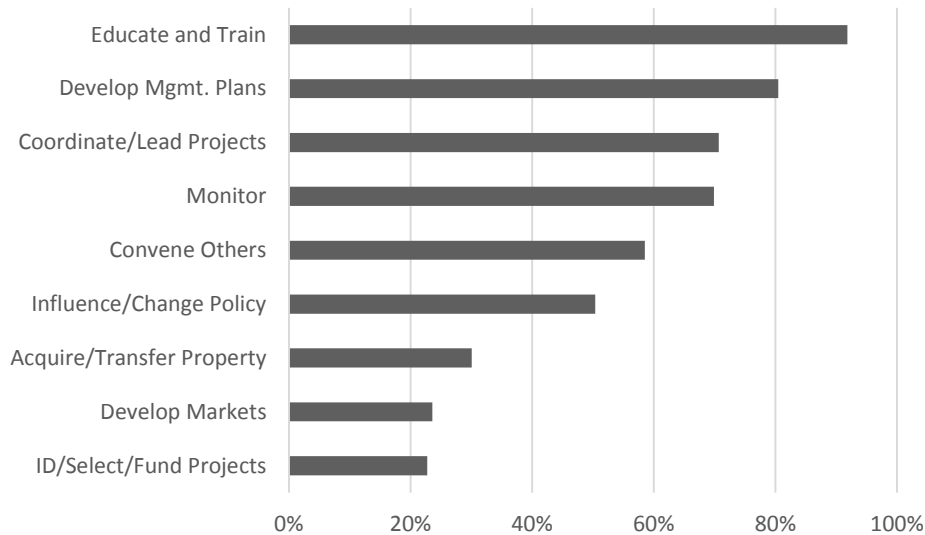


Figure 2.7. Strategies of Colorado collaboratives (n=123).

Almost all Colorado collaboratives (92%) used strategies involving education, outreach, and training.

This ‘educate and train’ strategy was applied to raise awareness about issues, influence behavior, inspire community members to commit to a place and its stewardship, or empower non-government stakeholders through learning. Many collaboratives (81%) worked together to ‘develop management plans’ to steward resources, mitigate wildfire, reduce nonpoint source pollution, and restore degraded ecosystems. Seventy-one percent of collaboratives implemented on-the-ground resource management or conservation projects, through coordination, joint implementation or other arrangements among members. In addition to the internal processes that all collaboratives conduct among their members, 59% of collaboratives convened processes for external stakeholders, to build trust or provide a public forum for debate and learning, for example. Half of the groups (50%) worked to change or influence

public policy (the actions of local, state, federal, or tribal government) through formal advising, developing standards, proposing new legislation, or advocacy. Almost a third of collaborative (30%) supported or coordinated property acquisitions or transactions (including land and water), often by applying for grants to purchase easements, coordinating 'groundwork' with willing property owners, or building support within the community for the use of easements. Almost a quarter (24%) worked together to develop, deliver, and/or promote market innovations to solve problems (through activities such as market analyses). Finally, 23% of the groups collaborated to find and select projects that aligned with the goals of a government funding source, connecting project proponents outside of the collaborative's members to resources.

Who participates, and how are they organized?

Some types of entities were more frequently represented as members than others (Figure 2.8). Local government representatives were the most common types of members, with at least one included in 85% of Colorado's collaboratives. Private industry (48%) and farmers/ranchers (45%) were more common members than academics or extension agents (40%). Representatives from environmental and outdoor recreation nonprofits and federal government agencies were also common, represented in 80% and 77% of collaboratives (respectively). Representatives of tribal government were least common, included in only 5% of collaboratives.³

³ Colorado has two federally recognized tribes (Southern Ute and Ute Mountain Ute), as well as other nations native to the state. The numbers I report only include representatives of agencies within the two federally recognized tribes, as I do not have data about the number of members with non-government tribal affiliations.

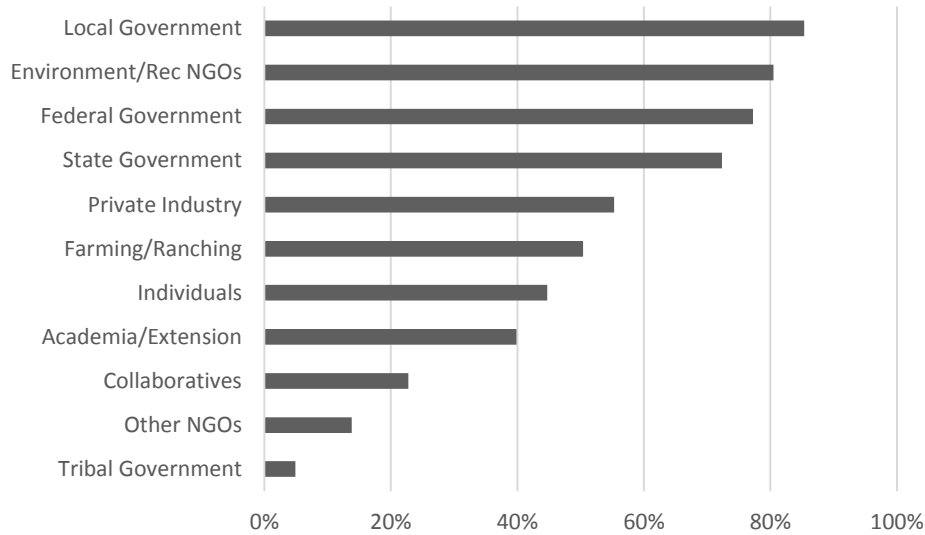


Figure 2.8. Percentage of the different kinds of members represented in Colorado’s collaboratives (n = 123).

Overall, the number of kinds of members for each collaborative (i.e., breadth or narrowness of representation, n = 123) ranged from 3 to 9 (median = 5). For 104 cases, I had sufficient information to analyze the total number of individual members. Membership size ranged from 5 to 98 members (median = 15). For these 104 cases, I also measured membership composition for each group by the proportion of members representing non-government (median = .49), local government (median = .22), and upper-level government members (median = .22). Members of collaboratives arrange themselves in a variety of forms from loose networks, to formal organizations, to quasi-agencies. Colorado’s collaboratives fell into three broad legal categories⁴: nonprofits (33% of collaboratives), unincorporated or fiscally sponsored associations (55%), and public bodies (11%) (n=122). About one third of collaboratives formalized into a nonprofit corporation at some point in their development. Over a quarter of these did so within a year of formation, but a third waited five years or more before becoming nonprofits. Rather than creating a new, formal organization, many cross-sector collaboratives

⁴ These designations are based on the legal standing of the association to enter into agreements, be sued, and so forth.

sought fiscal sponsorship from established nonprofit organizations, which extends to the collaborative (or the collaborative project) legal and tax-exempt status, and allows them to apply for grants. This category also included many collaboratives that use multi-year formal agreements, such as memoranda of understanding (MOUs), to structure their partnership. The remainder of collaboratives had legal designations as some form of public body, specifically local public bodies or local authorities (defined by Colorado statute), or formal committees chartered under the Federal Advisory Committee Act (FACA).

Discussion

How many collaborative initiatives are in Colorado, and where are they?

Over the last 40 years, more than 180 collaboratives have emerged in Colorado, with at least 157 still active today. As described earlier in Table 2.1, Fernández-Giménez et al. (2004) identified 107 active collaboratives stewarding Arizona's rangelands (as it happens, Colorado had a cumulative count of 107 collaboratives in the population as of 2004 as well). A statewide study currently underway at Portland State University has found 143 active natural resource collaboratives in Oregon, including 89 watershed councils, 26 forest collaboratives, 18 focused investment partnerships, four place-based water planning initiatives, and six Resource Advisory Councils (B. Cochran, National Policy Consensus Center, personal communication). New Mexico has at least 29 active and inactive groups: 12 watershed groups were identified in the Greater Watershed Sourcebook (Kenney et al., 2000), and 17 forest and watershed collaboratives have been identified by the New Mexico Forest and Watershed Restoration Institute (A. Barton, New Mexico Highlands University, personal communication). Unfortunately, no information is yet available regarding the geographic distribution of collaboratives in these states (as of the time of writing).

The clustering of collaboratives along populated corridors (Figure 2.1) suggests that population plays a role in where collaboratives arise, with collaboratives clustered around the densely populated Denver-Fort Collins corridor and distributed along populated corridors in less urbanized parts of the state.

Studies of spatial network formation have established that geographic distance plays a role in formation of network ties, with increasing distance limiting the ability of people to form and maintain relationships, even with technology and infrastructure that can facilitate connections across long distances (Daraganova et al., 2012). Further, 'institutionally thick' urban areas are home to many government agencies and non-government organizations that can support and participate in collaborative partnerships (Hardy & Koontz, 2010). If population were the only factor, however, one would expect to see more groups around the Pueblo and Grand Junction area and fewer in Durango and the San Luis Valley. Distributions of particular populations of species of interest (e.g. sage-grouse), as well as areas where forests have been devastated by insects and disease obviously play a role in where collaboratives are established. At least 78 collaboratives work either partly or entirely on public lands, and the majority of Colorado's public lands are located in the western part of the state.

How do collaboratives define their boundaries?

Geographic boundaries define the collaborative's territory and resources of concern, as well as their target spatial scale of influence. More than that, boundary definition is a political process that may reflect power relations, group identity, and even the values of concern to the collaborative (Cheng & Daniels, 2005; Cumming, Cumming & Redman, 2006). The definition may be decided by initiating leaders (as with some collaboratives catalyzed by mandate, like the Resource Advisory Councils and Basin Roundtables), or through the collaborative processes of developing their shared theory of change (Emerson & Nabatchi, 2015). Events, interests, and opportunities can lead to adjustments in boundaries over time. For example, some collaboratives have expanded to include nearby watersheds that did not have a collaborative in place, or shifted their boundaries to fit changing problems of concern.

Watershed boundaries are the most commonly used boundary for collaboratives in Colorado, and there are a few reasons why this might be the case. Watershed boundaries are largely associated with water

quality and wetland ecosystem health primary natural resource issues, which (when combined) make up over a third all collaboratives in the state (Huayhuaca & Reid, 2019). Watershed boundaries may better 'fit' the kinds of problems these groups often address, like nonpoint source pollution, degradation of riparian ecosystems and habitat, erosion and channel morphology concerns (Griffin, 1999). But there are also normative and political reasons for using watershed boundaries. Watershed boundaries may have more meaning for connecting identity to place than a jurisdictional boundary or zone of concern, particularly when defined at a relatively small spatial scale (Cheng & Daniels, 2005). Watershed boundaries may appeal to a broader base of non-government members (Griffin, 1999). I have not found evidence that watershed boundaries correspond to greater non-government participation, but they are often used by collaboratives with greater local government participation (Huayhuaca, unpublished data).

The common use of watershed boundaries may also be related to the role of policy in shaping collaboration. A 1987 amendment to Clean Water Act created the incentive-based 319 Program, which is a common source of funding for collaborative initiatives addressing water quality issues. Following the introduction of the 319 Program, the Environmental Protection Agency adopted a Watershed Approach Framework in the mid-1990s, which it describes as "a coordinating framework for environmental management that focuses public and private sector efforts to address the highest priority problems within hydrologically-defined geographic areas, taking into consideration both ground and surface water flow" (EPA, 1996, p.2). Watershed-based thinking was already proliferating on its own in Colorado before this EPA framework was officially adopted, "driven by issues such as the threat of expanded water quality regulatory requirements, compliance with endangered species needs, increasing municipal demand, and federal lands management" (Klein & Williams, 2007, p. vii).

Jurisdictional boundaries were second most common type of boundary used by collaboratives to describe their spatial extent. Many of the water supply collaboratives use jurisdictional boundaries that

follow river basin boundaries within state boundaries, and which actually correspond to the jurisdictions of river districts. Public lands boundaries, county or multi-county, and open space boundaries were used by over half of both forest-focused and land use-focused collaboratives. Ecologically defined boundaries were most common for fish and wildlife conservation collaboratives (Huayhuaca & Reid, 2019).

What kinds of issues do collaboratives address?

Collaboratives address many combinations of natural resource issues, along with their social and ecological sub-issues, which I explore further in the Chapter 3; here I will focus on the primary natural resource issues. Even if issues change over time, characteristics of the primary issue early in the development of a collaborative can have legacy effects. Relevant property and ownership regimes, policy frameworks, the concentration or diffuseness of decision authority over the resource, and other conditions shaped by the original issues can influence many aspects of collaboration (like membership and strategies) later in their development (Emerson & Nabatchi, 2015; Ostrom, 1990; Poteete et al., 2010). I explore this further in Chapter 4.

The sample of collaboratives over-represents the primary issues of land use and fish and wildlife conservation. For fish and wildlife conservation groups, Chapter 4 shows that this is likely due to their tendency to generate plans. For the land use collaboratives, several were convened by the federal government to address public lands issues, and detailed information about them is readily available on agency websites or other public archives.

For the 123 collaboratives used for in-depth analysis, the most common primary issues were fish and wildlife conservation, water quality, and riparian and ecosystem wetland health, which is similar to patterns found elsewhere in the U.S. For example, findings of a recent systematic review of studies of collaboration in the U.S. (Wilkins et al., in preparation), which found that ‘concerns for endangered, threatened, or declining flora and fauna species’ and ‘watershed health or water quality concerns’ were

the most common motivations for collaborative formation. A study of watershed initiatives in the western U.S. reported similar findings for the most common environmental problems addressed by only watershed groups: water quality (92%), fish and wildlife (77%), land use issues (71%), and water supply issues (66%) (Kenney et al., 2000). In their study of community-based natural resource initiatives in the western U.S., Moseley et al. (2011) found the most common ‘key issues’ to be public lands (82%), forest management (75%), and watershed management (73%). However, the Moseley et al. (2011) study limited their sample to groups working in forests and rangelands. My results reflect a larger proportion of collaboratives working on water-related issues than in the Moseley et al. (2011) study. That said, a weakness of this study (or any study attempting to characterize the fluid phenomenon of collaboration) is that the definition of a collaborative initiative can constrain the inclusion of groups that might be considered collaboratives elsewhere. For example, I did find several nonprofit, community-based organizations that focus their work on public lands (often providing coordination and training of volunteers, and often working in national forests, such as Friends of the Dillon Ranger District), but they did not meet the criterion for multiple kinds of participants.

When did collaboratives form?

The earliest collaboratives were water quality associations and authorities, which proliferated throughout the 1980s and 1990s (Figure 2.6). These were distinct from traditional water quality planning or management agencies because they involved stakeholders from several jurisdictions as well as non-government stakeholders working together within a natural watershed boundary. The concept of “ecosystem-based management,” as well as the idea of the watershed as a natural planning unit gained traction throughout the 1980s (Meffe et al., 2002; Griffin, 1999), and Colorado’s first watershed groups focusing on riparian or mixed (riparian, range, and/or forest) ecosystem health emerged in the late 1980s. The first two collaboratives focusing on biodiversity conservation at a large landscape scale appeared in 1988-1989, with at least 19 more forming over the next 10 years. The first group that

focused primarily on forest health (specifically wildfire mitigation) emerged the year following the Black Tiger Forest Fire in 1989, which was, at that time, the most destructive fire in the state's history. The number of new collaborative initiatives in Colorado sharply increased in the 1990s. This was a time characterized by political gridlock over the enforcement of the "green laws" of the 1970s (like the Endangered Species Act and the Clean Water Act) and increasing controversy over federal ownership of public lands fueled by the county supremacy movement (Stewart, 2001; Sousa & Klyza, 2007). Rapid demographic change in the west further deepened cultural divides. Colorado experienced the third fastest population growth rate in the U.S., at almost 31% over the decade, which coincided with a period of robust economic growth (Kendall, 2002). The benefits of this boom, however, were unevenly distributed and communities that had relied on traditional resource-based economies (like the timber industry) struggled with this rapid change. While rapid change and conflict certainly damaged relationships in some communities, several in Colorado responded proactively by starting cross-sector collaborations to address the negative economic and ecological impacts of changing land uses on both public and private lands (like the Ponderosa Pine Forest Partnership and the Public Lands Partnership). The first two decades of the 21st century have seen not only continued population growth, but also increasingly warm temperatures and dry conditions, leading to concerns over water supply and demand gaps. Warmer winters coupled with years of fire suppression set the stage for multiple outbreaks of native bark beetles that have gradually devastated millions of acres of forests. Already a severe drought year, 2002 also marked the Hayman Fire, still Colorado's largest. Six major forest fires occurred in the 1990s (from 1993-1996), which more than quadrupled to 25 from 2000 to 2008, and 18 more between 2010 and 2015. The rate of formation of collaborative initiatives addressing safety and vulnerability issues has increased sharply since the beginning of the millennium. Ten such collaboratives formed between 1990 and 1998, 21 formed between 2001 and 2009, and 22 more between 2010 and 2015.

Collaboratives in Colorado began to form in the 1970s and proliferated in the 1980s and 90s, which coincides with findings from other studies about the emergence of collaboration in the United States. In their nationwide study of watershed organizations, Clark et al. (2005) found early examples of watershed partnerships in Wisconsin and North Carolina dating back to the 1930s and even earlier. However, they also found that, by 1990, 36% of all watershed organizations in their sample had formed in eastern states, as opposed to only 17% in western states, suggesting that watershed groups formed comparatively earlier in the east than in the west. Another nationwide study of watershed groups found only 9% (n = 118) began before 1990 (Kenney et al., 2000), and a nationwide study of collaborative ecosystem management projects (Yaffee et al., 1996) found 1976 to be the earliest year of formation for this kind of effort.

Why do collaboratives form?

Government programs, regulations and policies (particularly at the federal and state levels) have played an important role in catalyzing Colorado's collaboratives through government program or policy incentives, concerns about regulatory impositions, or even mandates to collaborate (Moore & Koontz, 2003; Prokopy et al., 2014; Schultz et al., 2019; Wondolleck & Lurie, 2016). Policy-related catalysts have cumulatively driven more collaboratives (either directly or indirectly) than crises or risks of crises. There are several possible reasons for this. A separate study underway suggests that the prevalence of different kinds of catalysts has changed over time, with the number of collaboratives catalyzed by severe biophysical events apparently increasing starting in the early 2000s, while those catalyzed by policy threats have been decreasing since about the mid-2000s (Huayhuaca, unpublished data). Alternatively, the criteria used to select groups for analysis (see Methods) may have biased the sample against crisis-driven models of collaboration, which may involve a narrower set of stakeholders (as suggested by Emerson & Nabatchi, 2015), or which may form to complete short-term objectives and disperse relatively quickly, enduring less than two years.

Over half (54%) of collaboratives are catalyzed at least in part by biophysical catalysts (both low-intensity and severe), while 67% are driven by some kind of policy-related catalyst. This is not too dissimilar to the findings of Fernández-Giménez et al. (2004), that 63% of collaboratives emerge in response to “resource base issues” while 65% emerge in response to ‘sociopolitical issues,’ which include “complex regulatory requirements” (p. 27). Clark et al. (2005) found that 50% of watershed organizations nationwide were catalyzed as a “response to existing natural resource or ecological damage within the watershed” (p. 301, n = 210). While they did not measure government or policy catalysts, they did find that groups in western states were more likely to form proactively (before ecological damage occurred) than were those in eastern states. They attributed this to a greater role of “the threat or anticipation of governmental (often federal) intervention to address a natural resource issues” in the west than the east (pp. 306-307). This assertion is supported by findings here that, of the policy-related catalysts, 43% were associated with regulatory threats or concerns about litigation.

About 90% of the collaboratives with low-severity biophysical catalysts also described additional catalysts as well. Prokopy et al. (2014) posit that slow-changing or ongoing degraded environmental conditions do not act as catalysts of collaboration (at least in water quality initiatives), stating “[i]f gradually worsening conditions or the presence of poor water quality was in itself sufficient to cause change, then many more groups would be in existence... The question in these cases is, what made people suddenly pay attention...?” (p. 1187). I chose to include low-severity biophysical catalysts, based on how collaboratives described the situations and events that precipitated their formation. However, collaboration is no small investment, so it is not a surprise to see additional non-government opportunities, or government incentives, recommendations, mandates, or policy-related threats helping to grease the wheels of collective action in the absence of concerns about risk or crisis.

The initiating leadership of Colorado's collaboratives is broadly diverse, but differs from other states. Leadership in Colorado comes in roughly equal proportions from upper-level government, local government, non-government, and mixed government/non-government actors. As I explore in the coming chapters, leaders from each level may bring different advantages and constraints that affect the development of collaboratives, through problem framing, member recruitment, resources and capacity, and so forth (Koontz et al., 2004; Takahashi & Smutny, 2002; Young, 2006).

Fernández-Giménez et al. (2004) found that collaboratives in Arizona had slightly more non-government initiators (52%) than government initiators (48%), which is quite different from Colorado. When upper-level and local government initiators are combined and mixed initiators are excluded, there are more examples of government-initiated collaboratives (70%) and fewer examples of collaboratives led by non-government initiators (30%.) When analyzing non-exclusive categories of initiating leadership, 27% of Colorado's collaboratives have federal initiators, 40% have state initiators, and 37% have local government initiators, similar to results found by Kenney et al. (2000) (33% for federal initiators, 38% for state initiators, and 52% for local government). However, both Yaffee et al. (1996) and Wilkins et al. (in preparation) found higher percentages for federal initiators (45% and 56%, respectively) than for state initiators (27% and 25%); they also found much lower percentages for local government initiators (9% and 8%). In a separate study investigating relationships between initiators and issues, local governments are somewhat more likely to be initiate collaboratives addressing pollution (which is common for collaboratives with a water quality focus), (Huayhuaca, unpublished data). Thus, the high numbers of local government-led groups here and in Kenney et al. (2000) may be related to the large number of water quality groups included in the datasets.

I identified more collaboratives with collective interdependence than a competing interdependence. The interdependence variable emerged during the coding process, but as discussed in the introduction, many sources acknowledge this distinction (Bodin, 2017; Gray, 1989; Selin & Chavez, 1995). Margerum

(2008) asserts that collaborative environmental government is, by nature, a collective endeavor, which is true in a sense. Collaborative initiatives involve collective action to address problems that link stakeholders through their interdependence (Gray, 1989), but the interests they have in the problem domain need not be shared. I explore the theoretical and practical distinctions of these two orientations further over the next two chapters. Specifically, I find collaboratives with collective and competing orientations differ significantly in the kinds of issues that they address, the catalysts that trigger them, the kinds of initiators that lead them, their membership characteristics and the kinds of strategies that they undertake together.

What strategies do collaboratives use?

The strategies pursued by Colorado collaboratives were similar to those found in inventories of collaboratives in other states and across the U.S., with the difference that Colorado has many more collaboratives with education-related strategies than in other studies. Common strategies reported by other studies include monitoring, on-the-ground projects, resource management planning, education and outreach, influencing policy or policy research, and convening stakeholder processes (Fernández-Giménez et al., 2004; Kenney et al., 2000; Moseley et al., 2011; Wilkins et al., 2019, and Yaffee et al., 1996). All of these strategies were undertaken by 50% or more of the collaboratives in my study as well, although the order of importance (based on percentages) was different. For example, resource management planning, which was the second most common strategy for collaboratives in this study, was the most common for watershed groups in Kenney et al. (2000). Monitoring, the fourth most common strategy here, was the most common strategy for rangeland groups in Fernández-Giménez et al. (2004), collaborative initiatives in Wilkins et al. (in preparation), and collaborative ecosystem management projects in Yaffee et al. (1996, though their category was inclusive of other research as well). On-the-ground projects were most common for community-based groups in Moseley et al. (2011) (third most common in my study). Education/ outreach/ and training, which was most common here,

was less common in other studies, ranking either 3rd or 4th in terms of percent of collaboratives reporting that strategy. The reason for this discrepancy is unclear. I analyzed documents about each collaborative that represented their work at different points in time, and found that most collaboratives did report this kind of strategy at some point in their development, but its importance to their overall goals was not tracked.

Who participates in collaboratives, and how are they organized?

In terms of broad categories, membership in Colorado collaboratives looks similar to membership elsewhere in the U.S., as reported in other studies. In my study, 77% of collaboratives had federal government members and 72% had state government members. Wilkins et al. (in preparation) found the lowest percentages of these member types (50% and 52%, consecutively), and Yaffee et al. (1996) found the highest (88% and 86%, consecutively). The low numbers found for tribal government representation (6%) were consistent with the latter study, which found only 10% of projects had tribal corporation representation. Higher numbers were reported in the New Watershed Sourcebook, which found 35% tribal participation overall, with particularly high participation in the Great Basin and Columbia River Basin (Kenney et al., 2000).

Numbers of members reported by Clark et al. (2005) were much higher than those reported here: they found 28% of watershed organizations in western states had 76 or more members, while only 2% of the collaboratives in my study had membership of this size. The largest bracket for both studies was 6-25 members, but this included 72% of the collaboratives I analyzed and only 36% of theirs. However, numbers presented in Clark et al. (2005) were self-reported in surveys, without reference to how members were defined. Colorado collaboratives describe their membership in different ways, with some clearly designating a core groups as the decision-makers, while others are more inclusive in their description of members (see the Appendix for details on membership stratification and coding). Not

surprisingly, increasing specificity in describing core members corresponded to fewer kinds of members represented and fewer numbers of members overall. Participation and membership are notoriously ambiguous, fluid, and difficult to elicit even from core leaders (Huxham, 2000), especially when comparing across collaboratives that have different functions, like conservation planning groups with large and inclusive membership, and long-term watershed partnerships led by small committees focused on implementing action-level strategies like education and monitoring. My numbers were likely made more conservative due to my emphasis on the decision-making role of members.

I presented a very simple metric (organizational legal status) of a very complex concept, organizational formality (which includes specialization of function and roles, standardization of procedures, formalization of documentation, centralization of authority, and configuration of role structure (Pugh & Hickson, 2007)). Still, this metric reflects governance arrangements that have implications for a collaborative's capacity to achieve its strategies (Andrews & Edwards, 2004; Cheng & Sturtevant, 2012).

A full 55% of Colorado collaboratives are unincorporated or fiscally sponsored associations. As explored in a separate study, these kinds of organizations are characterized by a larger proportion of upper-level government members, and often focus on strategies that involve coordinating projects, resources, and information (Huayhuaca, unpublished data; Margerum, 2008).

Over one third of collaboratives in Colorado have formed nonprofits (and about a quarter of these within the first year of formation). Nonprofit collaboratives tend to have fewer kinds of members, fewer numbers of members, and a higher proportion of non-government members, and often tackle action oriented strategies such as education, monitoring, and project implementation (Diaz-Kope & Miller-Stevens, 2014; Huayhuaca, unpublished data). The remaining 12% (all of which were mandated or recommended by the government agencies or legislature) are public bodies, characterized by more kinds of members, larger numbers of members, a larger proportion of local government members, and a

tendency to focus on strategies like policy influence and development (Huayhuaca, unpublished data). Moseley et al. (2011) contrasted nonprofit and 'informal' organizations and found that environmental groups were the most commonly represented kind of interest group in nonprofits, and that informal collaboratives had significantly more government representation than nonprofits. If unincorporated collaboratives are considered informal, their findings somewhat support those here.

There are benefits and drawbacks when collaboratives formalize their organizational arrangements. On the one hand, it can clarify expectations, improve accountability, increase the likelihood that groups will deliver on their goals, and improve the chances of securing more resources in the future (Imperial & Koontz, 2007). Clear process guidelines can be especially helpful for groups with a diverse mix of government and non-government members. On the other, the process of agreeing on such arrangements takes a lot of time and financial resources to establish and maintain, which can come at the expense of progress on other goals (Bonnell & Koontz, 2007). The most informal groups I observed had relatively homogeneous membership and a collective understanding of how they should address their shared issues of concern (Huayhuaca & Reid, 2019).

The line between a collaborative and some other kind of organization is blurry and subject to change. Collaboration can be a phase in the development of a more formal organization (Imperial & Koontz, 2007). Alternatively, it can be a phase of learning, trust building, and coordination before a group adopts a shared stance on issues that they believe will promote the public good (Andrews & Edwards, 2004). Or collaboration can define a group brought together by a process that lasts for years until they disband. Twenty-seven collaboratives in the sample have endured for 20 or more years (Huayhuaca, unpublished data).

Conclusions

The aim of this study was to ask and answer ‘who-what-when-where-why’ questions about collaborative conservation groups in the state of Colorado. This study leaves many questions open for smaller-sample, case study research that could explain in greater depth how catalysts interact to influence the formation of collaboratives, how collaboratives adapt their issues over time, or what lessons can be learned from the inactive groups.

This study is the first state-level study to include such a broad range of groups, but another is underway as of 2018 in Oregon (which will also include health care collaboratives). More large-sample, statewide studies will allow researchers to make more direct and robust comparisons across states than I have been able to make. Longitudinal research on the catalysts and the rate of formation of different kinds of collaboratives could reveal insights about how collaboration is helped or hindered by increasingly severe disturbance events, economic and policy trends, or shifts in administration (at the state or federal level). For example, will big shifts in policy currently underway lead to fewer collaboratives (because of relaxed regulations) or more collaboratives (because of fewer funding sources)?

CHAPTER 3. HOW COLLABORATIVES FORM IN COLORADO: AN ANALYSIS OF INITIAL CONDITIONS AND PROBLEM CHARACTERISTICS

Introduction

As the variety of problems that collaboration is used to address has increased, so too has interest in how the origins of collaboration influence later collaborative dynamics, arrangements, and outcomes (Bryson, Crosby & Middleton Stone, 2015; Emerson & Nabatchi, 2015). Conceptual and theoretical frameworks are available to link social and ecological conditions to the likelihood of collaborative formation, to process dynamics and structural arrangements, and to the outcomes of interactions (e.g. Emerson, Nabatchi & Balogh, 2012; Lober, 1997; Ostrom, 2007). These frameworks are not well suited for large sample studies, in part due to constraints posed by the volume of information necessary to satisfy their application. However, many collaboratives record and share their ‘origin stories’ in documents accessible to the public, making it an attractive area of study for large sample research based on document analysis. While tracing formative characteristics to outcomes may not be feasible for a large N study, analyzing relationships between theoretically important formative characteristics is both feasible and largely unexplored. The purpose of this chapter is to first to clarify concepts related to the formation of collaboratives so that they can be measured for a large sample, then to explore these relationships and test assumptions from the literature by applying empirical data to a conceptual model.

Collaboration arises when the context and timing align to motivate collective action. Theories of collaborative formation, many of which have come from the fields of public policy and administration (Gray, 1989; Kingdon, 1984; Emerson & Nabatchi, 2015) and common pool resource theory (Ostrom, 1990), point to several key antecedents to collaboration. These can be roughly grouped as 1) contextual factors that make collaboration a more likely solution than other governance solutions, and 2) near-term initial conditions that actually lead to collaboration (Bryson et al., 2015).

Both context and initial conditions determine the future dynamics and success of collaboration, particularly through membership, i.e., the set of people who lend their capacity and resources to the group (Takahashi & Smutny, 2002). Through the collaborative process, participants create the collaborative's strategic purpose (Imperial & Koontz, 2007), and its organizational structures (Bryson, Crosby & Middleton Stone, 2006; Bonnell & Koontz, 2007). There are several comprehensive frameworks linking context and initial conditions to collaborative dynamics and outcomes (e.g. Ansell & Gash, 2008; Emerson, Nabatchi & Balogh, 2012; Bryson et al., 2006). These frameworks are excellent for analyzing one or a few cases of collaboration, but are too information intensive for a large N study. Further, in these frameworks initial conditions are often lumped together simply as antecedents of collaboration, without insights about whether and how they interact. The conceptual model I develop to guide analysis in this chapter adapts and clarifies selected concepts touched on by these comprehensive frameworks in order to 1) meet a practical challenge presented by analytical breadth versus depth, and 2) focus in on a common component within comprehensive frameworks (initial conditions) and explore constituent components and inter-relationships.

The model includes four conceptually dense elements: **catalysts**, **initiating leadership**, **interdependence**, and **the nature of the problem** that collaboratives arise to address. The nature of the problem is theorized to influence the likelihood of collaboration (Poteete, Janssen & Ostrom, 2010); as well as its purpose, membership, and structural characteristics once formed (Bryson et al., 2006; Emerson et al., 2012; Huxham, 2000; Imperial & Koontz, 2007; Lober, 1997; Poteete et al., 2010). Comprehensive frameworks like those mentioned above commonly incorporate some version of this idea, but with little conceptual agreement, and it remains under-specified.

In this study, I compare these four initial conditions across 123 cases of environmental collaboration in the state of Colorado. I unpack the **nature of the problem** (including its main resource issues, social and ecological sub-issues, and problem scope and scale), to understand this under-developed concept.

Finally, I develop a set of propositions from the literature to explore and test relationships between different parts of initial conditions. The insights gained from this exploration of problem characteristics and initial conditions sets the stage for Chapter 4, which analyzes the relationships between initial conditions, collaborative membership, and strategic purpose.

This chapter asks the following research questions: 1) can primary natural resource issues be characterized by their associations with scale, boundaries, the scope of their issues, and the substance of the social and ecological sub-issues? 2) Do the data support relationships between initial conditions proposed or implied in the literature? 3) What additional relationships between initial conditions, if any, can be identified? The first question unpacks the nature of the problems in terms of theoretically relevant components that are amenable to a large sample study. The second and third questions leverage the strength of a large sample study by testing propositions from the literature and identifying unexpected patterns.

I first present a brief review of theory on why collaboratives form to describe and justify the variables selected to characterize initial conditions in this study. I then examine the multi-faceted concept of the nature of the problem, and finally develop propositions about how initial conditions relate to one another.

Theory and model development

The term “initial conditions” refers to proximate or near-term conditions that lead to collaboration (Bryson et al., 2006), which were broadly categorized as different kinds of “drivers” in the Integrative Framework for Collaborative Governance Regimes (Emerson et al., 2012; see Chapter 1). Before describing how I have adapted these concepts for my analysis, I differentiate between initial conditions and context.

Context. Early conceptual frameworks used information-rich cases to blend contextual factors and drivers to explain why collaboration happens. The collaborative forming model (Lober 1997), adapted from the policy windows model of Kingdon, (1984), describes a *problem stream* as some undesirable state that must first manifest (through scientific observation, crisis, issue salience, or by otherwise drawing attention) before it can trigger collaboration. The problem stream exists alongside other streams that contribute to the overall likelihood of collaboration: the *policy stream* (relevant policies and institutions that guide behavior regarding the problem stream); the *organizational stream* (such as trends in cooperation or willingness to address the problem); and the *social/political/economic stream* (such as trends in public opinion regarding the problem). In this model, a *collaborative window* opens up when these four streams converge, and collaboration can occur *if* there is a collaborative *entrepreneur* with the necessary resources and networks that recognizes the window of opportunity and acts upon it by mobilizing others to collaborate (Lober, 1997). The emphasis of this model is on how stakeholders perceive the problem as a result of situations and contingencies that make the problem visible, rather than as a result of the characteristics of the problem itself.

Later frameworks differentiated between context and more proximate initial conditions and drivers. Contextual factors are conditions related to the environment in which the initiative is embedded, such as the various ‘streams’ described above, resource conditions, policy and legal frameworks, history of conflict, socio-economic and cultural conditions, network connectedness, and power relations (Bryson et al., 2006; Lober, 1997; Emerson et al., 2012). In addition to influencing the likelihood of collaboration by presenting general opportunities and constraints, context can continue to influence collaborative interactions and outcomes as new opportunities and constraints arise (Emerson et al., 2012).

Initial Conditions. On the other hand, *initial conditions* are more proximate circumstances that are essential to collaborative formation (Bryson et al., 2015; Coughlin et al., 1999). This chapter focuses on an analysis of initial conditions rather than on the more information intensive (and case study-

appropriate) contextual factors that lead to collaboration. The Integrative Framework for Collaborative Governance Regimes (CGR Framework, presented in Chapter 1) (Emerson et al., 2012; Emerson & Nabatchi, 2015) synthesized a large body of research on the necessary pre-conditions of collaboration and grouped them into four broad categories of what they refer to as “drivers”: uncertainty, interdependence, consequential incentives, and initiating leadership. It is important to note that the meaning of the term, *driver*, differs across disciplines. Drivers in social-ecological systems are variables that originate at higher scales outside the system (however defined) (Walker, Carpenter, Rockstrom & Peterson, 2012). I use the term initial conditions because its definition is broad enough to accommodate actual drivers of collaboration (in the sense implied by Walker et al., 2012) as well as those system properties and relationships that are theorized to shape collaboratives as they form.

Uncertainty (also described as turbulence in the institutional or organizational environment in early research on collaboration, see Gray, 1989) can drive collaboration when it serves to reduce, diffuse, or share risk or improve information. A similar concept included in the SES framework is the “unpredictability” of patterns associated with resource flows, which has been found to influence the likelihood of collective action (Poteete et al., 2010). I acknowledge the importance of uncertainty as a driver of collaboration, but I did not include this dimension in the model because it was difficult to assess using my methodology.

Interdependence drives collaboration when collaborators must rely on one another to access information, funding, or other resources (Huxham, 2000); when other independent solutions have failed (Bryson et al., 2006); or when key actors recognize that the challenge cannot be addressed individually and requires joint action (Emerson et al., 2012). This latter aspect of interdependence has also been interpreted as general agreement on the problem, the theory being that general agreement clarifies stakeholder interests and lowers barriers to collaboration (Gray, 1989; Bryson et al., 2006).

Network theorists distinguish between two categories of problems regarding the nature of interdependence that motivates collective action: coordination and cooperation problems (Berardo, 2014; Berardo & Scholz, 2010; Bodin, 2017). In coordination problems, stakeholders more or less agree on what they want to accomplish together, and collaboration arises from the need to align goals, actions, resources, and act collectively. In cooperation problems, stakeholders have different interests, and reaching agreement requires some negotiation and even potential tradeoffs. I drew on this typology to characterize observations that emerged from the data about the nature of the interdependence between stakeholders that motivated collaboration. However, to avoid conflation with similar terms referring to governance arrangements (Keast, 2015) and strategies (Margerum, 2008), I refer to interdependence rooted in the need to coordinate as **collective**, and in the need to cooperate as **competing**. Collectively-oriented collaboratives come together to meet shared needs and achieve mutually beneficial results; stakeholders may disagree on other points, but they are more in agreement early on about problem definition. Competitively-oriented collaboratives come together with divergent or conflicting interests and needs, and a partial aim of collaboration may be to resolve differences in values or perceptions of the problem, build trust, or to negotiate tradeoffs between stakeholders. Stakeholders with competing orientation may recognize their interdependence to the extent that collaboration is initiated, but their differences (lack of shared interests) can increase transaction costs of collaboration (Poteete et al., 2010).

In the CGR Framework, **initiating leadership** drives collaboration when one or more individuals recognize the presence of the other drivers and motivate other players to coordinate and come together to address the problem (Emerson et al., 2012). This concept is similar to collaborative or policy *entrepreneurs* (Lober, 1997; Kingdon, 1984) and *champions* (Selin & Chavez, 1995). Some of the proposed characteristics of actors that serve as initiating leaders pertain to individual skills and traits, like vision, energy, and charisma (Selin & Chavez, 1995). However, the ability to recognize the opening of

a collaborative window or the confluence of other drivers also depends to some extent on the position of the individual(s) relative to the problem. That position might be defined by stakeholders' jurisdictional responsibilities and authority, vested or official interests, knowledge and expertise, professional networks, ability to absorb high transaction costs and provide the necessary resources to get collaboration off the ground (Takahashi & Smutny, 2002; Lober, 1997; Purdy, 2012). These characteristics can also be thought of as scale-dependent comparative advantages (Cash & Moser, 2000; Young, 2006) of actors at different levels on jurisdictional, management, knowledge, network, or spatial scales, depending on the nature of the problem (Cash et al., 2006).

The authors of the CGR Framework define *consequential incentives* as either “external (situational or institutional crises, threats, or opportunities) drivers for collaborative action” or “internal (problems, resource needs, interests, or opportunities)” (Emerson et al., 2012, p. 9). I disaggregate this concept into **catalysts** and the **nature of the problem** (Figure 3.1). **Catalysts** focus attention on the problem, opening up the *collaborative window* described by Lober (1997) as when stakeholders recognize the salience and relevance of the issues to their interests. In their typology of catalysts for water quality collaborations, Prokopy, Mullendore, Brasier, and Floress (2014) differentiate between intentional catalysts (which may originate from government or non-government sources), and unintentional catalysts (which include actions like construction or development projects as well as disasters and industrial accidents). My classification of catalysts differentiates between two kinds of catalysts related to government policies or regulations (one is threats, the other combines the catalysts of mandates and recommendations); two kinds of opportunities/constraints (one is the combined opportunities and incentives from government and non-government sources, the other is land development); and two kinds of biophysical catalysts (one is severe, which combines high risks to human health/life or actual crises, and the other is low-severity catalysts). These catalysts align somewhat closely with those proposed in the Prokopy et al. (2014) typology, with the exception of the inclusion of low-severity biophysical catalysts. For these

catalysts, attention was drawn to a localized environmental problem before it had reached a point of crisis. Prokopy et al. (2014) would classify this as ‘slowly changing conditions,’ which they argue do not function as catalysts, stating “[i]f gradually worsening conditions...was in itself sufficient to cause change, then many more groups would be in existence," (p. 1187). I chose to maintain this kind of catalyst but note that 98% of the collaboratives that had this catalyst also had another kind of catalyst.

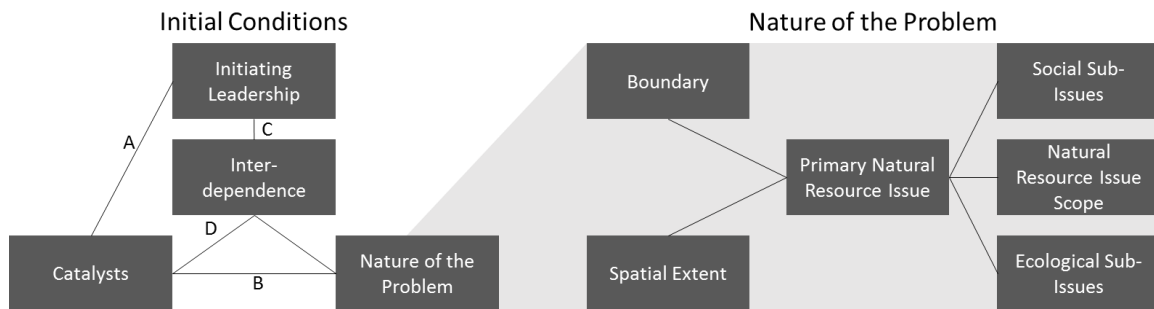


Figure 3.1. Conceptual model of 1) the initial conditions that characterize the formation of collaboratives (left), and 2) the variables related to one of the initial conditions concepts, ‘the nature of the problem’(right). Links indicate relationships analyzed in this study. Links with letters correspond to propositions outlined below; links without letters indicate exploratory analyses.

Finally, I arrive at the **nature of the problem** made visible and salient by the catalyst, which I present as a set of inter-related variables derived from the literature described next (and illustrated in Figure 3.1).

Scholars across disciplines acknowledge that biophysical and social characteristics of the natural resource problem influence the likelihood of collaboration, as well as its eventual form and function (Bodin, 2017; Bryson et al., 2015; Poteete et al., 2010; Kingdon, 1984; Emerson & Nabatchi, 2015).

However, the clarity of the concept in the literature ranges from vaguely specified to so specific as to be difficult to transform into measurable indicators outside of case study research. Further, it is a crosscutting concept that can be situated and analyzed within system context (for example, Prokopy et al., 2014, consider the degree of environmental degradation as an element of context); as an initial condition or driver (as proposed by Emerson et al., 2012); or as an emergent and evolving property of collaborative processes and feedbacks from short-term outcomes (Ansell & Gash, 2008; Emerson &

Nabatchi, 2015; Plummer & Armitage, 2007). I analyze the nature of the problem within initial conditions because it provides a consistent point in the development of each collaborative to identify attributes of the problem. However, I acknowledge that, particularly for small n studies, the nature of the problem might be better situated within either system context or as an output of process dynamics.

As introduced earlier, the concept of *internal consequential incentives* briefly mentioned in the CGR Framework is described as “problems, resource needs, interests, or opportunities” (Emerson et al., 2012, p. 9). While this provides a home for the nature of the problem within initial conditions, the CGR Framework provides little additional clarification. More helpful is a separate classification scheme elaborated by Emerson and Nabatchi (2015), *the nature of the policy challenge*, which is nested within a *formative typology* that groups CGRs as self-initiated, independently convened, or externally-driven (the formative typology is explored further in Chapter 4). The nature of the policy challenge is described as problems or undesired conditions that the collaborative initiative arose to respond to (Emerson & Nabatchi, 2015). The authors characterize the policy challenges as a function of the “range and intensity of their outcomes” (p. 165), which they label as acute, complex, or extensive. An *acute policy challenge* is a localized problem that is experienced by a diverse but narrow set of stakeholders “in extreme and severe ways” (p. 165). A *complex policy challenge* is experienced by a broader set of stakeholders with a more varied set of perspectives, and is thus prone to greater contention. An *extensive policy challenge* is experienced repeatedly or across multiple settings such that it “warrants similar approaches for policy and governance” (165). This classification scheme is still vague about natural resource issue differences, but intentionally so, because it was developed for application to collaboration in multiple policy sectors. Still, the scheme is difficult to apply as specified and is most helpful for providing a set of propositions about how variables interact, which are incorporated into the propositions presented and tested below.

On the other end of the spectrum, social-ecological systems (SES) scholarship provides some excellent examples of highly specific frameworks for describing and comparing the nature of the problem.

Perhaps best known is the Diagnostic SES Framework (Ostrom 2007, 2009), developed to describe and compare cases of complex SES addressing common pool and collective goods problems. The SES Framework incorporates elements of the Institutional Analysis and Development Framework (namely, “action arena,” which consists of interactions between an action situation, or game, and its participants) with interactions and outcomes into a focal ‘action situation’ and divides the SES into four interacting core subsystems: the resource system, resource units, the governance system, and the system’s resource users. Each subsystem consists of nested, multi-tiered variables that can be used to describe and compare variations in interdependencies between actors and their environment, as mediated through biophysical, social, and institutional parameters (Hinkel, Cox, Schlüter, Binder & Falk, 2015). The SES Framework as a whole is not a good fit for this study, because the intended unit of analysis is an action situation within an SES, rather than a collaborative initiative, which undertakes multiple action situations over time. Still, it synthesizes many factors (Figure 3.1) that can also be used to describe natural resource organizations, which I draw upon for my conceptual model: the clarity of **boundaries** (which I have adapted to the kind of boundary the collaborative uses to define its area); size (the **spatial extent** within the boundary), and natural resource sector (**primary resource issue**) (Ostrom, 1990; Rasmussen & Meinzen-Dick, 1995).

Biophysical differences in the natural resource (such as temporal and spatial dynamics of an ecosystem process) can influence the sensitivity to impacts of human activity (Poteete et al., 2010), but this level of analysis is beyond the scope of this study with so many cases. More pertinent to my model is how natural resource sectors differ in terms of the kinds of management challenges they face (Rasband, Salzman & Squillace, 2009; Guerrero, McAllister, Bodin & Wilson, 2015). For example, extractive renewable resources like timber or surface and groundwater involve challenges of sustaining yield, avoiding over-appropriation, or allocating fairly. Ecosystem services (or non-extractive renewable resources like water quality, habitat and biodiversity, and the avoided costs generated by healthy forest

and riparian ecosystems) face market failures when the positive externalities (values) they generate are not captured by the market; weak or non-existent legal protection; and problems of scale presented by jurisdictional boundaries. Intrinsic, recreational and aesthetic values provided by public lands and community open spaces face problems of congestion and ensuring use and equitable access to resources at levels that can sustain the value of the experience (Rasband et al., 2009). In reality, resource problems are usually an aggregate of several sub-problems, and many collaboratives address multiple issues of varying complexity (Bodin, 2017). To help us understand relevant differences between the nature of the problem and its relationships to other initial conditions, I also analyze **social sub-issues**, **ecological sub-issues**, and the **resource issue set** (the number of resource problems, both primary and non-primary) addressed by each collaborative soon after it formed (Figure 3.1).

To summarize, I adapted four concepts from the literature reviewed to characterize initial conditions leading to the formation of collaboratives (the left side of Figure 3.1). One of these initial conditions, the nature of the problem, is further broken into six sub-components (variables) (the right side of Figure 3.1) that were used to measure the problem as a function of its issues, boundaries and scale. Each collaborative had a primary natural resource issue, a set of natural resource issues, as well one or more social and ecological sub-issues that they addressed through their strategies. Each collaborative also had a single type of boundary, the area within which characterized its spatial extent (see the Appendix for details on metrics and coding for each variable). I examine relationships between initial conditions using a set of propositions developed below (links with letters), as well as exploratory analysis (links without letters). Links between variables within the nature of the problem indicate exploratory analyses of differences based on primary issues.

Propositions: Associations between initial conditions

I now draw on and integrate insights from the literature on how initial conditions might interact in order to develop propositions to test and explore connections between concept variables (Figure 3.1) using

empirical data. For each proposition, the null proposition proposes no association between variables. Explanations and metrics for variables are presented in the Methods section.

Catalysts and initiating leadership

As discussed above, theory suggests that collaboration emerges when entrepreneurs or initiating leaders perceive a problem via a catalyzing event, and that particular actors may have scale-dependent collaborative advantages (e.g., jurisdictional authority, financial or human resources, knowledge, or technical expertise) that allow them to recognize the presence of other drivers and initiate collaboration to address a given problem. Case study research of a Colorado collaborative responding to regulatory requirements for water quality suggested that government initiators might be more appropriate when there is “[a] ‘thinness’ of community” around issues (Steelman & Carmin, 2002, p. 172). For example, poor water quality conditions made visible through monitoring may be salient to water quality managers and point source polluters, but less so to most others (until, perhaps, a fish kill or other highly visible event makes it salient to a wider stakeholder base). In their formative typology, Emerson and Nabatchi (2015) propose that self-initiating collaboratives (interpreted here as those initiated by non-government actors) arise to address acute policy challenges (which they defined in partial reference to severe biophysical catalysts). From this, I expect to find associations between initiating leadership and catalysts variables (connection A, Figure 3.1).

Proposition 1: Policy mandates and recommendations will catalyze collaboratives initiated by a) local government and b) upper-level government, because both have the authority and jurisdictional responsibility to respond to these kinds of catalysts.

Proposition 2: Non-government initiators will respond to severe biophysical catalysts more often than other types of initiators, because crisis events lower transaction costs and make self-organization more likely.

Proposition 3: Local government initiators will respond to low severity biophysical catalysts more often than other types of initiators, because these catalysts are lower-profile and local governments have a

jurisdictional, scale-dependent comparative advantage to identify and manage environmental degradation.

Catalysts and the nature of the problem

Many collaborative initiatives are driven, at least initially, by regulations or incentives at the local governmental level, but more commonly by state and federal levels, particularly for natural resource problems like water and wildlife that fall with the public trust. Public Trust Doctrine holds that it is the purview of the state government to hold such resources for the benefits of the governed (which puts limits on the conversion of public property to private property) (Rasband et al., 2009). In the Tenth Amendment of the U.S. Constitution, states are granted police power to regulate natural resources and all else with implications for public health and well-being or in the public trust for the benefit of the state's citizens. Water supply, which in Colorado adheres to the Doctrine of Prior Appropriation⁵, is adjudicated through a system of state water courts, and falls within the state's purview as well. On the other hand, the ecosystem services provided by healthy forests and watersheds (like the avoided costs of wildfire and flood control) do not have strong regulatory 'hammers' as backstops to make collaboration a more attractive alternative than not collaborating (Nie, 2008). The insights of Prokopy et al. (2014) suggest that these kinds of resource problems might instead be driven by crisis events or opportunities and incentives intended to encourage collaboration. I generated the following propositions linking catalyst variables to primary natural resource issues (connection B, Figure 3.1):

Proposition 4: Collaboratives focused on a) fish and wildlife, b) water quality, and c) water supply will have more policy-related catalysts (either regulatory threats or compliance concerns, or outright mandates or recommendations) than collaboratives focused on other primary issues.

⁵ This legal doctrine of water rights establishes a 'first in time, first in right' priority system for accessing scarce water resources, and imposes standards of 'beneficial use' to apply and retain rights to water use. See Jones and Cech (2009) for an excellent primer on Colorado's interpretation of the Doctrine of Prior Appropriation.

Proposition 5: Collaboratives focused on wetlands and forest ecosystem health will form in response to more severe biophysical catalysts than collaboratives focused on other primary issues.

Due to the variety of different kinds of opportunities and incentives that might arise from government and non-government sources, the analyses of opportunity-related catalysts will be exploratory.

I also expect to see a relationship between the spatial extent of the resource problem and catalysts.

Emerson and Nabatchi's (2015) conceptualization of the nature of the policy challenge posits that acute challenges correspond to localized problems, whereas extensive challenges correspond to widespread or chronic problems amenable to similar policy solutions (applied to multiple situations). The term 'extensive' could be interpreted in several ways, but for this study I interpret it to mean spatially extensive (large). This is in accordance with research applying the SES Framework to cases of collective action, which finds that the likelihood of self-organization is negatively related to the spatial extent of the system (due to increased transactions costs introduced at larger spatial scales). Conversely, this suggests that collaboration at broad spatial scales is more likely to be induced via mandate or recommendation (Poteete, et al., 2010). Thus, I propose the following propositions relating catalysts to spatial extent (also connection B, Figure 3.1):

Proposition 6: Collaboratives catalyzed by severe biophysical events will be smaller in area than those that are not.

Proposition 7: Collaboratives catalyzed by policy mandates or recommendations will be larger in area than those that are not.

Interdependence and other initial conditions

Theory suggests that self-organization is more likely to occur when there is a shared understanding of the problem and when stakeholders have a vested (rather than official) interest in the natural resource system (Poteete et al., 2010; Emerson & Nabatchi, 2015). Other research suggests that the role of

government as a convening leader may be more appropriate for problems that are technically complex or require specialized knowledge, whereas non-government initiators (or independent third parties) may lend more legitimacy to complex or contentious problems requiring broader public support (Moore & Koontz, 2003; Koontz et al., 2004). Based on these insights, I propose two propositions linking initiating leadership with interdependence (Connection C, Figure 3.1):

Proposition 8: Non-government leaders will more often initiate collaboratives with collective interdependence, in which stakeholders have shared interests.

Proposition 9: Mixed government/non-government leaders will more often initiate collaboratives with competing interdependence, in which stakeholders have different interests.

Collaboratives with both collective and competing interdependence may arise from catalyzing events that garner a lot of attention and media coverage, or that trigger an emotional response. Summarizing research on catalysts and issues salience, Prokopy et al. (2014) underscore how the need to coordinate can be galvanized by shared crises; and, in their quote from Kingdon (1984), “the more visible the policy domain, the less important are crisis and disaster,” they imply that political controversy can galvanize collaboration with a more competitive orientation (p. 1180). For example, the policy domain surrounding water supply is highly visible and closely scrutinized by a wide variety of stakeholders, making crisis less important for spurring collaboration (Prokopy et al., 2014). I propose the following relationships between catalysts and interdependence (Connection D, Figure 3.1):

Proposition 10: Collaboratives with severe biophysical catalysts will have collective interdependence.

Proposition 11: Collaboratives with policy-related catalysts, specifically policy threats or concerns, will have competing interdependence.

As the concept of the nature of the problem is under-developed in the literature, I will explore relationships between its constituent variables, as well as the relationship between the concept of the nature of the problem and interdependence, but do not suggest propositions for these relationships.

I have elaborated the meaning of each of the four initial conditions of interest to this study, specified measurable variables for each, and developed propositions relating variables based on insights from the literature. Following the Methods, I apply empirical data from 123 collaboratives in Colorado to test these propositions and explore additional relationships between variables.

Methods

The criteria presented below were used to define, identify, and select cases for inclusion in this study.

Criteria 1-3 provide a broad definition of collaboratives to increase the variation of groups in this study (Creswell, 2013), because examining variation across cases is part of the purpose of the research.

Criteria 4-6 define the total study population of 183 (or big N), and criterion 7 restricts this large population to a smaller sample of 123 cases. In addition to extensive internet searches, I also used chain referral sampling (Creswell, 2013), asking experts and individuals associated with collaboratives to add to a growing list; the same criteria were applied before they were finally included in either the population or sample.

1. Members include a range of three or more of 11 possible categories of entities (see Table 3.1),
2. Members engage in a sustained process of interaction or consensus building lasting two or more years,
3. The initiative addresses the governance or management of one or more natural resources, ecosystem health, or conservation-related issues,
4. The collaborative emerged by or before 2015,
5. The initiative's boundaries fall wholly or partially in Colorado,

6. Sufficient information about the initiative was available online to verify that the initiative met the above criteria,
7. Sufficient documentation was available to collect information about the initiative’s history, purpose, strategies, and membership on the internet and/or internet references to printed materials accessible through the university.

Table 3.1. Categories of individual and organizational affiliations used to code members and initiating leaders. Inclusion of three kinds of “member types” was a criterion for inclusion in the study.

Initiating Leadership	Member Types
Upper Level Government	<ul style="list-style-type: none"> • Tribal (like the Water Quality Division of the Ute Mountain Ute Tribe) • Federal (like Natural Resources Conservation Service, U.S. Forest Service, or Bureau of Reclamation) • State (like Colorado Parks & Wildlife, or the Colorado Water Conservation Board)
Local Government	<ul style="list-style-type: none"> • Local governments include regional, county and municipal governmental agencies, and quasi-government organizations like soil conservation districts, water conservancy and conservation districts, utilities, ditch and reservoir companies, and other special districts
Non-Government	<ul style="list-style-type: none"> • Private industry and business (including trade and business associations) • Farmers, ranchers and large landowners (including agricultural associations) • Environmental and recreational nonprofits • Colleges and universities (including Extension) • Other organizations (like church groups or historical societies) • Other collaboratives • Individuals, private citizens, homeowners (including HOAs)
Mixed Government and Non-Government	<ul style="list-style-type: none"> • Includes non-government individuals or organizations plus local and/or upper level governments

I found 183 active and inactive collaboratives that met the first six criteria, but limited my analysis to the 123 initiatives that also met the seventh. See Chapter 2 Methods for description of sampling, data collection, and management and coding methods.

Variable categories

This section now outlines definitions and metrics for the variables within my conceptual model. See Chapter 2 for descriptive statistics for each.

Nature of the Problem. I analyzed statements about missions, goals, and major activities to develop categories and code cases for primary resource issues and social and ecological sub-issues of concern to collaboratives. Because issues change over time, primary natural resource issue was defined as the category that best characterizes the problem of concern to the collaborative within the first 1-2 years of formation. In cases where multiple environmental issues were of interest to the collaborative at a given time, I assigned categories based on where the greatest emphasis was placed in terms of planned or actualized strategies.

The following six categories were used to code each collaborative's primary natural resource issue:

- **Water quality:** Focused on pollution or poor water quality in flows of surface or subsurface waters, or surface and groundwater reservoirs
- **Forests ecosystems:** Focused on forested ecosystems (montane/sub-alpine forests and montane shrublands)
- **Wetlands ecosystems:** Focused on aquatic ecosystems (wetlands and marshes, riparian areas, stream channels, or natural/manmade reservoirs)
- **Fish & wildlife** Focused on management or conservation of mobile wildlife or populations of species (like fish, birds, or elk)
- **Water supply:** Focused on the administration of water quantity, water rights, water storage and infrastructure, and changing or redirecting water flows
- **Land use:** Focused on real estate or the transfer of surface or sub-surface rights; with rights to use and access land for different purposes, including energy development; or with land use change, local/regional identity and sense of place
- A seventh category, **rangeland ecosystems**, was merged with the next most appropriate categories on a case by case basis (namely land use, fish and wildlife, and wetlands ecosystem health) because of overlap and too few representative cases. Rangeland or grassland ecosystems include pasture and grasslands, semi-desert shrublands, pinyon-juniper woodlands, or plains agricultural lands.

The **natural resource issue scope** is defined as the total number (from 1-7) of the 7 resource issues above (including rangeland ecosystem health) addressed by the collaborative, regardless of whether the issue was primary or not.

The seven categories below were used to record **social sub-issues** addressed by the collaborative:

- **Livelihoods/economy:** Protecting or improving economic conditions, usually associated with resource-based livelihoods like agriculture, ranching, logging, mining, or tourism
- **Recreation/cultural values:** Protecting or improving recreation opportunities, aesthetics or other cultural values associated with the environment
- **Infrastructure:** Maintaining, improving physical infrastructure, such as water delivery mechanisms, power lines, reservoirs and canals, trails, or buildings
- **Property rights:** Protecting or adjusting land, water, or sub-surface property rights
- **Safety/vulnerability:** Protecting safety, health, life, and property (including infrastructure); reducing vulnerability or improving a community's ability to respond to and recover from emergencies and disturbance events
- **Liability/compliance:** Increasing a community's ability to comply with rules and regulations, enhancing local control, or reducing potential for liability
- **Relationships/trust:** Enhancing trust, reducing conflict, forming new/improved relationships between stakeholders at any level, beyond core members or strategic partners.

There were the following eight categories of **ecological sub-issues**:

- **Land management impacts:** Degradation of a resource system (regardless of ownership) caused by resource management practices (such as timber harvesting); recreational uses like hiking, boating, fishing, camping; farming/agricultural practices (like pesticide application or irrigation); livestock grazing practices (like soil compaction or over-grazing); or mineral/metals extraction, coal/oil/gas extraction, or the generation of renewable energy
- **Altered streamflows:** Degradation caused by 1) straightened streams, dams, paved waterways, or other engineered hydrological modifications (such as erosion, sedimentation, sinking water tables, flooding, or aquatic habitat fragmentation); or 2) vegetation loss and resulting erosion, streambank instability or loss of sinuosity

- **Impacts of drought, climate change, and water appropriation:** Degradation caused by long-term drought, altered climate regimes, over-appropriation of ground and surface water, or diversion of water to a different location/ adjudication for different use and resulting impacts.
- **Weeds/woody invasives:** Undesirable plant species whose presence compromises the desired use(s) of a given resource system
- **Pollution:** Degradation caused by point source, non-point source, and terrestrial pollution, including landfills
- **Altered fire regimes:** Impacts to a resource system caused by long-term fire suppression yielding fuel build-up, susceptibility to disease/infestation, and increased risk of wildfire
- **Land conversion:** Fragmentation of landscapes/ecosystems through real estate transactions and subdivision (usually urban or exurban housing or private sector development) that physically alters the landscape. Common examples are the sale and subdivision of large ranches that are no longer economically viable for their owners, as well as forest conversion and development in the wildland urban interface (WUI)
- **Wildlife impacts:** Degradation of a resource system caused by native or non-native wildlife, such as over-grazing and subsequent erosion (elk) or predation of native species (game fish). Also includes human-wildlife conflict or undesirable effects of wildlife management.

There were three types of **boundaries** in the analysis for this study: watershed boundaries (delimited by topography and water drainage); jurisdictional boundaries (such as public lands or county lines, or other boundaries that indicate who has authority to make decisions within a given area); and problem boundaries (defined by the ecological problem of concern, such as a migration corridor, a wildfire zone of concern, or an area affected by invasive species or pollution). I defined **spatial extent** as the area within the boundaries defined by the collaborative, first converted to km², and then performed a log₁₀ transformation to normalize the data.

I analyzed three kinds of **catalysts** (policy-related, biophysical, or opportunities/constraints), each of which had two mutually exclusive categories. Although Prokopy et al. (2014) assert that, with sufficient information, a single catalyst of collaboration should be identifiable for each case, only 44% of Colorado's collaboratives had a single kind of catalyst (whereas 50% had two and 6% had three). This

study considers all three kinds of catalysts, regardless of whether they were the sole catalyst or one of a multiple behind the formation of a collaborative. I used the following categories of **catalysts**:

- Policy-related
 - **Policy threats/concerns**: Collaboration triggered by concerns about the implications of a regulation or government policy, including lawsuits, regulatory takings, imposed standards, or penalties associated with non-compliance
 - **Mandates or recommendations**: Collaboration is induced by legislation, recommended by a government agency or a policy, usually accompanied by funding or in-kind support
- Biophysical
 - **Low-severity biophysical catalysts**: Environmental degradation reaches a point sufficient to garner attention but had not yet reached the point of risk or crisis
 - **Severe biophysical catalysts**: Combines high severity events (like floods, fires, or major contaminant spills), that affect well-being, life and property as well as medium-severity events, such as beetle epidemics that present a risk of future crisis that could impact human health and wellbeing
- Opportunities/Constraints
 - **Opportunities and incentives**: Combines government and non-government sources of financial or human capital, such as grants that encourage collaboration, non-government organization (NGO) initiatives or missions that push for collaboration, events intentionally designed to promote new collaborations; or intentional re-organizations of past collaborations, such as spinoffs
 - **Land development pressures**: Proposed or actual construction projects to develop land or overland infrastructure (did not include infrastructure in waterways)

I grouped 11 possible types of organizational, agency, or individual actors into four broader groups to define four **initiating leadership** levels: non-government individuals or organizations, local or quasi-government agencies, upper-level government agencies (including state, federal, and tribal governments), or mixed government and non-government initiators (Table 3.1). Collaboratives can also be convened by a neutral third party or non-government 'bridging organization' (Selin & Chavez, 1995;

Emerson & Nabatchi, 2015), which was also measured, but include with non-government initiators for the analyses presented in this chapter.

In this study, the variable called **interdependence** differentiates between collaboratives motivated by the need to coordinate among stakeholders with collective or shared interests, or the need for stakeholders with competing interests to cooperate to address a problem. I looked for indicators in texts to code each collaborative using one of three categories:

- Collective Orientation: Initiators and/or early participants had shared needs or shared objectives, or the initial aim of collaboration was to work collectively to achieve mutually beneficial results
- Competing Orientation: Initiators and/or early participants had competing needs or objectives, or the initial aim of collaboration was to resolve contested/conflicting/competing values or perceptions of the problem, or to negotiate tradeoffs between stakeholders
- Unsure: Case cannot be coded due to insufficient or contradictory information (these were excluded from analysis)

Analyses

Once qualitative data coding was complete, the data were imported into SPSS for exploratory analysis and proposition testing. The data did not meet assumptions of normality (indicated by Shapiro-Wilk tests), so I used non-parametric tests for all analyses. I used χ^2 tests for independence to test relationships between categorical or dichotomous variables, with a minimum of 80% or more of expected cell counts within the crosstabulation greater than five for all results reported (100% meet this criterion unless otherwise indicated, *p*-values corrected for multiple comparisons) (McHugh, 2013). To identify which cells deviated from independence for *n*-way contingency tables, I did a cell-by-cell post-hoc comparison using adjusted standardized residuals. Large adjusted residual values (± 2 or greater) indicate which cells account for the lack of independence in the crosstabulation (that is, when dummy coded and run as two-by-two contingency tables, they constitute significant associations) (Laerd

Statistics, 2016). I used Fisher's exact tests to interpret findings for propositions in certain instances where there were too few cases to obtain a χ^2 values.

I used Kruskal-Wallis H tests or Mann-Whitney U tests to assess relationships between continuous dependent variables and categorical independent variables (like primary resource issues and initiating leadership level) or dichotomous independent variables (like catalysts). Pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons. Adjusted p -values are presented. For both kinds of tests, I present mean ranks (rather than medians, which are more intuitive), because distributions were dissimilar, as assessed by visual inspection. For all analyses, differences were considered statistically significant at $p < .05$.

Results

Characterizing the nature of the problem

Before testing propositions, I begin by exploring differences between the primary natural resource issues in terms of their sub-issues, their scope of resource issues, their boundaries, and their spatial extent. Each collaborative had only one primary natural resource issue, but they could address multiple social and ecological sub-issues, which are separate binary variables (thus, I analyzed crosstabulations separately for each sub-issue, $df = 5$ for each). I identified important differences between primary issues, but also among the many sub-issues that overlap (Table 3.2).

I was interested in how collaboratives focused on different primary issues then differed in their association with particular sub-issues, e.g., whether the proportion of forest-focused collaboratives addressing economics and livelihoods issues was significantly higher or lower than collaboratives focused on other primary issues. Adjusted residuals appear in parentheses below observed percentages, with values larger than ± 2 highlighted in bold to indicate which categories of the primary natural resource issue accounted for the statistically significant associations between the categorical primary

issue variable and the binary sub-issue variable. Positive adjusted residuals indicate a positive relationship between the primary issue and sub-issue, and vice versa for negative adjusted residual values. For example, the most commonly addressed social sub-issue was economics and livelihoods (addressed by 69% of all collaboratives in the sample). Ninety-four percent of land use collaboratives addressed economics and livelihoods issues, while only 40% of water quality collaboratives did. Their adjusted residuals (in bold in Table 3.2) indicate that land use and water quality primary issues account for the significant association between the primary natural resource issue variable and the economics/livelihoods issue variable (when dummy coded, land use and water quality are statistically significantly related to economics/livelihoods issues, positively for the former, negatively for the latter).

Looking down the columns in Table 3.2, one can see how primary issue types differed in terms of the sub-issues that they were strongly positively (or negatively) associated with. For example, a significant proportion of collaboratives focused on wetlands ecosystem health addressed sub-issues related to safety (80%), weeds and woody invasive (85%), and altered streamflows (which includes erosion and channel morphology problems; 100%). Relative to other kinds of primary issue types, significantly fewer wetlands ecosystem health collaboratives addressed concerns about liability and compliance (5%), impacts of land management (45%), and habitat or landscape fragmentation (10%). While large percentages of these same collaboratives addressed sub-issues related to recreation/aesthetics/cultural values, infrastructure, and pollution, these percentages were not significant relative to the other categories of natural resource primary issue.

Table 3.2. Comparison of how social and ecological sub-issues differed across primary natural resource issues addressed by Colorado’s collaboratives, showing the % of collaboratives of a given primary issue addressing each sub-issue (n=123). Collaboratives had multiple sub-issues and thus the columns within sub-issues do not total to 100%. % Freq. = frequency of collaboratives with this sub-issue. Adjusted residuals are presented in parentheses under percentages in each sub-issue cell. Residuals in bold highlight adjusted residuals larger than ±2, indicating which primary issues account for significance in each row. For all analyses, *df* = 5.

	Primary Natural Resource Issue (% of collaboratives)								
	% Freq.	$\chi^2(5)$	<i>p</i>	Wetlands Ecosystem n=20	Forest Ecosystem n=22	Water Quality n=25	Land Use n=17	Fish/ Wildlife n=25	Water Supply n=14
Social Sub-Issues (%)									
Economics/ Livelihoods ^A	69.1	20.1	.001	55.0 (-1.5)	72.7 (.4)	40.0 (-3.5)	94.1 (2.4)	84.0 (1.8)	78.6 (.8)
Recreation, Aesthetics, Cultural Values ^A	67.5	18.2	.003	73.7 (.8)	45.8 (-2.9)	52.0 (-1.9)	94.1 (2.5)	70.8 (.5)	85.7 (1.5)
Infrastructure	48.0	25.7	<.0005	65.0 (1.7)	40.9 (-.7)	40.0 (-.9)	58.8 (1.0)	16.0 (-3.6)	92.9 (3.6)
Property Rights	47.2	61.9	<.0005	30.0 (-1.7)	0.0 (-4.9)	20.0 (-3.0)	82.4 (3.1)	76.0 (3.2)	100.0 (4.2)
Safety/ Vulnerability	43.1	58.3	<.0005	80.0 (3.6)	95.5 (5.5)	20.0 (-2.6)	29.4 (-1.2)	4.0 (-4.4)	35.7 (-.6)
Liability/ Compliance	40.7	32.9	<.0005	5.0 (-3.5)	9.1 (-3.3)	60.0 (2.2)	41.2 (.0)	60.0 (2.2)	71.4 (2.5)
Relationships/ Trust	47.2	12.7	.026	40.0 (-.7)	45.5 (-.2)	28.0 (-2.1)	47.1 (.0)	52.0 (.5)	85.7 (3.1)
Ecological Sub-Issues (%)									
Land Mgmt. Impacts	73.2	39.8	<.0005	45.0 (-3.1)	40.9 (-3.8)	88.0 (1.9)	100.0 (2.7)	100.0 (3.4)	57.1 (-1.4)
Altered Stream Flows	62.6	45.6	<.0005	100.0 (3.8)	22.7 (-4.3)	56.0 (-.8)	29.4 (-3.0)	76.0 (1.6)	100.00 (3.1)
Drought/Climate	48.0	24.6	<.0005	35.0 (-1.3)	27.3 (-2.1)	40.0 (-.9)	35.3 (-1.1)	64.0 (1.8)	100.00 (4.1)
Weeds/ Woody Invasives	45.5	24.4	<.0005	85.0 (3.9)	50.0 (.5)	20.0 (-2.9)	35.3 (-.9)	56.0 (1.2)	21.4 (-1.9)
Pollution	43.9	55.1	<.0005	60.0 (1.6)	22.7 (-2.2)	100.0 (6.3)	35.3 (-.8)	4.0 (-4.5)	35.7 (-.7)
Altered Fire Regimes	39.8	54.2	<.0005	30.0 (-1.0)	100.0 (6.4)	4.0 (-4.1)	47.1 (.7)	44.0 (.5)	7.1 (-2.7)
Land Conversion	37.4	43.5	<.0005	10.0 (-2.8)	18.2 (-2.1)	12.0 (-2.9)	58.8 (2.0)	84.0 (5.4)	42.9 (.4)
Wildlife Impacts ^B	22.8	---	---	0.0	4.5	4.0	41.2	72.0	7.1

^A91.7% of expected cell counts > 5, criteria for use of a χ^2 test was met. ^BDoes not meet expected cell count criteria for χ^2 tests of 80% or more > 5, thus a Fisher’s exact test was used.

As can be seen in Table 3.2, there is much overlap between collaboratives that address land use and fish & wildlife conservation primary issues. Due to these similarities, I further analyzed a subset of land use (n = 13) and fish and wildlife (n = 13) primary resources issue cases (for which there was sufficient data) for the type of *land ownership* targeted by the actions of collaboratives. These were coded as all or mostly private, all or mostly public, public and private. While there were not enough cases to use inferential statistics, 100% of the collaboratives with the fish and wildlife primary resource issue were working on public and private lands, compared to 30% for collaboratives focused on land use. More land use groups worked on all/mostly public lands (54%) than all/mostly private lands (15%). The remaining results presented in Table 3.2 are summarized in greater detail, along with other variables from the nature of the problem, at the end of this section.

Primary resource issues also corresponded to statistically significant differences in 1) the total number of resource issues addressed by collaboratives (issue scope), and 2) their spatial extent (Table 3.3). Distributions of resource issue scope differed significantly among the primary resource issues, with water quality and forest health primary issues having a smaller scope of issues than collaboratives focused on other primary issues (particularly water supply, which tended to have a larger issues scope). Water quality was significantly lower than water supply ($p = .012$), land use ($p = .019$), and fish and wildlife ($p = .022$). Forest ecosystem health was significantly lower than water supply ($p = .019$), land use ($p = .016$), and fish and wildlife ($p = .038$). While they appear very close, land use was significantly lower than water supply ($p = .019$).

There were statistically significant differences in distributions of spatial extent by primary resource issues, largely accounted for by collaboratives focused on water supply issues (which tend to be larger in spatial extent), as well as water quality and wetlands ecosystem health issues (which both tend to be smaller in spatial extent), relative to other primary issues. Specifically, collaboratives working on water

supply issues had larger geographic areas than collaboratives working on forest ecosystem health ($p = .005$), wetlands ecosystem health ($p = .005$), and water quality ($p = .001$).

Table 3.3. Comparison of ranking primary natural resource issue by resource issue scope and spatial extent (Kruskal-Wallis H tests). For natural resource issue set ($n=123$), numbers for each primary issues are the same as in Table 3.2. For spatial extent ($n=118$), some data were missing, so the frequencies for each primary issue were adjusted downwards to: water quality ($n=25$), wetlands ecosystem health ($n=20$), forest ecosystem health ($n=20$), land use/access ($n=16$), fish and wildlife ($n=23$), and water supply ($n=14$).

	n	H(5)	p	Primary Natural Resource Issues (Mean Ranks)					
				Wetlands Ecosystem	Forest Ecosystem	Water Quality	Land Use	Fish/Wildlife	Water Supply
Resource Issue Set	123	29.4	<.0005	49.2	45.9	45.3	82.8	76.6	84.2
Spatial Extent	118	22.6	<.0005	45.0	72.7	42.8	56.1	64.0	87.6

There were also statistically significant relationship between boundary types and primary resource issues ($n = 112$). Watershed boundaries were used most commonly by water quality collaboratives, $\chi^2(2) = 24.85$, $p < .0005$, as well as wetlands ecosystem health collaboratives, $\chi^2(2) = 9.469$, $p = .009$. Forest ecosystem health collaboratives had a weak positive association with jurisdictional boundaries, $\chi^2(2) = 6.865$, $p = .032$, and problem-defined/ecological boundaries were commonly used by fish and wildlife collaboratives, $\chi^2(2) = 19.75$, $p < .0005$.

Finally, I assessed differences in spatial extent among three types of boundaries (excluding nine cases with hybrid boundaries; $n=109$). Groups with jurisdictional boundaries (mean rank = 79.65) were significantly larger in extent than groups with either watershed boundaries (mean rank = 47.84) ($p < .0005$) and problem-defined/ecological boundaries (mean rank = 38.13), $\chi^2(2) = 31.76$ ($p < .0005$). Collaboratives using jurisdictional boundaries tended to be larger than those that use watershed or ecological boundaries.

In answer to the first question presented in this chapter, I summarize the above findings with a rough characterization of the primary natural resource issues based on their associations with scale,

boundaries, the scope of their issues, and the substance of the social and ecological sub-issues.

Colorado's watershed and forest ecosystem health-focused collaboratives were similar to one another (and different from collaboratives addressing other primary issues) in that they commonly addressed social sub-issues related to increasing safety or reducing vulnerability. Forest-focused collaboratives tended to work on a narrower scope of issues, at larger spatial scales than groups addressing other primary issues (with the exception of water supply), and often had jurisdictional boundaries (e.g. public lands boundaries). Wetlands ecosystem-focused collaboratives, as well as water quality collaboratives, tended to be small and used watershed boundaries. Water quality collaboratives were distinct from wetlands ecosystem groups in their emphasis on compliance with water quality standards. Like forest collaboratives, they had a narrow scope of issues (and were unique in being significantly less likely to include economics and livelihoods issues that other collaboratives, which was among the most common categories of social sub-issues addressed).

Water supply and administration problems overlapped with water quality problems in their emphasis on liability and compliance (in their case, largely concerns about meeting requirements of river compacts), and with wetlands ecosystem problems in their focus on altered streamflows. However, 91% of cases with this primary issue were defined within jurisdictional boundaries that cover significantly larger areas than water quality and wetlands ecosystem problems (and even forest ecosystem problems). For example, Colorado has nine "Basin Roundtables" that are large in spatial extent, and while based on the idea of geophysical river basin boundaries, the boundaries are actually more administrative than natural. They largely correspond to the seven water divisions that serve as administrative units for organizing water courts and the Division of Water Resources, with a few conglomerates of added or excluded water management districts.

Water supply collaboratives also differed from other water-focused collaboratives in their ubiquitous inclusion of property rights issues (specifically water rights, governed by the Doctrine of Prior

Appropriation in the state of Colorado). Many also included concerns about protecting and improving infrastructure (mainly storage), conflicts and building trust, and not surprisingly, drought and climate change issues. They were also notable in their large and inclusive scope of natural resource issues.

There was a great deal of overlap between land use problems with the conservation of fish and wildlife. All cases for both of these primary issues included concerns about negative impacts of particular land management practices (like energy development, recreation impacts, or overgrazing). Significant proportions of both also addressed issues involving property rights and conversion/ fragmentation of landscape ecosystems. They both addressed significantly more resource issues than collaboratives that form to address water quality or forest health. However, recreation, cultural values, and aesthetics, as well as economics and livelihoods issues, are more commonly addressed by collaboratives that start off with a land use primary issue, whereas fish and wildlife collaboratives often incorporate concerns about compliance or litigation. Also, a larger proportion of land use collaboratives focused their attention primarily on public lands, whereas fish and wildlife conservation groups often use ecologically defined boundaries that weave together public and private lands.

Catalysts and initiating leadership

The remaining results test the propositions stated earlier and explore relationships between initial conditions to address the second and third questions of the study.

Proposition 1: Policy mandates and recommendations will catalyze collaboratives initiated by a) local government and b) upper-level government.

Proposition 2: Non-government initiators will respond to severe biophysical catalysts more often than other types of initiators.

Proposition 3: Local government initiators will respond to low severity biophysical catalysts more often than other types of initiators.

Local government was not associated with policy mandates or recommendations, thus there is no support for Proposition 1a. Upper-level government very commonly responded to mandates and recommendations by initiating collaboration, as predicted by Proposition 1b. Non-government initiators did not respond to either kind of policy catalysts. There is no support among Colorado collaboratives for Propositions 2 & 3. Non-government initiators did not respond more often than other initiators to severe biophysical catalysts, nor did local government initiators respond to low severity biophysical catalysts more often than other initiators. Instead, local government initiators led collaboration in response to risks and crises, and non-government initiators and mixed government/non-government initiators more commonly led collaboration in response to opportunities and incentives (Table 3.4).

Table 3.4. Comparison of initiating leadership across catalysts (n=123), showing the % of collaboratives with different initiating leaders that had each kind of catalyst. Collaboratives could have more than one catalyst, thus columns do not sum to 100%. % Freq. = frequency of collaboratives with this sub-issue. Adjusted residuals are presented in parentheses under percentages in each sub-issue cell. Residuals in bold highlight adjusted residuals larger than ± 2 , indicating which primary issues account for significance in each row. For all analyses, $df = 3$.

Catalysts	% Freq.	$\chi^2(3)$	p	Initiating Leadership (%)			
				Non-Government (n=26)	Local Government (n=27)	Upper-level Government (n=35)	Mixed (n=35)
Policy threat/ concern	29.3	5.4	.143	11.5 (-2.2)	29.6 (.0)	37.1 (1.2)	34.3 (.8)
Mandate/ recommendation	21.1	33.6	<.0005	0.0 (-3.0)	11.1 (-1.4)	54.3 (5.7)	11.4 (-1.7)
Opportunities/ incentives	45.5	39.0	<.0005	84.6 (4.5)	37.0 (-1.0)	8.6 (-5.2)	60.0 (2.0)
Land development ^A	5.7	---	---	3.8	14.8	0.0	5.7
Low-severity biophysical	32.5	3.7	.295	42.3 (1.2)	40.7 (1.0)	22.9 (-1.4)	28.6 (-.6)
Severe biophysical	21.1	9.6	.022	19.2 (-.3)	37.0 (2.3)	5.7 (-2.6)	25.7 (.8)

^ADoes not meet expected cell count criteria for a χ^2 test of 80% or more >5, thus a Fisher's exact test was used.

Catalysts and the nature of the problem

Proposition 4: Collaboratives focused on a) fish and wildlife, b) water quality, and c) water supply will have more policy-related catalysts (either regulatory threats or compliance concerns, or outright mandates or recommendations) than collaboratives focused on other primary issues.

The kinds of catalysts that drive collaboration and the primary issues that they form to address are significantly related (Table 3.5). A significant proportion (60%) of the collaboratives that formed to address fish and wildlife resource problems were responding to policy threats or concerns (primarily the Endangered Species Act), as predicted by Proposition 4a. Collaboratives with a water quality focus were also positively associated with policy threats or concerns, supporting Proposition 4b, though the association was weak (Cramer’s $V=.252$). Exploratory analysis revealed that water quality issues were more commonly linked to low-severity biophysical catalysts than policy threat catalysts, with the former driving 80% of collaboratives focused on water quality.

Table 3.5. Comparison of primary natural resource issues with catalysts, showing the % of collaboratives of a given primary issue that had each catalyst (n=123). Collaboratives could have multiple catalysts. % Freq. = frequency of collaboratives with this catalyst. Adjusted residuals are presented in parentheses under percentages in each catalyst cell. Residuals in bold highlight adjusted residuals larger than ± 2 , indicating which primary issues account for significance in each row. For all analyses, $df = 5$.

Catalysts	% Freq.	$\chi^2(5)$	p	Primary Issue (%)					
				Wetlands Ecosystem	Forest Ecosystem	Water Quality	Land Use	Fish/Wildlife	Water Supply
Policy threat/ concern	29.3	33.1	<.0005	5.0 (-2.6)	4.5 (-2.8)	52.0 (2.8)	29.4 (0.0)	60.0 (3.8)	7.1 (-1.9)
Mandate/ recommendation ^A	21.1	---	---	10.0	4.5	16.0	17.6	28.0	64.3
Opportunities/ incentives	45.5	44.7	<.0005	90.0 (4.4)	81.8 (3.8)	20.0 (-2.9)	41.2 (-.4)	16.0 (-3.3)	28.6 (-1.4)
Land development ^A	5.7	---	---	0.0	0.0	4.0	35.3	0.0	0.0
Low-severity biophysical	32.5	39.2	<.0005	35.0 (1.3)	13.6 (-2.1)	80.0 (5.7)	11.8 (-2.0)	16.0 (-2.0)	14.3 (-1.5)
Severe biophysical ^A	21.1	---	---	45.0	68.2	8.0	5.9	0.0	7.1

^ADoes not meet expected cell count criteria of 80% or more >5, thus a Fisher’s exact test was used.

A Fisher’s exact test revealed that the 64.3% of water supply collaboratives are driven by mandate ($p < .0005$). Note, however, that all nine of these cases were driven by the same mandate, the Colorado Water for the 21st Century Act, passed by the state legislature in 2005. Given this, there is no support for Proposition 4c.

Proposition 5: Collaboratives focused on wetlands and forest ecosystem health will form in response to more severe biophysical catalysts than collaboratives focused on other primary issues.

There were too few cases driven by severe biophysical catalysts ($n = 26$) to obtain χ^2 values for wetlands and forest ecosystem resource issues. Sixty-eight percent of forest-focused collaboratives involved a severe biophysical catalyst, which was significant ($p < .0005$). By contrast, biophysical catalysts had no association with the 45% of wetlands ecosystem-focused collaboratives. Thus, Proposition 5 was not supported.

Risks/crises often catalyzed groups addressing the social sub-issue of safety and vulnerability, $\chi^2(1) = 27.677$, $p < .0005$, as one might expect, given the danger crises can post to human safety and infrastructure. This was especially true for collaboratives focused on forest and wetlands primary resource issues, suggesting some support for that proposition. Severe biophysical catalysts sometimes had opportunity and incentive catalysts, $\chi^2(1) = 10.089$, $p = .001$. More specifically, 38.5% of collaboratives that included a risks/crisis catalyst also had a funding incentive from a *government* source ($p = .003$).

When combined, opportunities and incentives from government and non-government sources were particularly important for both forest and wetlands ecosystem collaboratives. There were no strong relationships between specific catalysts and land use resource issues, although a Fisher's exact test supported a significant relationship between land use and land development threat, $p < .0005$ (land use was the primary issue for six of the seven cases in which land development was a major catalyst).

Proposition 6: Collaboratives catalyzed by severe biophysical events will be smaller in area than those that are not.

Proposition 7: Collaboratives catalyzed by policy mandates or recommendations will be larger in area than those that are not.

Proposition 6 was not supported. Collaboratives with severe biophysical catalysts did not work in areas of either larger or smaller land areas than collaboratives without severe catalysts ($p = .589$). However,

collaboratives driven by a low-severity biophysical catalyst (mean rank = 46.52) did work in smaller areas than other collaboratives without this catalyst (mean rank = 66.15, $U = 1041.0$, $z = -2.951$, $p = .003$).

Collaboratives catalyzed by a policy mandate or recommendation (mean rank = 79.69) worked in larger land areas than other collaboratives (mean rank = 54.35, $U = 1612.5$, $z = 3.239$, $p = .001$), as predicted by Proposition 7.

Interdependence

Proposition 8: Non-government leaders will more often initiate collaboratives with collective interdependence.

Proposition 9: Mixed government/non-government leaders will more often initiate collaboratives with competing interdependence.

Interdependence was categorized as either competitive or collective. Indeed, collaboratives led by non-government initiators had a collective orientation more often than would be expected if the variables were independent, supporting Proposition 8 (Table 3.6). However, those led by mixed government/non-government initiators did not have strong competing orientation, thus there is no support for Proposition 9. In fact, slightly more collaboratives with this kind of initiator, 58.1%, had a collective orientation ($p = .772$). Instead, collaboratives led by local governments often had a collective orientation ($p = .007$), and those led by upper-level government often had a competing orientation ($p < .0005$, Table 3.6).

I also expected to see associations between particular catalysts and interdependence:

Proposition 10: Collaboratives with severe biophysical catalysts will have collective interdependence.

Proposition 11: Collaboratives with policy-related catalysts, specifically policy threats or concerns, will have competing interdependence.

Both propositions were supported: collaboratives with severe biophysical catalysts had a stronger collective orientation ($p < .0005$) than those without this catalyst, and those with policy threat catalysts had a more competing orientation ($p < .0005$, Table 3.6). Interdependence was related to other catalysts as well. Collaboratives driven by opportunities and incentives from government or non-government sources had a more collective orientation ($p < .0005$), as did those driven by low-severity biophysical catalysts (though this association was slightly weaker for the latter, $p = .008$).

Mandates/recommendations commonly triggered collaboratives with competing interdependence ($p = .005$).

Table 3.6. Comparison of interdependence with different kinds of initiating leadership, catalysts, and resource sub-issues; percentages presented by row (2-way χ^2 using dummy coded variables for initiating leadership). *P*-values indicate evidence against the null hypothesis that there was no association between interdependence and the presence kind of initiating leader, catalyst, and sub-issue ($n = 103$). For all analyses, $df = 1$.

	$\chi^2(1)$	<i>p</i>	Interdependence	
			Collective (<i>n</i> =62)	Competing (<i>n</i> =41)
Initiating Leadership			%	%
Non-government	8.0	.005	86.4	13.6
Local government	7.2	.007	85.7	14.3
Upper-level government	21.9	<.0005	24.1	75.9
Catalysts				
Opportunities/incentives	20.7	<.0005	82.4	17.6
Severe biophysical	16.6	<.0005	95.8	4.2
Low-severity biophysical	7.0	.008	78.8	21.2
Policy threats/concerns	16.4	<.0005	32.4	67.6
Policy mandates/ recommendations	8.1	.005	29.4	70.6
Social Sub-Issues				
Safety/ vulnerability	13.5	<.0005	79.2	20.8
Property rights	35.0	<.0005	31.4	68.6
Liability/compliance	30.7	<.0005	30.4	69.6
Livelihoods/economy	15.7	<.0005	47.9	52.1
Ecological Sub-Issues				
Pollution	13.1	<.0005	80.0	20.0
Wildlife impacts	24.7	<.0005	16.7	83.3
Land conversion	10.8	.001	39.5	60.5
Land mgmt. impacts	9.5	.002	50.7	49.3
Drought/climate	5.3	.021	47.8	52.2

I did not formulate propositions for relationships between interdependence and the variables within the nature of the problem, but interdependence was strongly related to primary natural resource issues. Water quality, as well as wetlands and forest ecosystem issues, tended to be the focus of collectively-oriented collaboratives, while land use, fish and wildlife, and water supply were often the focus of collaboratives with competing orientation ($\chi^2(5) = 60.218, p < .0005$). However, theory suggests that issue salience, not natural resource sector, is important for problem framing (Koontz et al., 2004), and my premise is not that primary resource issues have inherent collective or competing tendencies. Colorado collaboratives with a competing orientation very commonly focus on sub-issues of property rights issues, liability/compliance issues, and negative impacts of wildlife; they often address economics/livelihoods issues, land/habitat fragmentation, and other negative impacts of land management. Collaboratives with a competing orientation were weakly focused on drought and climate change. Collaboratives that start off with a more collective orientation tended to address pollution and safety/vulnerability issues. In addition the associations presented in Table 3.6, collaboratives with a competing orientation had a larger scope of natural resource issues (mean rank = 66.12) than those with a collective orientation (mean rank = 42.66) ($n = 103, U = 1850.0, z = 4.005, p < .0005$) (Mann-Whitney test).

Discussion

Catalysts bring attention to problems in ways that are relevant to initiating leaders at different levels, making some leaders more or less likely to drive collaboration given particular catalysts. Particular kinds of catalysts are more likely to trigger collaboration around different natural resource issues and at different spatial scales. By unpacking the nature of the problem concept and analyzing its relationships with other initial conditions, I identified differences between primary natural resource issues in terms of spatial scale and substance and scope of their sub-issues, particularly between collaboratives addressing water quantity and water quality. I also identified stark differences between collaboratives with

collective and competing interdependence, particularly with regard to the social sub-issues they address.

Catalysts and initiating leaders

The interests, expertise, and vantage point of initiating leaders may make them more sensitive to recognizing when a collaborative window has opened (Lober, 1997). All collaboratives triggered by legislative mandates or policy recommendations involved government initiators at some level, with the significant majority (73%) led by upper-level government representatives (from federal, state, or tribal agencies). These are similar to the findings of Mitchell, O’Leary and Gerard (2015), who found the most commonly cited reason for collaborating reported by managers at the federal level were mandates “by law, policy, or their leaders to engage in collaborative efforts because collaboration is seen as an important way of increasing performance” (Mitchell et al., 2015, p. 696).

Local governments, rather than non-government initiators as I proposed, responded to severe biophysical catalysts (risks and crises) more than other initiating leaders, perhaps because emergency management in Colorado is coordinated at the local level, with each county having a disaster agency (Colorado Revised Statute 24-33.5-700). Opportunities and incentives from non-government sources tended to attract both non-government and mixed initiators. Interestingly, about one third (33%) of collaboratives that included this kind of catalyst were re-organizations (spinoffs) of previous collaborations. Spinoff collaborations have been suggested as an evaluative indicator of successful collaborative outcomes (Innes & Booher, 1999).

Catalysts and the nature of the problem

I unpacked the concept of the nature of the problem by breaking it into variables appropriate for large sample data collection and analyzing the strength of associations between those variables, using primary natural resource issues as the independent variable. I focused on six different primary natural

issues (forest ecosystem health, wetlands ecosystem health, water quality, land use, fish/wildlife conservation, and water supply/ administration) and their associations with social and ecological sub-issues, the scope of natural resource issues they were concerned with, their boundaries, and spatial extent (Figure 3.2). The patterns that emerge from this natural resource issue classification scheme may be valuable to consider when designing collaborative structures, processes, or evaluations, or when developing training materials for practitioners of collaboration (particularly in combination with their implications for membership and strategies, explored in the next chapter).

<p>Wetlands Ecosystem Health</p> <ul style="list-style-type: none"> • Sub-issues: weeds/ invasives, altered streamflows, safety/ vulnerability • Issue scope: not significantly associated • Boundary: watershed • Spatial extent: small 	<p>Forest Ecosystem Health</p> <ul style="list-style-type: none"> • Sub-issues: altered fire regimes, safety/vulnerability • Issue scope: small • Boundary: jurisdictional • Spatial extent: not significantly associated 	<p>Water Quality</p> <ul style="list-style-type: none"> • Sub-issues: pollution, compliance/liability • Issue scope: small • Boundary: watershed • Spatial extent: small
<p>Fish & Wildlife Conservation</p> <ul style="list-style-type: none"> • Sub-issues: wildlife impacts, land fragmentation, land mgmt. impacts, property rights, compliance/liability • Issue scope: large • Boundary: problem-defined • Spatial extent: not significantly associated 	<p>Land Use</p> <ul style="list-style-type: none"> • Sub-issues: land mgmt. impacts, land fragmentation, econ/ livelihoods, recreation/ aesthetics/cultural values, property rights • Issue scope: large • Boundary: not significantly associated • Spatial extent: not significantly associated 	<p>Water Supply</p> <ul style="list-style-type: none"> • Sub-issues: altered streamflows, drought/climate, infrastructure, property rights, compliance/ liability, trust/conflict • Issue scope: large • Boundary: jurisdictional • Spatial extent: large

Figure 3.2. Summary of associated variables within the nature of the problem for each primary natural resource issue: wetlands ecosystem health (n=20), forest ecosystem health (n=22), water quality (n=25), fish and wildlife conservation (n=25), land use (n=17), and water supply (n=14).

The focus of this discussion of associations between catalysts and the nature of the problem is on primary issues and spatial extent. Strongly regulated natural resource issues were often catalyzed by pre-emptive concerns (threats) of those regulations, or mandates/ government recommendations. Fish and wildlife conservation problems often had policy threat catalysts. The Endangered Species Act (ESA),

which (when implemented), is a powerful regulation for the conservation of biodiversity at the federal level (but with potential implications at all levels of jurisdiction) (Doremus & Tarlock, 2003). Many collaborations driven by ESA are multi-year planning efforts, such as sage-grouse working groups or Habitat Conservation Planning committees, some of which evolve into collaborative organizations.

ESA has ‘teeth’ when enforced, but policies that are more carrot than stick also drive collaboratives, particularly those focused on habitat conservation. Several collaboratives in Colorado arose from policy recommendations paired with funding incentives. For example, portions of Colorado fall within two Joint Venture regions, established by the North American Waterfowl Management Plan (NAWMP) as “a means for governments and private organizations to cooperate in the planning, funding and implementation of projects to preserve or enhance waterfowl habitat” (NAWMP, 1986, p. 14). Not long after the Joint Ventures were established, Colorado’s Department of Wildlife (now Parks and Wildlife) began developing the Colorado Wetlands Wildlife Conservation Program (Wetlands Program), which created several smaller-scale collaborations analogous to the Joint Venters, called Wetlands Focus Area Committees.

The association between catalysts and water supply resource problems was less clear, due to relatively few well-documented collaboratives for whom this is a primary issue. Sixty-four percent of these cases are Colorado’s nine Basin Roundtables, created simultaneously by legislative mandate to address long-standing tensions between a) the tradition of local-level authority and control over water provision and planning; b) the primacy of water rights and adherence to the Doctrine of Prior Appropriation; and c) the need for state-level water supply planning in the face of change and uncertainty.

Over half of collaboratives focused on water quality (52%) were catalyzed by policy threats, primarily in response to state and federal requirements associated with the Clean Water Act section 303(d) and the ‘threat’ of externally imposed water quality standards, but also to avoid listing under the

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). However, low-severity biophysical catalysts were more strongly linked to water quality than policy threats. It is possible that this finding is a result of insufficient data to support other catalysts. As discussed earlier, Prokopy et al. (2014) argue that low severity or gradually occurring environmental degradation is an aspect of “baseline conditions” (either context or the nature of the problem) rather than catalyzing events themselves, and that other catalysts (crises or the regulatory frameworks that set water quality standards and monitoring requirements) are actually responsible for the problem being noticed. I did observe cases of water quality group formation driven purely by policy-related catalysts, but in many cases these regulatory drivers were coupled with ecological issues that were detected by the general public without reaching a crisis level, like bad smells or algal blooms.

This also begs the question, what constitutes a crisis? The exclusion of gradually changing environmental conditions from the typology of catalyst events by Prokopy et al. (2014) may reflect their focus on watershed groups (which are water quality and wetlands ecosystem groups here). Collaboratives focused on wetlands and water quality in Colorado are often defined at small spatial scales relative to other kinds of issues. Likewise, catalyzing events like floods and contaminant spills happen rapidly relative to ecological issues like altered fire regimes and drought. While there are certainly several cases of collaboration in Colorado driven by spatially or temporally concentrated events like floods, mine spills, fishkills, and wildfire, several collaboratives emerged in response to gradual die-off from beetle infestation prior to a wildfire event and without incentives or emergency funds from government sources. This suggests that the concerns about future crises, especially when combined with highly visible degradation, can motivate collaboration even when change is gradual.

This appears to be the case with many forest-focused collaboratives. Unfortunately, there were too few Colorado cases to observe significant differences between collaboratives driven by risk of future crisis as

opposed to those driven by actual crisis events, but when these two catalysts were combined as a severe biophysical catalyst, this drove a significant proportion of forest collaboratives.

I drew on the concept of the *nature of the policy challenge* (part of a larger formative typology presented by Emerson & Nabatchi, 2015) to develop propositions linking catalysts to spatial extent. As discussed earlier, *acute policy challenges* involve localized problems that manifest in an intense or concentrated way (whereas *extensive policy challenges* are either widespread, chronic, occur repeatedly in many locations, and are expected to be catalyzed externally or by higher-level authorities). Based on this, I expected that severe biophysical catalysts would drive the formation of collaboratives focused at small scales, which I did not observe. This may be due to too few cases in Colorado, or because some of the forest collaboratives that emerged to address beetle kill are very large in spatial extent (as is the scale of the problem). Even though declining forest health manifests slowly and over a large area, the risk of wildfire is urgent enough that it can catalyze collaboration.

Low-severity biophysical catalysts did correspond to collaboratives working at smaller scales lends support to the localized aspect of acute policy challenges, but suggests that the “intensity” function may not always be important. Terms like crisis, intensity, turbulence, and urgency (commonly used in literature describing catalysts, e.g. Bryson et al., 2006; Heikkila & Gerlak, 2005; Prokopy et al., 2014) are subjective and difficult to assess at the scale of this study, which is why I used threats or crises that potentially affect human life and health, which are easier to recognize in texts. However, localized environmental degradation may be closer to the meaning intended by the authors. I explore the nature of the policy challenge and formative typology further in the next chapter, elaborating possible combinations of variables that could characterize acute challenges.

Future research could investigate the unique scale-related challenges faced by spatially extensive collaboratives and/or collaborative driven by risks of future crisis that manifest slowly. The anxiety

created by large-scale forest die-off may boost widespread participation and momentum at first, but committed participation and interest may be difficult to maintain over time. Case-study level analysis comparing how collaborative dynamics (as described by Emerson et al., 2012) unfold over time for collaboratives driven by risk vs. crisis (holding scale constant) or at different scales (holding the risk catalyst constant), could be useful to initiating leaders and members of collaboratives responding to future crises.

Opportunities and incentives from both government and non-government sources were also common catalysts for both forest and wetlands ecosystem-focused collaboratives (like grants or in-kind human resources support). Moreover, high severity biophysical catalysts were often accompanied by incentives and opportunities that encouraged collaboration, particularly from government sources. For example, following catastrophic flooding along Colorado's Front Range region in 2013, the U.S. Department of Housing and Urban Development approved funding for the Watershed Resilience Pilot Program, jointly developed by the Colorado Water Conservation Board and Department of Local Affairs. The program supported long-term approaches to flood recovery, risk mitigation and community development (including restoration projects and, importantly, support for organizational capacity). The funding supported some existing watershed groups, but it also helped several new coalitions emerge.

While high severity catalysts were not linked to spatial extent, policy mandates and recommendations did drive the formation of many collaboratives working at on large-scale issues. This lends support for a spatial interpretation of what Emerson and Nabatchi (2015) called *extensive policy challenges*. There were several examples of policy-driven collaboratives exemplifying a similar policy solution applied across multiple settings, which is more in keeping with the original extensive policy challenge definition described by the authors (widespread, chronic, or occurring in multiple locations). Examples include the Joint Ventures, the sage-grouse working groups, the Wetlands Focus Area Committees, the Basin

Roundtables, and the Resource Advisory Councils (convened by the Bureau of Land Management to address public lands issues).

Interdependence

The interdependence that motivates collaboration may be rooted in the collective need to coordinate or align shared interests or to cooperate across competing interests. Collectively-oriented stakeholders enter the process with more or less shared interests, which can reduce barriers to self-organizing collective action (Bodin, 2017; Emerson & Nabatchi, 2015; Poteete et al., 2010). Indeed, collectively-oriented collaboratives in Colorado were more likely to be started by leaders from non-governmental organizations, members of the community, or from local government. Not surprisingly, collaboratives catalyzed by risk/crisis also tend to start off with collective orientation. Collectivism was also common when the catalyst was opportunities and incentives from government or non-government sources, although the category is so broad as to provide little insight as to why. When the catalyst is a funding opportunity, collectivism may occur because collaborators need to work together to generate a shared agreement stating their purpose and strategy in a short timeframe. There was also a weak positive relationship between collective orientation and low-severity catalysts, particularly in collaboratives focused on pollution issues. In many cases, pollution problems are led at the local government level, where they have jurisdictional responsibilities to monitor and maintain water quality standards, as well as an official interest in avoiding the consequences of non-compliance. This lends support to the assertions of Prokopy et al. 2014, that low-severity catalysts may be better thought of as part of the nature of the problem—i.e., the problem may be bad enough that it is perceived, but perception, and ultimately collaborative formation, is catalyzed by policies of institutionalized monitoring.

The catalysts for collaboratives with a competing orientation are quite distinct from those with a collective orientation. Catalysts for competing groups are often regulatory threats or concerns, or sometimes outright mandates, initiated by upper-level government representatives with official

responsibilities related to the catalyzing policy. Collaboratives with competing interdependence often tackle sub-issues like land management impacts and land conversion, wildlife impacts, and drought/climate change that characterize land use, fish and wildlife conservation, and water supply resource problems.

Regardless of the nature of their interdependence, collaboratives are acting jointly to create environmental collective goods (such as reduced risk of catastrophic wildfire or contaminated water, reliable water supply, conserved biodiversity, or healthy, working landscapes). A big difference between the two types may lie in these social issues of concern, and how joint action on environmental issues affects tradeoffs for stakeholders.

Collaboratives with competing interdependence commonly tackle social sub-issues involving property rights, economic wellbeing/livelihoods, and concerns associated with liability and regulatory noncompliance. These are complex issues that, in different ways, define and limit the people with a direct stake (something to gain or lose) in collaboration, and who have authority and obligations to make decisions about resources. Property rights define who can access, benefit from, and make legitimate decisions about scarce resources like land and water (Cole & Ostrom, 2012). They are unevenly distributed, legally complex, and highly political. Stakeholders pursuing resource-based livelihoods have a direct stake in the health or availability of a resource (Brick & Snow, 2001).

Livelihoods are often competitive in their use of resources (such as rafting companies who depend on instream flows, and irrigators who depend on reducing instream flows to irrigate crops). Gains for one set of stakeholders can mean losses for another. These issues are particularly contentious because they are tied up with cultural identity and economic survival. Liability and compliance issues define stakeholders based on their legal obligations and responsibilities or their position on a policy (Barker et al., 2003). Liability and compliance issues are politically contentious by nature, with implication for costs, control, and justice (Purdy, 2012). Each of these social issues involve power imbalances and tradeoffs

that can affect people's bottom line. When joint action affects these issues, stakeholders come to the table to protect their interests.

On the other hand, the most common social sub-issue for collectively-oriented collaboratives was safety—everyone benefits from joint actions that reduce vulnerability to disaster or increase public safety. The tradeoff in these situations is that cooperators cannot exclude non-cooperators from free riding on their efforts. A 'free rider problem' occurs when disincentives to cooperate arise from the difficulty of excluding parties who do not contribute to a collective solution from the benefits of that solution (Ostrom, 1990, Rasband et al., 2009). This free rider problem becomes more difficult when there are more stakeholders, which reduces the group's ability to agree on a course of action. The fact that there are so many collectively oriented groups in Colorado (60% of the 103 cases coded for interdependence) suggests that the free rider problem can be overcome by collaboration, or that it may not present as big of a barrier to collaboration as previously thought. However, as described in Chapter 4, differing sources of interdependence have significant implications for a collaborative's membership and strategic purpose.

Conclusions

In this chapter, I clarified, disaggregated, and analyzed relationships between the initial conditions that give rise to collaboratives, which are commonly lumped together under different names (including direct antecedents and drivers) within more comprehensive frameworks. Such frameworks, while excellent for analyzing a small number of cases, require adaption for application to a large sample. I drew heavily on one such framework, the Collaborative Governance Framework (Emerson et al., 2012, see Chapter 1) and its "drivers" component, borrowing terms and concepts from additional frameworks and typologies to improve the clarity and measurability of concepts. For example, the "coordinating and cooperating" dichotomy of collective action motivation (Berardo & Scholz, 2010) was adapted to analyze collective and competing interdependence. Distinctions between the external and internal "consequential

incentives” component of the CGR Framework, previously under-developed, were elaborated and specified. The former was translated into catalysts using the typology presented by Prokopy et al., 2014. The latter was expanded from internal consequential incentives to the nature of the problem, a separate initial condition consisting of a set of inter-related variables that define the nature, scope and scale of the problem the collaborative emerged to respond to.

By unpacking the nature of the problem, I identified broad patterns that differentiate natural resource issues in terms of spatial scale, boundaries, and the number and nature of their issues and sub-issues. These insights produced a novel classification scheme based on empirical data that, with some adjustments, could be elaborated into a useful taxonomy to assist in situation assessments prior to designing or evaluating collaborative structures and processes.

I distilled several insights from the literature about how the initial conditions that lead to the formation of collaboratives are related to one another. I then tested those propositions on a large sample of collaboratives in the state of Colorado working in different resource sectors. In addition to testing propositions, I identified unexpected relationships that led us to new insights about how combinations of initial conditions set the stage for collaboration.

The elaboration of the nature of the problem construct in this study allowed testing of some of the assumptions of the nature of policy challenge concept (within the formative typology) proposed by Emerson & Nabatchi (2015), which I build on in the next chapter. This study provided support for the existence and importance of extensive policy challenges, i.e., large scale or chronic problems amenable to similar policy solutions and are often driven externally (Emerson & Nabatchi, 2015). I did not find a direct linkage between spatial extent and high severity biophysical catalysts, although low severity biophysical catalysts did correspond to collaboratives defined at smaller scales. Collective interdependence distinguishes acute challenges, but its role in differentiating extensive and complex

policy challenges remains unclear. The nature of the policy challenge and formative typology proposed by Emerson and Nabatchi (2015) is intuitively appealing, and so I continue conceptual development in the next chapter to improve its utility as a framework for comparing collaboratives across different resource sectors and scenarios. In particular, development of more nuanced metrics for comparing issue complexity across multiple cases is called for.

Future research could delve into the different kinds of challenges faced by collaboratives with severe catalysts at different spatial and temporal scales. While disaster events can mobilize energy and resources to address immediate environmental problems, collaboratives that emerge from crisis face unique challenges, like sustaining momentum and finding funding after the crisis has passed. These collaboratives need to hit the ground running, simultaneously developing the structures necessary to support a collaborative organization, building trust among stakeholders, planning and implementing post-disaster restoration projects, all while navigating complex grant requirements and constraints. On the other hand, collaboratives that address ecological disturbance that unfolds at larger or slower scales must contend with sustaining attention and support over longer periods and across larger landscapes with less proximate stakeholders. In terms of future large sample research, an analysis of the influence of different initial conditions on financial, human, and collaborative capacity could highlight differences between natural resource issues with important implications for how funds might be better allocated to support desired outcomes of collaboration.

CHAPTER 4. EXAMINING RELATIONSHIPS BETWEEN INITIAL CONDITIONS, MEMBERSHIP, AND STRATEGIES ACROSS COLLABORATIVES IN COLORADO

Introduction

The ability of collaborative conservation and natural resource management initiatives to achieve successful outcomes is influenced by the context and initial conditions present when they form (Bonnell & Koontz, 2007; Lober, 1997; Takahashi & Smutny, 2002). Initial conditions are the near-term circumstances and problem setting characteristics that lead to collaborative formation, including the nature of the problem that the collaborative forms to address, the initiating leaders of collaboration, the catalyzing events that trigger them, and the interdependence that brings stakeholders together (Bryson, Crosby & Middleton Stone, 2006; Emerson, Nabatchi & Balogh, 2012). Initial conditions such as these indirectly influence the outputs, outcomes, and impacts of collaboration (Thomas & Koontz, 2011) via their direct influence on the internal dynamics of collaboration, including the capacity for joint action (Emerson et al., 2012). This is the ability of a group to mobilize, pool, and leverage various kinds of resources and assets (including people) to develop and carry out effective strategies that lead to desired outcomes (Chaskin, 2001; Cheng & Sturtevant, 2012; Emerson & Gerlak, 2014; Emerson et al., 2012). In this study, I examine relationships between a set of initial conditions of collaborative formation, characteristics of their membership, and the strategies that they develop and undertake through joint actions to achieve shared objectives.

Research has identified several ways that initial conditions influence membership and strategies (as well as how membership affects strategies), and a few typologies (e.g. Margerum, 2008; Diaz-Kope & Miller-Stevens, 2014) have been developed that link these concepts. However, these insights are often based on one or a few cases. Poteete and Ostrom (2008) suggest addressing this gap by conducting studies with larger sample sizes. Studies that have used larger samples have usually focused on the

phenomenon of collaboration in particular natural resource settings, focusing on ‘watershed groups,’ or ‘ecosystem management’ collaborations (e.g. Lubell, 2002; Yaffee et al., 1996), often without clearly defining how their version of collaboration differs from collaboration in other natural resource settings. Koontz (2016) suggests that typologies can help compare cases and identify patterns across diverse settings, as well as add “rigor and systematization to loose collections of lessons learned” (p.72). In this study, I analyze relationships between the initial conditions, membership characteristics, and strategies of 123 collaboratives in the state of Colorado, working across policy contexts and multiple resource sectors. Throughout the process, I draw on several typologies of collaboration to structure my analysis and interpret the findings. I reflect on how well they fit the findings, and add new dimensions to these typologies involving initial conditions, participation from local government. My aim is to contribute to large sample research per the suggestion of Poteete & Ostrom (2008); to respond to suggestions from other authors to compare across various organizational, policy, and natural resource contexts (Bryson, Crosby & Middleton Stone, 2015; Bodin, 2017; Mandell & Steelman, 2003); and to advance theory by exploring the assumptions of several typologies of collaboration.

I begin with a brief overview of the meaning of **initial conditions**, **membership** and **strategies**, and introduce a set of typologies that help define the concepts to be measured, and which relate them to one another (Table 4.1). I then present the conceptual model and set of research questions that structure this study. Finally, I review assumptions from the typologies, supplemented with theory and findings from the literature, about expected relationships between initial conditions, strategies, and membership. I examine these expectations further in the Discussion.

Table 4.1. Typologies of collaborative formation, policy challenges, membership, and strategies discussed incorporated into analysis and interpretation of findings.

Typology/ Author	Types Proposed	Descriptions
Formative typology (Emerson & Nabatchi, 2015)	Self-initiated	Those that self-organize and emerge ‘organically’ in response to a problem recognized and defined by a set of actors participating in the initiative. Initiating leadership had a direct stake in the substantive outcomes of collaboration, and reached out directly to other leaders and participants across divides of interest, values, geography, or policy perspective, or other gulfs
	Independently convened	The initiating leadership does not have a direct, vested interest, but by virtue of their individual reputation or the standing of their organization, they can serve as convener, creating the necessary bridging function to bring together multiple, diverse stakeholders
	Externally-driven	Collaboration is induced (incentivized or possibly mandated) by a higher-level authority or institution with an official stake in the outcomes, which may be removed from the locus of action or may be more directly connected by jurisdictional, oversight, or other responsibilities
Nature of the policy challenge (Emerson & Nabatchi, 2015)	Acute policy challenge	A localized problem that is experienced by a diverse but narrow set of stakeholders
	Complex policy challenge	Experienced by a broader set of stakeholders with a more varied set of perspectives, and is thus prone to greater contention
	Extensive policy challenge	Experienced repeatedly or across multiple settings such that it “warrants similar approaches for policy and governance” (165). May also correspond to larger spatial area
Watershed group membership typology (Moore & Koontz, 2003)	Citizen-based	Membership is largely made up of “private citizens” (p. 454)
	Mixed	“Composed of an equal mix of public and private representatives” (p. 454)
	Agency-based	Membership is primarily made up of “public representatives” (p. 454)
Implementation of change typology (Margerum, 2008)	Action	“Focus on direct action or ‘on the ground’ activities, such as monitoring, education, and restoration” (p. 488)
	Organizational	Address resource problems by coordinating the policies and programs of constituent member organizations
	Policy	“Focus on government legislation, policies, and rules,” (p. 489)
Watershed partnership typology (Diaz-Kope & Miller-Stevens, 2014)	Grassroots partnerships	Governance arrangements with “informal policies and procedures that are formulated and implemented by the coordinated efforts of citizens and non-profits seeking to address a local issue within their community” (p. 31)
	Cross-sector	Involve the “integration of formal and informal policies and procedures formulated and implemented among a set of multisector institutional stakeholders,” including government and non-government stakeholders (p. 31)
	Interagency partnerships	Partnerships with “institutional policies and procedures shared among a network of multilevel governmental stakeholders that coordinate their activities and share their resources to address complex policy problems within a problem domain” (p. 31)

Terms and typologies

Initial Conditions. In Chapter 3, I examined relationships between four kinds of initial conditions (nature of the problem, initiating leadership, catalysts, and interdependence) (Figure 4.1 reviews the

relationships explored in Chapter 3). The term “initial conditions” refers to proximate or near-term conditions that lead to collaboration (Bryson et al., 2006).

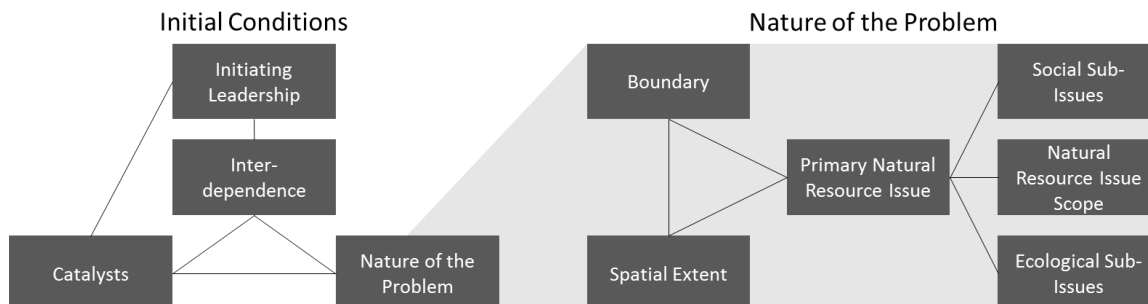


Figure 4.1. Conceptual model from Chapter 3, which structured analysis of 1) the initial conditions that characterize the formation of collaboratives (left), and 2) the variables related to one of the initial conditions concepts, ‘the nature of the problem’(right).

In Chapter 3, I considered associations between issues, boundaries, and scale to describe the **nature of the problem**. Research has shown that the likelihood of collective action is influenced by characteristics of the focal natural resource problems of concern, such as the severity of degraded conditions and the predictability of system dynamics (Cox, Arnold & Tomás, 2010; Ostrom, 1990; Poteete, Janssen & Ostrom, 2010).

Initiating leaders, also called policy or collaborative entrepreneurs (Kingdon, 1984; Lober, 1997) are another element of initial conditions. Initiating leaders are the individuals, organizations, and/or government agency personnel who recognize that a problem can be solved by collaboration, and who then motivate people to collaborate (Emerson & Nabatchi, 2015; Takahashi & Smutny, 2002).

Collaboration is usually triggered in response to events or situations, called **catalysts** (Prokopy, Mullendore, Brasier & Floress, 2014). Catalysts form what some have called policy or collaborative windows (Kingdon, 1984; Lober, 1997), which focus attention on the problem as stakeholders recognize the salience and relevance of the problem to their interests. In Chapters 2 and 3, I described some of the catalysts behind the formation of Colorado’s collaboratives as opportunities (often funding or human

resources) from government or non-government sources, mandates or recommendations from government, concerns or threats presented by looming regulations, and crisis or the threat of future crisis.

The last initial condition I address is **interdependence**. This is characterized here by a simple typology based on the source of interdependence, which is either the need to coordinate among stakeholders with collective interests, or the need to cooperate among stakeholders with competing interests (Berardo, 2014; Bodin, 2017). Collectively-oriented collaboratives come together to meet shared needs and achieve mutually beneficial results. Competitively-oriented collaboratives bring stakeholders with divergent or conflicting needs together to address a problem, and a partial aim of collaboration may be to resolve differences in values or perceptions of the problem, build trust, or negotiate tradeoffs between stakeholders (Bodin, 2017; Gray, 1989). Chapter 3 described important differences between collaboratives with these two types of interdependence in terms of the kinds of issues that they tend to address, the catalysts that drive them, and the kinds government and non-government entities that lead them. I use the terms collective and competing, rather than coordination and cooperation, to avoid conflating the terms with the kinds of strategies or actions undertaken by the collaborative.

Membership. I use the terms **members** and **membership** to refer to those that play a consistent, central, and/or decision-making role within the collaborative. This definition is necessarily broad to capture the range of formal and informal arrangements, and varying definitions of ‘members’ presented by collaboratives. It is conceptually similar to the way that Emerson and Nabatchi (2015) define participants, as those that have committed to being at the table to work on the issue of shared concern or interdependence.

Collaboratives may be broad or narrow in the kinds of interests and affiliations represented in their membership. I use the term **membership breadth** to refer to the number of different kinds of members,

like ranchers or tribal government representative (see methods). In addition, collaboratives range in membership size from very small (e.g., a small board or steering committee) to very large (dozens of regular members engaged during a particular phase of collaboration). I refer to the total number of individual members as **membership size**. The **composition of membership**, i.e., the balance of different kinds of members also varies substantially. Moore & Koontz (2003) developed a typology of membership depending on the relative composition of government and private interests represented, classifying groups as citizen-based, government-based, or mixed. I expand on their membership typology by measuring proportionate representation of local government, in addition to non-government and upper-level government members. To my knowledge, this has not been done before.

Strategies. In this study, the term **strategy** is used to describe sets of actions that collaborators agree to work on together to achieve desired changes in the system as they have defined it (Conservation Measures Partnership, 2013). Strategies are developed as members of the collaborative generate a shared theory of change (also called shared theory of action) as an output of dynamic engagement processes (Emerson & Nabatchi, 2015). The shared theory of change can be described as a more or less formal/explicit logic model connecting the substance of shared goals to the strategies for achieving desired outcomes. It incorporates their shared purpose and the proposed solutions, as agreed upon by members and tacitly or explicitly revealed in their authoritative texts (e.g., mission statements, strategic plans, and other documents presented to the public) (Emerson & Nabatchi, 2015; Koschmann et al., 2011). Ultimately, collaborative strategies and actions are a means to an end, rather than an end in themselves, and therefore are different from outcomes and impacts of collaboration on target goals (Emerson & Nabatchi, 2015; Thomas & Koontz, 2011). Strategies may be carried out as actions by the collaborative itself, its constituent organizational members, or they may be contracted out to other entities by the initiative (Emerson & Nabatchi, 2015).

To clarify how strategies relate to similar terms, strategies manifest through implemented actions (Conservation Measures Partnership, 2013). *Implementation* “generally refers to the actions taken by public and private entities at multiple levels of authority directed at attaining objectives, and includes the strategic mobilization and application of human, financial, and technological resources to alter routines” (Cheng, Gerlak, Dale & Mattor, 2015 p. 1). The term *accomplishments* is also used. For example, Koontz and Johnson (2004) identified 13 types of accomplishments by watershed groups that are similar to the kinds of strategies that I identify (e.g. education and outreach; developing plans; changes to existing policy; influencing policy (through advocacy); land acquisition; restoration projects; research, monitoring; designation of protected resources; and changes to land use practice). Some use the term *outputs* synonymously with actions and accomplishments, as when Thomas & Koontz (2011) describe actions as either intermediate outputs (early products or services generated, such as a completed watershed plan) or end outputs (final products or services generated, such as an implemented restoration project). My choice to use the term strategies rather than implemented actions, accomplishments, or outputs pertains to my method of data collection (see methods section), and constraints on my ability to consistently distinguish between intended actions and completed actions.

As described in Chapter 2, there are numerous strategies undertaken by collaboratives in Colorado. In order to scale up analysis, I apply a typology developed by Margerum (2008), which itself draws on theories proposed in the institutional analysis literature and the Levels of Collaborative Action Framework (Imperial, 2005). Margerum’s typology differentiates between three archetypes of collaborative initiative that differ in the theory of change they use to tackle a resource problem: action, organizational, and policy collaboratives. Action collaboratives are those that “focus on direct action or ‘on the ground’ activities, such as monitoring, education, and restoration” (p. 488). Organizational collaboratives address resource problems by coordinating the policies and programs of constituent

member organizations, and policy level collaboratives “focus on government legislation, policies, and rules,” (Margerum, 2008, p. 489). Using this typology to group individual strategies into levels, I analyze **strategy level** by considering the proportion of strategies described by each collaborative grouped at **action, organizational, and policy** levels.

In addition to the typologies of membership and strategy level used primarily for analysis, three additional typologies are used primarily for interpretation. The first two are nested: the formative typology and its sub-typology of the nature of the policy challenge (Emerson & Nabatchi, 2015). While difficult to apply directly using my methodology, they are both helpful for linking the four initial conditions introduced earlier to one another as well as to membership characteristics. The formative typology differentiates between collaborative governance regimes that are self-initiated, independently convened, or externally-driven. This could be interpreted as distinguishing between the origin of the convening party (i.e. the initiating leadership) or catalysts (with externally driven groups responding to policy-related catalysts). Nested within the formative typology is the second typology (what the authors call a ‘conditioning factor’ of the formative typology), called the nature of the policy challenge (Emerson & Nabatchi, 2015). This differentiates between three types of policy challenges as a function of the “range and intensity of their outcomes” (p. 165), which they label as acute, complex, or extensive. An *acute policy challenge* is a localized problem that is experienced by a diverse but narrow set of stakeholders “in extreme and severe ways” (p. 165). A *complex policy challenge* is experienced by a broader set of stakeholders with a more varied set of perspectives, and is thus prone to greater contention. An *extensive policy challenge* is experienced repeatedly or across multiple settings such that it “warrants similar approaches for policy and governance” (165). The formative typology suggests that self-initiated collaborative governance regimes will arise to respond to acute policy challenges; independently convened collaboratives will address complex policy challenges; and externally driven collaboratives will address extensive policy challenges. Note that my conceptualization of the “nature of

the problem” component within initial conditions takes inspiration from the nature of the policy challenge typology, but draws on other theories to develop variables that are more specific and measurable, and which overlap less with other initial conditions (see Chapter 3).

Lastly, Diaz-Kope & Miller-Stevens (2014) presented a watershed governance typology that blends elements of the membership typology of Moore & Koontz (2003) with aspects of the typology of Margerum (2008). They contrast grassroots partnerships (in which non-government individuals and organizations work on localized problems); cross-sector partnerships (involving the integration of programs and policies among both government and non-government actors); and interagency partnerships (involving a network of government representatives that share and coordinate resources to address complex policy problems) (Diaz-Kope & Miller-Stevens, 2014). Unlike the typologies of Emerson and Nabatchi (2015), the watershed governance typology links membership to strategies and implies other relationships between variables of interest to this study (described further below).

In Chapter 3, I incorporated elements several comprehensive frameworks such as those presented by Bryson et al. (2006), Emerson et al. (2012), and Ostrom and Cox (2010), “zooming in” to examine relationships between four initial conditions concepts: initiating leadership, catalysts, interdependence, and the multi-dimensional nature of the problem concept. In this chapter, I ask the following questions, illustrated by the conceptual model below (Figure 4.2): 1) how are initial conditions (nature of the problem, initiating leadership, catalysts, and interdependence) related to membership characteristics? 2) How are initial conditions related to the strategies that collaboratives work on together to achieve their shared objectives? 3) How are membership characteristics related to strategies?

I then integrate assumptions from the typologies introduced above, supplemented by additional theories and findings from the literature presented in the next section, to interpret the findings.

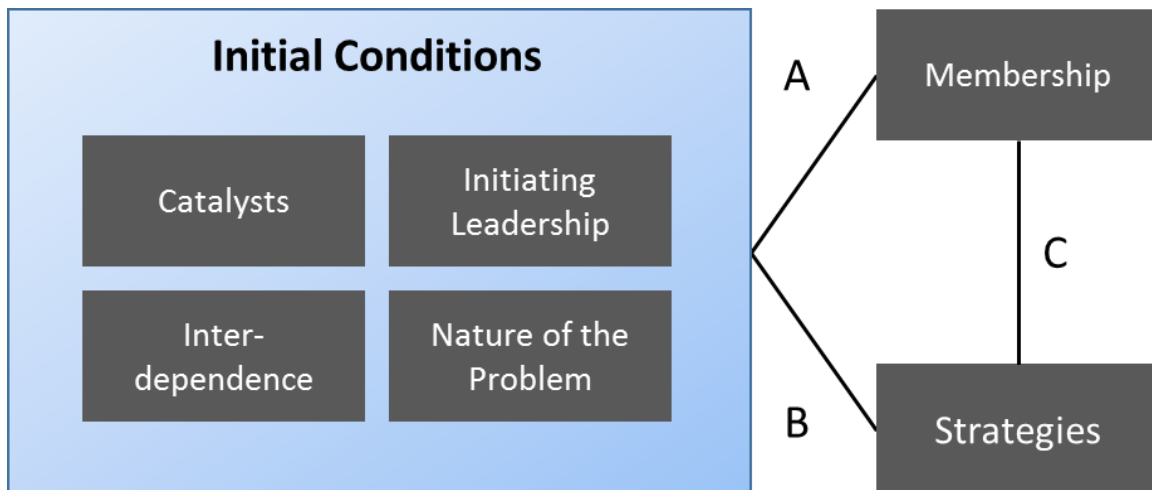


Figure 4.2. Conceptual model of relationships between initial conditions, membership, and strategies. Connecting links labelled by letters indicate relationships of interest.

Theories linking initial conditions, membership, and strategies

The influence of initial conditions on membership and strategies is complex and intertwined, as I explore next. Imperial and Koontz (2007) concisely outline the connections between problems, purpose, membership, and strategies by stating: “[c]ollaborative organizations tend to be strategic in nature and formed for specific purposes and to address specific problems. The combination of purposes and problems helps shape the membership,” (p. 13). In turn, the set of strategies that a collaborative can work on are constrained by the authority and capacity of its members (Imperial & Koontz, 2007; Bonnell & Koontz, 2007; Takahashi & Smutny, 2002).

Initial conditions to membership. One way the **nature of the problem** can influence membership is through the salience of the natural resource issues to different kinds of stakeholders. This could be determined by the extent to which their livelihoods depend on a particular resource; their vested interest in owning, accessing, or using the resource; or their decision-making authority over the resource (Emerson & Nabatchi, 2015; Heikkila & Gerlak, 2005; Ostrom, 1990). In the Chapter 3, I identified how particular primary natural resource issues tend to incorporate ecological and social sub-issues that may shape salience to different kinds of stakeholders. For example, protection of property rights is a sub-

issue that commonly occurs in groups initially focused on land use, fish and wildlife, and water supply issues.

The boundaries and scale that frame those salient issues shape the kinds and combinations of stakeholders attracted to a collaborative's membership. The choice of geographic boundaries, and thus the spatial and jurisdictional scale at which the collaborative will work, is a political process that may reflect power relations, group identity, and even the values of concern to the collaborative (Cheng & Daniels, 2005; Cumming, Cumming & Redman, 2006). Increasing scale may improve the ability of collaboration to 'fit' the scale of the problem, as well as increase the number of jurisdictions and stakeholders that could potentially pool resources to increase the scale of collaborative impact (Bonnell & Koontz, 2007; Cash et al., 2006; Heikkila & Gerlak, 2005). There are, of course, tradeoffs to increasing spatial scale. Increasing spatial distances between stakeholders and the problem, or stakeholders and each other, presents logistical challenges for face-to-face interaction and decreases the likelihood of stakeholders participating on a consistent basis in collaboration (Bonnell & Koontz, 2007; Daraganova et al., 2012; Diaz-Kope & Miller-Stevens, 2014; Koontz et al., 2004; Margerum, 2008).

The nature of the policy challenge concept introduced earlier (Emerson & Nabatchi, 2015) also implies theoretical relationships between problems and membership. It incorporates elements of problem scale (jurisdictional or spatial); issue salience or urgency as revealed by catalysts; and membership into its definitions of acute, complex, and extensive policy challenges. Acute policy challenges suggest that problems defined at a smaller spatial level tend to have narrower and/or fewer members. Their definition of complex policy challenges references membership breadth but not scale, and extensive challenges imply large scale but not necessarily membership. However, Heikkila and Gerlak (2005) explicitly make this connection by characterizing collaboratives that work at large spatial scales as having heterogeneous membership and fragmented management responsibility. They found that an

important factor in helping to overcome the barriers to collective action that are presented by member heterogeneity (Ostrom, 1990) was a widespread recognition of issue salience and a sense of problem urgency (Heikkila & Gerlak, 2005). Margerum (2008) and Diaz-Kope & Miller-Stevens suggest similar relationships, that membership heterogeneity increases with spatial scale, and that composition shifts from more non-government to more government as the scale at which problems are defined increases.

Initiating leaders are another initial condition with the potential to influence membership in several ways. Since it is they who recognize the problem, initiating leaders play an important role in problem framing. Their perspective on, and stake in the outcome of, the problem informs how they define the issues and scale of importance and present them to others, which in turn affects who participates (Cheng & Daniels, 2005; Koontz et al., 2004; Young, 2006). The history of relationship building and interactions that generate trust between initiators and stakeholders helps determine the amount of social capital available to them, which will help lower transaction costs of collaboration as they recruit members (Adger, 2003; Heikkila & Gerlak, 2005). Initiators also shape membership through the governance structures they impose or recommend to collaboratives, which may be influenced by the norms and expectations of their home organizations or affiliations, or by their personal values or preferences (Bonnell & Koontz, 2007; Huxham, 2000; Takahashi & Smutny, 2002).

The initial condition of **catalysts** also have potential to affect membership. Their effect is perhaps most direct when mandate or recommendation to collaborate suggests, or even defines in statute, the kinds of members, specific jurisdictions, or interest groups that should participate in the collaborative (e.g. the Colorado Water for the 21st Century Act). Mandates may indeed be necessary in some cases when “the reach and magnitude” of the problem pose logistical challenges for bringing many and diverse interests together in a collaborative forum (Wondolleck & Lurie, 2016). Crisis events, on the other hand, receive a

great deal of media attention and trigger emotional responses that can galvanize grassroots support and membership (Prokopy et al., 2014).

Lastly, the type of **interdependence** motivating collaboration may affect membership by increasing or reducing barriers to working together. Transaction costs associated with collective action are lower for groups whose participants share norms and trust each other to keep agreements and reciprocate (Ostrom, 1990). However, contentious problems in which stakeholders have competing interests may require broad and diverse participation in order develop solutions that are considered to be legitimate (Koontz & Johnson, 2004; Sabatier et al., 2005). Thus, competing interdependence may require more time to settle differences and develop necessary trust and norms for collective action.

Understanding how membership is shaped is important because membership composition is thought to influence collaboration in many ways that can affect its potential for successful outcomes (Koontz & Thomas, 2006). Research on collective action in common pool resource management suggests the transaction costs of reaching agreement increase with 1) increasing numbers of participants, and 2) increasing heterogeneity of participants, both of which can decrease the degree of shared norms, expectations, and social capital among members (Poteete et al., 2010). The size and diversity of membership can influence the design of processes, rules, and organizational structures that shape the identity of the collaborative (Imperial & Koontz, 2007). Members bring skills and resources to collaboration that might include funding, time, technical and logistical support; administrative and organizational assistance; requisite skills for analysis or implementation; and needed expertise. These assets affect the collaborative's ability to obtain necessary human, technical, and financial resources, and to achieve its strategic purpose (Bryson et al., 2006; Cheng & Sturtevant, 2012; Emerson et al., 2012), to which I now turn.

Membership to strategies. The composition of membership (citizen-based, government-based, or mixed government and non-government members), as well as membership breadth, have been shown to influence specific kinds of strategies (and the actions and outputs they generate) in watershed groups (Moore & Koontz, 2003). For example, studies of watershed groups in Ohio have shown that strategies involving watershed planning and research were more likely to be carried out by groups composed of a mix of government and non-government members; that organizational development and maintenance were more likely to be emphasized by both mixed and government-based groups; that increasing public awareness around issues was more common for mixed and citizen-based groups; and that policy advocacy and influence was a strategy commonly pursued by citizen-based watershed groups (Koontz & Johnson, 2004; Moore & Koontz, 2003). The watershed governance partnership typology (Diaz-Kope & Miller-Stevens, 2014) suggests that grassroots (citizen-based) groups are most effective when they apply strategies to share information and build social capital (like education, outreach, and convening forums or processes to build trust), and that cross-sector (mixed) groups are more effective at coordinating on-the-ground projects. Margerum (2008) links membership to strategy levels, suggesting that collaboratives focused on action-level implementation will have greater non-government participation, while organizational and policy level collaboratives will have greater government participation (he does not distinguish between local and upper-level government).

Koontz and Johnson (2004) found similar patterns analyzing breadth of watershed group membership. Watershed groups with narrower membership focused on advocacy, while groups with broader membership were more likely to pursue strategies like watershed planning, issue prioritization, restoration projects, and internal maintenance and development of the collaborative organization (Koontz & Johnson, 2004). In a similar vein, an analysis of watershed groups in Oregon (which are all citizen-based, but still have diverse interest represented) showed that groups with broader

representation of interests were more likely to complete assessments, watershed plans, and project implementation than those with narrower representation (Bidwell & Ryan, 2006).

Initial conditions to strategies. Theory suggests that the relationship between initial conditions and strategies is less direct, mediated through a combination of processes of engagement and problem definition that lead to the development of the shared theory of change, as well as through the capacity for joint action that early members bring to collaboration (Emerson et al., 2012, Emerson & Nabatchi, 2015). However, the typologies of Margerum (2008) and Diaz-Kope and Miller-Stevens (2014) propose linkages between concepts that I include as initial conditions and strategy level. For example, both posit that collaboratives focused on problems defined at small spatial scales will focus more on direct action strategies, and that organizational and policy-level activities will take place at larger scales, and that both organizational and policy-level strategies may be used to address problems that are more complex in nature.

Methods

The criteria presented below were used to define, identify, and select cases for inclusion in this study. Criteria 1-3 provide a broad definition of collaboratives to increase the variation of groups in the study, because examining variation across cases is part of the purpose of the research (Creswell, 2013). Criteria 4-6 define my population of 183, and criterion 7 defines a representative sample of 123 (see Chapter 2 Methods). In addition to extensive internet searches, I also used chain referral sampling (Creswell, 2013), asking experts and individuals associated with collaboratives to add to a growing list of other collaboratives in Colorado; the same criteria were applied before they were finally included in the study.

1. Members include a range of three or more of 11 possible categories of entities (see Table 4.2),
2. Members engage in a sustained process of interaction or consensus building lasting 2 or more years,

3. The initiative addresses the governance or management of one or more natural resources, ecosystem health, or conservation-related issues,
4. The collaborative emerged by or before 2015,
5. The initiative’s boundaries fall wholly or partially in Colorado,
6. Sufficient information about the initiative was available online to verify that the initiative met the above criteria,
7. Sufficient documentation was available to collect information about the initiative’s history, purpose, strategies, and membership on the internet and/or internet references to printed materials accessible through the university.

Table 4.2. Categories of individual and organizational representatives used to code members and group them by affiliations for the membership composition variables (proportion of non-government, local government, and upper-level government representatives). Inclusion of three kinds of “member types” was a criterion for inclusion in the study.

Initiating Leadership	Member Types
Upper-Level Government	<ul style="list-style-type: none"> • Tribal (like the Water Quality Division of the Ute Mountain Ute Tribe) • Federal (like Natural Resources Conservation Service, U.S. Forest Service, or Bureau of Reclamation) • State (like Colorado Parks & Wildlife, or the Colorado Water Conservation Board)
Local Government	<ul style="list-style-type: none"> • Local governments include regional, county and municipal governmental agencies, and quasi-government organizations like soil conservation districts, water conservancy and conservation districts, utilities, ditch and reservoir companies, and other special districts
Non-Government	<ul style="list-style-type: none"> • Private industry and business (including trade and business associations) • Farmers, ranchers and large landowners (including agricultural associations) • Environmental and recreational nonprofits • Colleges and universities (including Extension) • Other organizations (like church groups or historical societies) • Other collaboratives • Individuals, private citizens, homeowners (including HOAs)
Mixed Government and Non-Government	<ul style="list-style-type: none"> • Includes non-government individuals or organizations plus local and/or upper level governments

I found 183 active and inactive collaboratives that met the first six criteria, but limited my analysis to the 123 initiatives that also met the seventh. See the Chapter 2 Methods for detailed methods for sampling, data collection management, and coding. See the Appendix for the full list of Colorado collaboratives.

Initial conditions variables

Nature of the problem. I interpreted statements about missions, goals, and major activities to develop categories and code cases for primary natural resource issues. Because issues change over time, primary natural resource issue was defined as the category that best characterizes the problem of concern to the collaborative within the first 1-2 years of formation. In cases where multiple environmental issues were of interest to the collaborative at a given time, I assigned categories based on where the greatest emphasis was placed in terms of planned or actualized strategies.

The following six mutually exclusive categories made up the primary natural resource issue variable:

- **Water quality:** Focused on pollution or poor water quality in flows of surface or subsurface waters, or surface and groundwater reservoirs
- **Forests ecosystems:** Focused on forested ecosystems (montane/sub-alpine forests and montane shrublands)
- **Wetlands ecosystems:** Focused on aquatic ecosystems (wetlands and marshes, riparian areas, stream channels, or natural/manmade reservoirs)
- **Fish & wildlife** Focused on management or conservation of mobile wildlife or populations of species (like fish, birds, or elk)
- **Water supply:** Focused on the administration of water quantity, water rights, water storage and infrastructure, and changing or redirecting water flows
- **Land use:** Focused on real estate or the transfer of surface or sub-surface rights; with rights to use and access land for different purposes, including energy development; or with land use change, local/regional identity and sense of place, and
- A seventh category, **rangeland ecosystems**, was included in issue scope, but merged with the next most appropriate categories on a case by case basis for primary natural resource issue (namely land use, fish and wildlife, and wetlands ecosystem health) because of overlap and too few representative cases. Rangeland or grassland ecosystems include pasture and grasslands, semi-desert shrublands, pinyon-juniper woodlands, or plains agricultural lands.

The number of collaboratives in my sample, categorized by primary natural resource issues included:

wetlands ecosystem health (n = 20), forest ecosystem health (n = 22), water quality (n = 25), land use (n

= 17), fish and wildlife conservation (n = 25), and water supply and administration (n = 14). Primary issues are used throughout this chapter as a descriptor for the collaboratives that focused on that issue (e.g. 'land use groups' or 'water supply collaboratives.' It does not indicate that this is their sole focus. The continuous variable **natural resource issue scope** is defined as the total number (from 1-7) of the 7 resource issues above (including rangeland ecosystem health) addressed by the collaborative, regardless of whether the issue was primary or not. The continuous variable **spatial extent** is the area within the boundaries defined by the collaborative, first converted to km², and then log₁₀ transformed to normalize the data.

In the previous two chapters, I grouped 11 possible organizational, agency, or individual member types into a more general, four-level categorical variable of **initiating leadership** (non-government individuals or organizations, local or quasi-government agencies, upper-level government agencies, and mixed government/non-government initiators). For this chapter, I split the non-government initiating leaders into two categories, those called bridging organization initiators, and those called "grassroots" initiators, making initiating leadership a five-level, mutually exclusive categorical variable. I define **bridging organization initiators** as initiators from organizations that strategically link multiple groups of actors to one another across boundaries, levels or scales by creating an arena for information and innovation exchange, collaborative learning, trust building, conflict resolution, or simply serving as a neutral third party convener (Crona & Parker, 2012; Folke et al., 2005; Westley & Vredenburg, 1991; Selin & Chavez, 1995). If there was evidence that any non-government entity initiator was acting in an official capacity (on behalf of their organization rather than on behalf of a contractor), and was providing a lead role in designing the process or direction of the group, then it was coded as bridging. I define **grassroots initiators** as all non-government member types (Table 4.2) that were I did not or could not identify as acting on behalf of a bridging organization. Non-government initiators were coded as grassroots if 1) they were individuals or lacked an organizational affiliation; 2) there was no evidence they were

initiating the collaborative on behalf of their organization; or 3) there were multiple non-government initiators, including bridging organizations. I separated these two non-government initiators based on theory regarding their relative capacities. The resulting five categories of initiating leaders were: grassroots initiators (n=13), bridging organization initiators (n=13), local government initiators (n=27), upper-level government initiators (n=35), and mixed government/non-government initiators (n=35)

I focused on two of the **catalyst** variables analyzed previously, mandates/recommendations from government, and high severity catalysts (which includes crises and risks of future crisis), both of which are non-mutually exclusive, dichotomous variables that indicate presence (1) or absence (0) of evidence. **Interdependence** was coded collective (0) or competing (1) (see Appendix for more details on all variables).

Membership variables

I gathered information on participants in whatever way they were described, then classified the level of participation reported at four levels: partners, general participants, members, and core members. Data on “partners,” the widest definition of participant. The classification “general participants” was applied when participants were listed as “members,” but without reference to the centrality or consistency of those participants. This level of participant definition was common for less formal groups. “Members” are those that play a consistent role as voting or non-voting participants with some level of decision-making authority within the collaborative (information often found in bylaws, charters, strategic plans, and sometimes on websites. The narrowest definition of membership is “core members,” which usually constitute just a board of directors or steering committee. This level of participation is common when the group has formalized into a non-profit structure. Different kinds of collaboratives define their membership differently, and the specification of membership at the “general participant” level does not necessarily mean that participants are not core members. For all analyses involving membership size and proportions, I ran analyses twice, first using core members and members (n = 90), then using core

members, members, and general participants (n = 104) (in both cases I excluded partnership data). I used the larger dataset because patterns remained roughly the same, and because I think that differences in membership reporting mostly reflect actual differences in the way groups defined membership. Members may represent themselves as individuals or an affiliation based on their livelihood or identity. I measured five continuous membership variables: **membership breadth** (the number of individual member types included, values minimum value of 3, maximum value of 11); **membership size** (or the total number of individual members); and **membership composition** based on the proportion (%) of a) **non-government**, b) **local government**, and c) **upper-level government** members represented in total membership (see Table 4.2 for the member types and the affiliations they were grouped with for membership composition variables).

Strategy variables

Sixteen strategy codes emerged during early cycle coding, four of which were not included in this analysis due to either near ubiquity (organizational administration and organizational legitimization) or low intercoder reliability (paid service provision and long-term studies/technology development). All categories were non-mutually exclusive and dichotomous (i.e., a group may use multiple strategies), indicating presence (1) or absence (0) of evidence (see Appendix for additional details about coding, definitions, and examples):

- Education/outreach/training
- Monitor
- Implement on-the-ground projects
- Coordinated implementation of projects
- Develop new markets
- Convene external process
- Identify/select/fund projects
- Influence policy

- Develop/change policy
- Exercise management authority
- Acquire/transfer property
- Develop plans

To investigate differences in the levels of strategies that collaboratives pursue, I developed a simple additive index using 10 of the 12 variables that were similar to the 3 kinds of collaboratives described by Margerum (2008). “Action” level strategies consisted of three categories: education, outreach and training; monitoring; and on-the-ground project implementation. “Organizational” level strategies consisted of: project identification, selection, or financial support; coordination of member projects; and a category that combined developing market-based conservation approaches and convening a public process to engage non-members. “Policy” level strategies consisted of: influencing policy through advocacy or pressuring government; developing new policies or changing current policies (including Total Maximum Daily Loads for allocation of pollutants), and exercising authority to manage resources and enforce site-specific control regulations. The total sum of each level’s strategies (maximum of three) were divided by the sum of all nine strategies to obtain proportionate “scores” for each level that sum to one. Two categories that were not included in the index due to difficulties assigning them to a level were analyzed separately: acquisition and transfer of property rights/easements, and resource management planning.

Analyses

My analysis goal was to measure the relationship indicated by the connecting lines in Figure 4.2: between the initial conditions and membership (connection A), initial conditions and strategies (connection B), and membership and strategies (connection C). Table 4.3 summarizes the relationships tested, variables and variable types for independent and dependent variables, and tests used.

Table 4.3. Summary of concepts, variables and types, and statistical tests conducted in this study. I.V. = Independent Variable, D.V. = Dependent Variable.

Relationship Tested	Concept	Independent Variable	I.V. Type	Dependent variables	D.V. Type	Test used	
Link A: Initial Conditions to Membership	Nature of the Problem	Primary issue	Categorical	5 membership variables	Continuous	Kruskal-Wallis H test	
		Issue scope	Continuous	5 membership variables	Continuous	Spearman's rank-order correlations	
		Spatial extent	Continuous	5 membership variables	Continuous	Spearman's rank-order correlations	
	Initiating Leadership	Initiating Leadership	Categorical	5 membership variables	Continuous	Kruskal-Wallis H test	
		Initiating Leadership	Categorical	Individual member types presented in Table 4.2	Dichotomous	χ^2 tests for independence (follow up Fisher's exact test with dummy coded categorical variables if expected counts were low)	
	Catalysts	Mandate/recommendation	Dichotomous	5 membership variables	Continuous	Mann Whitney U test	
	Catalysts	Severe biophysical (risk/crisis)	Dichotomous	5 membership variables	Continuous	Mann Whitney U test	
	Inter-dependence	Interdependence	Dichotomous	5 membership variables	Continuous	Mann Whitney U test	
	Link B: Initial Conditions to Strategies	Nature of the Problem	Primary issue	Categorical	12 individual strategy variables	Dichotomous	χ^2 tests for independence (follow up Fisher's exact test with dummy coded categorical variables if expected counts were low)
Primary issue			Categorical	3 Strategy level scores	Continuous	Kruskal-Wallis H test	
Issue scope			Continuous	3 Strategy level scores	Continuous	Spearman's rank-order correlations	
		Spatial extent	Continuous	3 Strategy level scores	Continuous	Spearman's rank-order correlations	
Initiating Leadership		Initiating Leadership	Categorical	3 Strategy level scores	Continuous	Kruskal-Wallis H test	
Catalysts		Mandate/recommendation	Dichotomous	3 Strategy level scores	Continuous	Mann Whitney U test	
Catalysts		Severe biophysical (risk/crisis)	Dichotomous	3 Strategy level scores	Continuous	Mann Whitney U test	
Inter-dependence		Interdependence	Dichotomous	3 Strategy level scores	Continuous	Mann Whitney U test	
Link C: Membership to Strategies		Membership	5 Membership variables	Continuous	3 Strategy level scores	Continuous	Spearman's rank-order correlations

The diverse nature of the collaboratives in my dataset yielded skewed distributions and numerous outliers for dependent variables, so I relied on nonparametric analyses. For analyses contrasting my two categorical variables (initiating leadership and primary issue) against dichotomous variables (such as individual strategies), I used χ^2 tests of independence. I used χ^2 tests of association to analyze relationships between dichotomous or dummy coded variables, Fisher's exact test of independence when expected counts were below five for 20% or more of any contingency table cells. I ran Spearman's rank-order correlations to assess relationships between continuous variables, following visual inspection of scatterplots for monotonic relationships. To assess relationships between dependent variables and my two categorical variables, I used Kruskal-Wallis H tests followed by a post hoc pairwise comparisons using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons. Visual assessment of boxplots revealed dissimilar distributions in all cases, so only mean ranks are presented for results of these tests, with adjusted *p*-values. I used Mann-Whitney U tests to analyze differences in dependent variables for several dichotomous independent variables of interest. I report both medians and mean ranks depending on similarity or dissimilarity of distributions based on visual assessment (indicated in the text), and reported *p*-values are asymptotic. I also used Mann-Whitney U tests as post-hoc tests following Kruskal-Wallis tests using dummy variables to compare the effects individual categories of initiating leadership and primary natural resource issues with other dichotomous variables on the dependent variables. In order to improve the interpretability and comparability of my results, I report and interpret effect sizes using guidelines outlined in Vaske (2008). I report Cramer's V for χ^2 tests of independence, and ϕ for tests of association. For the remaining tests, I used formulas recommended in Tomczak and Tomczak (2014) to calculate η^2 (which provides a value that, when multiplied by 100, indicates the percent of variance in the dependent variable explained by the independent variable) and η (the measure of effect size) for the Kruskal-Wallis tests ($\eta_H^2 = \frac{H-k+1}{n-k}$) and r^2 and r (see η^2 and η) for the

Mann-Whitney tests ($r^2 = \eta^2 = \frac{z^2}{n}$). I interpreted effect sizes by using the η index for Kruskal-Wallis and r index for Mann-Whitney using these levels: 1) a small or minimal relationship is .1 for both indices; 2) a medium or typical relationship is .247 is for η and .3 for r ; and 3) a strong or substantial relationship is .371 for η and .5 for r (Fritz, Morris & Richler, 2012).

Results

Initial conditions and membership characteristics (connection A, Figure 4.2)

I begin by noting, as expected, that membership breadth (the number of kinds of members) and membership size (the total number of individual members) were strongly positively correlated $r_s(102) = .664, p < .0005$. I present results for both variables, in addition to results (when significant) for the three membership composition variables (the percentage of either non-government, local government, or upper level government members).

I investigated differences in membership characteristics based on **primary natural resource issues** (Kruskal-Wallis tests, Table 4.4). Distributions of membership breadth were statistically different between primary issues, $\chi^2(5) = 13.478, p = .019, \eta = .269$ (a moderate effect size). Membership was broader for collaboratives focused on fish and wildlife than for those focused on wetlands ecosystem health ($p = .035$). The relationship between primary issues and membership size was stronger than for membership breadth, $\chi^2(5) = 20.235, p = .001, \eta = .394$ (Table 4.4). In post hoc tests, collaboratives focused on water supply had more members than those focused on forest ecosystem health ($p = .035$) or wetlands ecosystem health ($p = .009$). Collaboratives addressing fish and wildlife issues had more members than those working on wetlands ecosystem health ($p = .021$). Collaboratives that form to address wetlands ecosystem health issues tended to have fewer types and numbers of members.

Distributions of non-government member composition differed significantly by primary issue, $\chi^2(5) = 18.409, p = .002, \eta = .370$. Specifically, wetlands ecosystem health collaboratives had significantly more

non-government members than water supply collaboratives ($p = .008$) or water quality ($p = .017$) (Table 4.4).

Table 4.4. Comparison (vertically in table) of mean ranks of six categories of primary natural resource issues for membership breadth ($n=123$), size ($n=104$), and 3 variables for membership composition ($n=104$ for each): % non-government, % local government, and % upper-level government members (Kruskal-Wallis tests).

Primary Natural Resource Issue	Membership Breadth		Membership Size		% Non-Gov. Members		% Local Gov. Members		% Upper-Level Gov. Members	
	Mean Rank	n	Mean Rank	n	Mean Rank	n	Mean Rank	n	Mean Rank	n
Water Supply	77.2	14	74.1	13	34.3	13	75.8	13	49.8	13
Fish & Wildlife	76.7	25	67.2	22	50.9	22	28.9	22	77.4	22
Forest Health	63.9	22	39.8	16	51.6	16	45.3	16	59.4	16
Land Use	57.1	17	48.2	15	65.3	15	49.6	15	40.5	15
Water Quality	54.3	25	49.7	21	40.6	21	67.5	21	48.4	21
Wetlands Health	44.7	20	36.1	17	72.7	17	55.9	17	31.4	17

Primary natural resource issue was more strongly related to both local government membership composition ($\chi^2(5) = 27.759, p < .0005, \eta = .482$) and upper-level government membership composition ($\chi^2(5) = 27.153, p < .0005, \eta = .475$) distributions than other variables I measured. Collaboratives that formed to address water supply had significantly more local government members than groups focused on fish and wildlife conservation ($p < .0005$). Water quality groups also had more local government representatives than fish and wildlife groups ($p < .0005$). Fish and wildlife groups had more upper-level government members than water quality ($p = .023$), land use ($p = .004$), or wetlands ecosystem health groups ($p < .0005$).

Another aspect of the nature of the problem was **spatial extent**. There were weak positive correlations for the size of geographic area covered by collaboratives with membership breadth ($n = 118, r_s = .197, p = .032$), and membership size ($n = 118, r_s = .209, p = .038$). The last element of the nature of the problem was **natural resource issue scope**, which also had weak positive correlations for membership breadth ($n = 123, r_s = .286, p = .001$) and size ($n = 104, r_s = .295, p = .002$) (Spearman's correlations).

Next, I analyzed relationships between membership characteristics and five levels of **initiating leadership** (Table 4.5). Distributions of membership breadth was statistically significantly different between groups, $\chi^2 (4) = 26.381, p < .0005, \eta = .436$ (indicating a substantial relationship between these variables). Post hoc analysis indicated membership was broader in groups initiated by bridging organizations ($p = .015$), mixed initiators ($p = .036$), upper-level government ($p = .001$) than by those initiated by grassroots initiators. Groups also differed significantly for distributions of membership size, $\chi^2 (4) = 40.453, p < .0005, \eta = .607$ (also a substantial effect size). Membership size was larger in groups initiated by upper-level government than by grassroots leaders ($p < .0005$), local government ($p = .003$), and mixed initiators ($p < .0005$), but not significantly larger than bridging-initiated groups. Membership size was also statistically significantly larger for groups initiated by bridging organizations than for those led at the grassroots level ($p = .012$).

Table 4.5. Comparison (vertically in table) of mean ranks of five levels of initiating leadership for membership breadth (n=123), size (n=104), and three variables for membership composition (n=104 for each): % non-government, % local government, and % upper-level government members (Kruskal-Wallis tests).

Initiating Leadership	Membership Breadth		Membership Size		% Non-Gov. Members		% Local Gov. Members		% Upper-Level Gov. Members	
	Mean Rank	n	Mean Rank	n	Mean Rank	n	Mean Rank	n	Mean Rank	n
	Upper-level Government	78.3	35	75.6	34	43.2	34	51.8	34	63.8
Bridging Organizations	76.0	13	61.6	11	55.0	11	56.0	11	53.4	11
Mixed Government/Non-government	65.4	35	43.6	28	57.2	28	48.4	28	52.6	28
Local Government	44.8	27	39.0	19	40.8	19	70.8	19	46.0	19
"Grassroots"	32.3	13	20.8	12	84.3	12	31.8	12	29.8	12

Different initiating leadership levels also corresponded to significant differences in distributions for non-government membership composition ($\chi^2 (4) = 20.170, p < .0005, \eta = .404$), local government membership composition ($\chi^2 (4) = 13.353, p = .01, \eta = .307$), and upper-level government membership composition ($\chi^2 (4) = 12.483, p = .014, \eta = .293$; Table 4.5). Specifically, grassroots initiators had significantly more non-government members than did local government ($p = .001$) and upper-level

government initiators ($p < .0005$). Likewise, grassroots initiators had a significantly fewer local government members than did local government initiators ($p = .004$), and significantly fewer upper-level government members than groups initiated by upper-level government ($p = .008$). Among the 11 categories of individual member types, the category that included grassroots level members (individuals, homeowners, citizens, or otherwise unaffiliated people), was most commonly represented as members in collaboratives led at the grassroots level ($p = .018$) (Fisher's exact test).

When split out from non-government initiators, leadership from bridging organizations appears to be more like upper-level government initiators in terms of their membership characteristics. They have significantly higher mean ranks for breadth than grassroots and mixed initiators, and their relatively high mean ranks for membership size were not significantly different than upper-level government initiators. To investigate this further, I follow up with a χ^2 test for independence, which showed that university representation was significantly different depending on who served as the initiator ($\chi^2(4) = 15.02, p = .005$, Cramer's $V = .357$). University-affiliated members participated in 62% of groups initiated by bridging organizations and 57% of groups initiated by upper-level government representatives, which was significantly higher than university participation percentages for local government initiators (19%, as defined in the methods).

I analyzed two **catalysts** of interest with respect to membership characteristics, policy mandates/recommendations and high severity biophysical catalysts, i.e., crises or risks of crises. Distributions were not similar, so mean ranks are presented in Table 4.6. Collaboratives catalyzed by high severity events had significantly narrower and significantly smaller membership, than those without this catalyst ($U=903.5, z=-2.25$; $U=533.5, z=-2.74$, respectively). Collaboratives catalyzed by policy mandates or recommendations were broader and larger in membership ($U=1585.0, z=2.04$; $U=1327.0, z=3.10$, respectively). Effect sizes (r in Table 4.6) for both mandates/recommendations and high severity

catalysts were small (.184, .202, respectively) for membership breadth and medium to small (.304, .269, respectively) for membership size.

Table 4.6. Comparison (horizontally in table) of mean ranks of both membership breadth (n=123) and membership size (n=104, Mann-Whitney tests) when catalyst were both present and absent. Categories were not mutually exclusive or exhaustive.

	<i>p</i>	Effect Size <i>r</i>	Catalyst Present n	Catalyst Absent n	Catalyst Present Mean Rank	Catalyst Absent Mean Rank
Membership Breadth						
Policy Mandate/ Recommendation	.041	.184	26	97	74.46	58.66
Crisis/Risk of Crisis	.024	.202	26	97	48.25	65.69
Membership Size						
Policy Mandate/ Recommendation	.002	.304	23	81	69.7	47.62
Crisis/Risk of Crisis	.006	.269	21	83	36.40	56.57

I tested whether membership characteristics differed between the two types of **interdependence**, collective or competing. Distributions of membership breadth (n = 103) and membership size (n = 90) for collective and competing interdependence were similar, so medians are reported (Table 4.7). Median membership was broader for collaboratives with competing interdependence than for those with collective interdependence (U = 1860.0, z = 4.03). Median membership size was also larger for competitively-oriented collaboratives than collectively-oriented ones (U = 1551.5, z = 4.61). Effect sizes (*r* in Table 4.7) were moderate for both (.397, .486). Interdependence was not significantly associated with any of the membership composition variables.

Table 4.7. Comparison (horizontally in table) of the differences between collective and competing interdependence for membership breadth (n=103) and membership size (n=90, Mann-Whitney tests).

	<i>p</i>	Effect size <i>r</i>	Competing n	Collective n	Competing Median	Collective Median
Membership Breadth	<.0005	.397	41	62	6	5
Membership Size	<.0005	.486	38	52	21	11

Initial conditions and strategies (connection B, Figure 4.2)

I now turn to the second question: how are initial conditions related to strategies? Scores for action, organizational, and policy-level strategies are proportions of the number of overall strategies (see methods), and indicate whether a collaborative worked on more or fewer strategies grouped at each level.

Collaboratives focused on different **primary natural resource issues** had significantly different distributions of scores for action-level strategies, and the effect was strong ($n = 123$, $\chi^2 (5) = 53.865$, $p < .0005$, $\eta = .646$) (Table 4.8). The distributions for action-level strategy scores were higher for wetland ecosystem health and water quality groups, meaning they used more strategies like education, monitoring, and on-the-ground project implementation. Specifically, wetlands ecosystem health groups used more action-level strategies than groups addressing forest health ($p = .02$); fish and wildlife ($p < .0005$); land use ($p < .0005$); and water supply ($p < .0005$); but not more than water quality. Water quality groups used more action-level strategies than fish and wildlife ($p = .026$); land use ($p = .002$); and water supply ($p < .0005$); but not significantly more than forest ecosystem health. Both land use and forest ecosystem health collaboratives used more action-level strategies than water supply groups at the same adjusted significance level ($p = .04$).

Distributions of scores for organizational-level strategies (like coordinating member projects, developing markets and convening processes) also differed significantly depending on the primary natural resource issue ($n = 123$, $\chi^2 (5) = 24.773$, $p < .0005$, $\eta = .411$) (Table 4.8). Specifically, forest ecosystem health groups worked on more organizational-level strategies than water quality ($p=.043$) and wetlands ecosystem health ($p = .005$) groups. Water supply groups worked on more organizational strategies than water quality groups ($p = .019$); wetlands health groups ($p = .003$); and forest health groups ($p = .003$).

Table 4.8. Comparison (vertically in table) of mean ranks of six categories of primary natural resource issues for action, organizational, and policy level strategy scores (n=123) (Kruskal-Wallis tests).

Primary Natural Resource Issue	n	Action level	Org. Level	Policy Level
		Score Mean Rank	Score Mean Rank	Score Mean Rank
Water Supply	14	28.0	84.4	88.9
Land Use	17	37.0	64.0	84.3
Fish & Wildlife	25	48.5	69.2	72.4
Forest Health	22	65.3	77.2	49.1
Water Quality	25	79.8	46.5	54.6
Wetlands Health	20	99.3	38.3	34.7

Distributions of scores for policy-level strategies (such as advocacy or policy development) were statistically significantly different depending on primary natural resource issue (n = 123, $\chi^2(5) = 36.915$, $p < .0005$, $\eta = .522$) (Table 4.8). Water supply groups pursued more strategies at the policy level than water quality groups ($p = .032$); forest health groups ($p = .007$); land use groups ($p = .007$); and wetlands ecosystem health groups ($p < .0005$). Land use groups worked at the policy level significantly more than forest health groups ($p = .016$) and wetlands health groups ($p < .0005$). Finally, fish and wildlife collaboratives worked on more policy-level strategies than wetlands health ($p = .003$).

To dig into the details of these strong relationships, I analyzed associations between individual strategies using dummy coded primary natural resource issues to compare which were related to particular strategies. Expected counts for on-the-ground project implementation strategies were moderately higher for wetlands ecosystem health groups than they would be if the two variables were independent. This means that wetlands groups were more likely to use on-the-ground projects ($\chi^2(1) = 24.429$, $p < .0005$, $\phi = .446$), while water quality groups were more likely to do monitoring than other groups ($\chi^2(1) = 7.274$, $p = .007$, $\phi = .243$). Forest ecosystem health groups were strongly positively linked to market development, $\chi^2(1) = 29.584$, $p < .0005$, $\phi = .49$, and were the only resource issue group significantly related to this strategy. As described earlier, collaboratives that land use groups tended to work more at the policy level, but were otherwise quite diverse in their strategies and not positively associated with any single strategy. Interestingly, land use was the only primary issue that was significantly and

negatively associated with the education/outreach/training strategy, one of the most commonly included strategies of all collaboratives in the state ($p < .0005$).

On the other hand, the fish and wildlife primary issue was significantly positively linked to many strategies across multiple levels of action. Fish and wildlife groups were weakly more likely to do monitoring, ($\chi^2 (1) = 4.877, p = .027, \phi = .199$) at the action level; moderately more likely to do project coordination ($\chi^2 (1) = 12.615, p < .0005, \phi = .32$) at the organizational level; and weakly more likely to do policy influence ($\chi^2 (1) = 8.838, p = .003, \phi = .268$) and policy development ($\chi^2 (1) = 6.309, p = .012, \phi = .226$) at the policy level. Further, fish and wildlife groups were significantly more likely to pursue the two strategies not included in the index: acquisition and transfer of property rights ($\chi^2 (1) = 17.164, p < .0005, \phi = .374$), and resource management planning ($p = .004$ using Fisher's exact test). Resource management planning was a very common a strategy for collaboratives, and fish and wildlife was the only issue significantly more likely to pursue it. Collaboratives that focused on water supply issues were also significantly positively associated with a broad range of strategies (though less so than fish and wildlife), and they often worked at the organizational and policy levels. They were significantly more likely to work on two particular strategies at the organizational level: project identification and support ($\chi^2 (1) = 27.984, p < .0005, \phi = .477$), and convening non-member processes ($\chi^2 (1) = 7.667, p = .006, \phi = .25$). They commonly used the specific strategies of policy influence ($\chi^2 (1) = 15.099, p < .0005, \phi = .35$) and policy change/development ($\chi^2 (1) = 7.383, p = .007, \phi = .245$).

Spatial extent was significantly correlated with strategy levels (Spearman's correlation). Collaboratives employing action-level strategies tended to work within smaller geographic areas ($n = 118, r_s = -.373, p < .0005$). Collaboratives with more organizational-level strategies worked in larger geographic areas ($n = 118, r_s = .289, p < .0005$), as did collaboratives with more policy-level strategies ($n = 118, r_s = .220, p = .016$). The last aspect of the nature of the problem analyzed was **natural resource issue scope** ($n = 123$). Collaboratives with more action-level strategies addressed fewer issues ($n = 123, r_s = -.251, p = .005$),

those with more policy-level strategies had a larger scope of issues ($n = 123$, $r_s = .231$, $p = .010$). There was no relationship between issue scope and organizational-level strategies.

Initiating leadership had strong relationships with both action and policy-level strategies, but was not significantly related to organizational-level strategies (Table 4.9). Distributions of scores for action-level strategies varied between initiating leaders ($n = 123$, $\chi^2(4) = 25.956$, $p < .0005$, $\eta = .431$), with upper-level government initiators using significantly fewer action-level strategies than leadership from mixed government/non-government ($p = .004$), local government ($p = .004$), bridging organizations ($p = .007$) and grassroots ($p = .001$). Conversely, collaboratives led by upper-level government worked on more policy-level strategies than those with leadership from local government ($p = .002$), grassroots ($p = .01$), mixed ($p = <.0005$), and bridging organizations ($p = .001$), ($n = 123$, $\chi^2(4) = 28.997$, $p < .0005$, $\eta = .460$), (Table 4.9).

Table 4.9. Comparison (vertically in table) of mean ranks of five levels of initiating leadership action and policy level strategy scores ($n=123$) (Kruskal-Wallis tests).

Initiating Leadership	n	Action-Level Mean Rank	Policy-Level Mean Rank
"Grassroots"	13	83.4	51.9
Bridging Organizations	13	76.5	46.2
Local Government	27	69.8	55.1
Mixed Government/ Non-government	35	67.2	51.5
Upper-level Government	35	37.5	87.4

I followed up with individual comparisons using dummy-coded variables for each kind of initiating leader (Mann-Whitney tests) to identify which initiators were accounting for the greatest variance in strategy level scores. Only grassroots and upper-level government initiators had statistically significant relationships with action and policy-level strategies. Grassroots led collaboratives conducted statistically significantly more action-level strategies (median = 0.67) than those not initiated at that level (median = .50), but the effect size was small ($U = 993$, $z = 2.31$, $p = .021$, $r = .208$). Collaboratives led by upper-level

government pursued significantly fewer action-level strategies (median = .33) than other kinds of initiators (median = .60), ($U = 681.0$, $z = -4.863$, $p < .0005$, $r = -.438$). They conducted statistically significantly more policy-level strategies (median = .33) than other initiators (median = .00) ($U = 2430.0$, $z = 5.326$, $p < .0005$, $r = .480$).

Median scores for action and policy-level strategies differed significantly depending on whether collaborative had mandates/recommendation **catalysts** ($n=26$) or did not have this catalyst ($n=97$) (Mann-Whitney U tests). Collaboratives catalyzed by mandates/ recommendations worked on fewer action-level strategies (median = .33) than those without this catalysts (median = .60) ($U = 684$, $z = -3.6$, $p < .0005$, $r = -.325$), and worked on more policy-level strategies (median = .33) than those without this catalyst (median = .00), ($U = 1668$, $z = 2.7$, $p = .007$, $r = .243$). Collaboratives catalyzed by high severity events ($n=26$) worked on significantly fewer policy-level strategies (median = .00) compared to those without this catalyst ($n=97$, median = .20), $U = 948.5$, $z = -2.1$, $p = .039$, $r = -.186$.

Finally, distributions of scores for action and policy-level strategies were statistically significantly different depending on whether collaborative started out with collective **interdependence** ($n = 62$) or competing interdependence ($n=41$) (Mann-Whitney tests). Collaboratives with collective interdependence worked on more action-level strategies (mean rank = 66.4) than those with competing orientation (mean rank = 30.3) ($U = 381.0$, $z = -6.1$, $p < .0005$, $r = -.596$). Collaboratives with competing interdependence worked on more policy-level strategies (mean rank = 75.5) than collectively-oriented groups (mean rank = 35.5) ($U=2233.0$, $z=6.8$, $p < .0005$, $r = .674$). Effect sizes were strong for both.

Membership and strategies (connection C, Figure 4.2)

My third question was about relationships between membership and strategies. When present, their relationships were weak to moderate (Table 4.10). Higher policy level scores corresponded to broader and larger membership, but had no effect on the percentage of government or non-government

members represented. There was no relationship between membership breadth and size at the organizational level of strategies, but groups working at this level tended to have fewer non-government members and more upper-level government members. A larger emphasis on action-level strategies corresponded to narrower and smaller membership, and higher non-government membership composition.

Table 4.10. Comparison (vertically in table) of *df*, *r_s* and *p*-values of membership breadth (n=123), membership size (n=104) and 3 composition variables, % non-government, % government, and % upper-level government members (n=104 for each) for action, organizational, and policy-level strategy scores (Spearman’s rank order correlation). Bolded *p*-values are significant.

Membership Characteristics	Action Level Score			Organizational Level Score			Policy Level Score		
	<i>df</i>	<i>r_s</i>	<i>p</i>	<i>df</i>	<i>r_s</i>	<i>p</i>	<i>df</i>	<i>r_s</i>	<i>p</i>
Membership Breadth	121	-.230	.01	121	.105	.249	121	.220	.015
Membership Size	102	-.420	<.0005	102	.066	.508	102	.465	<.0005
% Non-Gov. Members	102	.238	.015	102	-.343	<.0005	102	-.083	.404
% Local Gov. Members	102	-.031	.758	102	.062	.529	102	.026	.794
% Upper-Level Gov. Members	102	-.180	.067	102	.319	.001	102	-.006	.949

There was no association between any of the membership characteristics and the resource management planning strategy. Collaboratives that used the easements, acquisitions, and property transactions strategy had more members than those that did not (n = 104, U = 1649.0, z = 3.041, *p*= .002, *r* = .298), but no other membership characteristics were related to this strategy either.

Discussion

I identified linkages between initial conditions variables with 1) collaborative membership characteristics and 2) the focus of the strategies they work on together, as well as somewhat weaker relationships between the membership characteristics of collaboratives and their strategies (Figure 4.3). The salience and complexity of natural resource issues and sub-issues translate to significantly different membership characteristics and composition across primary natural resource issues, and to the kinds of strategies they focus on. Initiating leaders, in combination with catalysts, play an important role in shaping membership characteristics. I apply insights from the theory and typologies (summarized in Table 4.1) to interpret the findings, with an emphasis on the formative typology and nature of the policy challenge

typologies of Emerson and Nabatchi (2015). I first examine the nature of the problem (primary natural resource issues, spatial extent, and issue scope) with respect to membership and strategies, building on results from Chapter 3 to improve the distinction between the acute, complex, and extensive policy challenges. I then examine the patterns identified between initiating leadership, membership, and strategies and relate them back to expectations from the formative typology. I examine the influence of catalysts and interdependence on membership and strategies throughout both discussions, rather than discussing them separately. Throughout the discussion I attempt to clarify and integrate theories about how formation shapes membership and purpose presented by the piecemeal theories and typologies introduced earlier (particularly the typologies summarized in Table 4.1), and examine how well these ‘types’ fit the data.

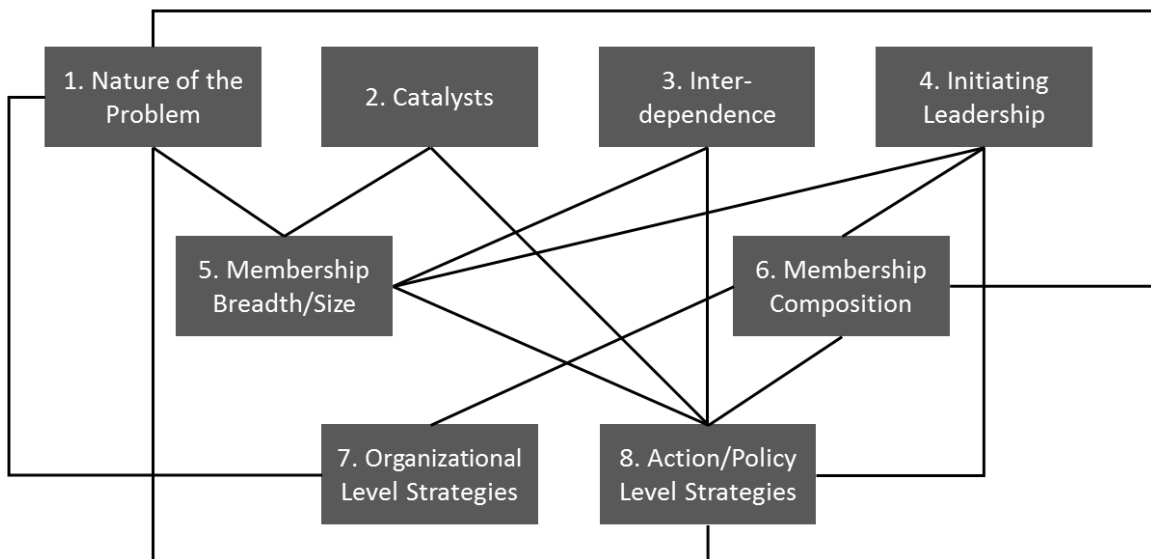


Figure 4.3. Relationships between initial conditions (4 boxes, top row), membership variables (2 boxes, middle row), and strategy levels (2 boxes, bottom row).

Nature of the problem, membership, and strategies

The variable **primary natural resource issue** (part of the nature of the problem, Box 1, Figure 4.3) had several significant strong and moderate relationships to membership and strategies (Boxes 5, 6, 7 & 8), and appeared to have the strongest influence on local and upper-level government member

composition and organizational-level strategies. Highlights of significant relationships are summarized in Figure 4.4.

<p>Wetlands Ecosystem Health</p> <ul style="list-style-type: none"> • Membership: narrow, small, more non-gov., fewer upper-level gov. members • Strategies: project implementation • Strategy Level: action 	<p>Forest Ecosystem Health</p> <ul style="list-style-type: none"> • Membership: small • Strategies: developing markets • Strategy Level: coordination 	<p>Water Quality</p> <ul style="list-style-type: none"> • Membership: more local gov., fewer non-gov, fewer upper-level gov. members • Strategies: monitoring • Strategy Level: action
<p>Fish & Wildlife Conservation</p> <ul style="list-style-type: none"> • Membership: broad, large, more upper-level gov. fewer local gov. members • Strategies: monitoring, project coordination, policy influence, policy development, property transfers, planning • Strategy Level: policy 	<p>Land Use</p> <ul style="list-style-type: none"> • Membership: fewer upper-level gov. members • Strategies: no positive association • Strategy Level: policy 	<p>Water Supply</p> <ul style="list-style-type: none"> • Membership: large, more local gov., fewer non-gov. members • Strategies: project ID/support, convening process, policy influence, policy development • Strategy Level: policy and coordination

Figure 4.4. Summary of positive significant relationships between different primary natural resource issues and characteristics of membership and strategies for each primary natural resource issue: wetlands ecosystem health (n=20), forest ecosystem health (n=22), water quality (n=25), fish and wildlife conservation (n=25), land use (n=17), and water supply (n=14).

Collaboratives focused on wetlands ecosystem health and water quality issues are usually analyzed together as “watershed groups” (Clark et al., 2005; Kenney et al., 2000) due to their tendency to use watershed boundaries (see Chapter 3), and they are similar in many ways. Membership for wetlands ecosystem health collaboratives is often narrow and small. Water quality collaboratives also have fewer members, but a notable difference is that wetlands groups had significantly more non-government members, while water quality groups had significantly fewer. Both issues correspond to collaboratives that work at the action level, particularly restoration projects for wetlands ecosystem groups and monitoring for water quality groups. I had anticipated higher policy level scores for water quality groups, given that several have developed Total Maximum Daily Loads (which include standards for water

quality), and a few of them even have authority to enforce site-specific control regulations, but there was no significant relationship between this issue and policy level activities.

Collaboratives with the primary issues of water quality and water supply were similar in their tendency to include more local government members. These are resource issues where jurisdictional authority often lies at the local level (municipalities and special districts for water quality, water conservancy/conservation districts and ditch companies for water supply). Besides this (and their water resource focus), the similarities between water quality and water quantity collaboratives end there.

Water quality and water supply issues are significantly different in several ways (see Chapter 3). Water quality is the issue associated with the smallest geographic areas, water supply with the largest.

Stakeholder interdependence is rooted in collectivism for water quality issues, and in competition for water supply issues (characterized by scarcity and that tend to include contentious sub-issues like property rights). Collaboratives focused on water quality tend to address fewer issues overall compared to groups focused on other primary issues, while water supply groups tend to have the largest scope. In this chapter, I add strategy level to these differences. In contrast to water quality collaboratives, which tend to operate at the action level, collaboratives that focus on water supply more commonly work at the organizational and policy levels, and are tend to pursue a broad range of strategies. Water supply (and scarcity) are among the most contentious resource issues in the west. Thus, it is no surprise that many collaboratives that form to address these issues also convene public processes for debate and conflict resolution, and work to influence, develop, or change water policy,

such as protecting the *acequia*⁶ system of water appropriation or developing alternative water transfer mechanisms to prevent ‘buy and dry’.⁷

Fish and wildlife collaboratives in Colorado tend to be broader and larger than wetlands ecosystem collaboratives, and have higher upper-level government membership composition than any other primary issue. This is likely because of the important role of state and federal agencies in the conservation and management of wildlife, such as Colorado Parks and Wildlife and the U.S. Fish and Wildlife Service. Collaboratives focused on fish and wildlife issues used varied strategies that cut across strategy levels. While a significant number of fish and wildlife groups have conducted or coordinated monitoring (which fell under action-level strategies), they also conducted organizational and policy-level strategies. Several fish and wildlife conservation collaboratives have a linking function similar to many water supply groups—to identify projects and connect them to resources from state agencies. Many also work on influencing or developing policy related to land and water use, since these issues are connected to habitat fragmentation. However, two strategies that fish and wildlife collaboratives commonly work on were not incorporated into the index (see Methods; they were excluded due to ambiguity of their associated strategy level): acquisition and transfer of property rights (which includes arranging easements), and management planning. Resource management planning was a very common strategy for fish and wildlife collaboratives.

⁶ *Acequias* are a traditional system of water governance of Spanish settlers of the southwestern US in which water is "considered common property, and compliance with community obligations is required in order for an individual to maintain his/her individual water rights" (Cox, 2011, p. 2)

⁷ The term ‘buy and dry’ describes a phenomenon that has been acutely felt in parts of Colorado and elsewhere in the west, where population influx is fueling demographic and economic change. As demand for supply increases in urban areas, water is transferred from agricultural use to municipal use. Since the latter half of last century, urban and exurban areas have looked to the agricultural sector of nearby rural communities facing the stress of declining crop prices and out-migration of younger generations and offered huge sums of money for water rights that are difficult for farmers to say no to. This loss of water from agriculture to urban growth is (practically) irreversible given the rising value of water and the declining tax base of agricultural communities, and it marks a cultural shift to the new west that is painful to many who value the agricultural heritage of the “old” west.

As with fish and wildlife groups, I expected to see greater upper-level government representation (particular federal representatives) as members of forest collaboratives, since 68% of Colorado's forests are on federal lands. While 86% of forest groups did have federal representation within their membership, this was not significant, since representation from federal, state, and local government (as well as environmental groups) was fairly high for all collaboratives overall (see Chapter 2). Forest ecosystem health collaboratives often focused on organizational-level strategies, and in fact were the only kind significantly more likely to work on market development. Many of Colorado's collaboratives that address forest health issues have at some point considered market-based solutions to achieve the dual objective of forest thinning and improving economic conditions. There was no positive association between forest ecosystem health and action-level strategies. This may be because two of the three action-level strategies that are common among groups addressing forest health (education/ outreach/ training and monitoring) are common across all collaboratives. The third (project implementation) is less common among forest collaboratives because so much of Colorado's forested lands are public (meaning that project implementation is usually carried out by public lands managers, outside the purview of the collaborative itself).

Collaboratives that focused initially on land use issues had only one discernable pattern related to membership, namely having significantly fewer upper-level government members. They pursue more policy level strategies, not surprisingly focusing on policy influence related to the development, protection, or regulation of land use activities. It is surprising that land use collaboratives are not significantly more likely than other kinds of issue-focused groups to work on strategies involving property transaction and land easements (even though over 40% do use this strategy). Interestingly, land use collaboratives were the only kind of collaborative negatively associated with the strategy of education/outreach/training, which is the most common strategy described by collaboratives in the state. As discussed in Chapter 3, the issue of land use overlaps with other issues like water supply and

fish and wildlife conservation, and the individual cases that make up the group are quite diverse in their characteristics. There are currently not enough well documented land use collaboratives in Colorado to identify strong differences in membership and strategies between land use and other primary natural resources issues. More information about these groups may be available offline, and investigation using different data collection methods may be able to differentiate them further.

In Chapter 3, I analyzed patterns in the combinations of variables for the nature of the problem by each primary natural resource issues (summarized in Figure 4.5). Although not as strongly related to membership and strategies as primary natural resource issues, spatial extent and issue scope are valuable for examining assumptions proposed by the typology of acute, complex, and extensive policy challenges (Emerson & Nabatchi, 2015), particularly when considered in tandem with catalysts and interdependence. The relationships that distinguish each policy challenge are illustrated in separate figures.

<p>Wetlands Ecosystem Health</p> <ul style="list-style-type: none"> • Sub-issues: weeds/ invasives, altered streamflows, safety/ vulnerability • Issue scope: not significantly associated • Spatial extent: small 	<p>Forest Ecosystem Health</p> <ul style="list-style-type: none"> • Sub-issues: altered fire regimes, safety/vulnerability • Issue scope: small • Spatial extent: not significantly associated 	<p>Water Quality</p> <ul style="list-style-type: none"> • Sub-issues: pollution, compliance/liability • Issue scope: small • Spatial extent: small
<p>Fish & Wildlife Conservation</p> <ul style="list-style-type: none"> • Sub-issues: wildlife impacts, land fragmentation, land mgmt. impacts, property rights, compliance/liability • Issue scope: large • Spatial extent: not significantly associated 	<p>Land Use</p> <ul style="list-style-type: none"> • Sub-issues: land mgmt. impacts, land fragmentation, econ/ livelihoods, recreation/ aesthetics/cultural values, property rights • Issue scope: large • Spatial extent: not significantly associated 	<p>Water Supply</p> <ul style="list-style-type: none"> • Sub-issues: altered streamflows, drought/climate, infrastructure, property rights, compliance/ liability, trust/conflict • Issue scope: large • Spatial extent: large

Figure 4.5. Summary of associated variables within the nature of the problem for each primary natural resource issue: wetlands ecosystem health (n=20), forest ecosystem health (n=22), water quality (n=25), fish and wildlife conservation (n=25), land use (n=17), and water supply (n=14).

Acute policy challenges are localized problems that affect stakeholders “in severe ways,” and which correspond to narrower and smaller membership (Emerson & Nabatchi, 2015, p. 165). In Chapter 3, I noted that there is no direct link between high severity catalysts and spatial extent. However, these two characteristics are linked through their influence on membership. Collaboratives operating at smaller spatial scales (Box 1b, Figure 4.6) have fewer types and numbers of members (Box 5), as do those driven by high severity catalysts (Box 2), thus providing indirect support for the characterization of acute policy challenges as both localized and severe. Collaboratives with narrower membership breadth and fewer members also tend to have a narrower scope of issues (Box 1c), which may distinguish acute from complex policy challenges (discussed further below). Likewise, narrower and smaller membership corresponded to collective interdependence (Box 3). Collective interdependence may also distinguish the combination and substance of issues and sub-issues (Box 1a) that make up acute policy challenges. For example we might expect acute policy challenges to involve a small set of localized issues that link stakeholders through collective interdependence (such as pollution or public safety), and/or which require on-the-ground projects to address (like weeds or erosion problems). While Emerson and Nabatchi do not directly link policy challenges to levels of strategy, others do propose that collaboratives working on smaller, localized problems will work through direct action to implement change (Diaz-Kope & Miller-Stevens, 2014; Margerum, 2008), supported by the results linking spatial extent to action level strategies (Box 8).

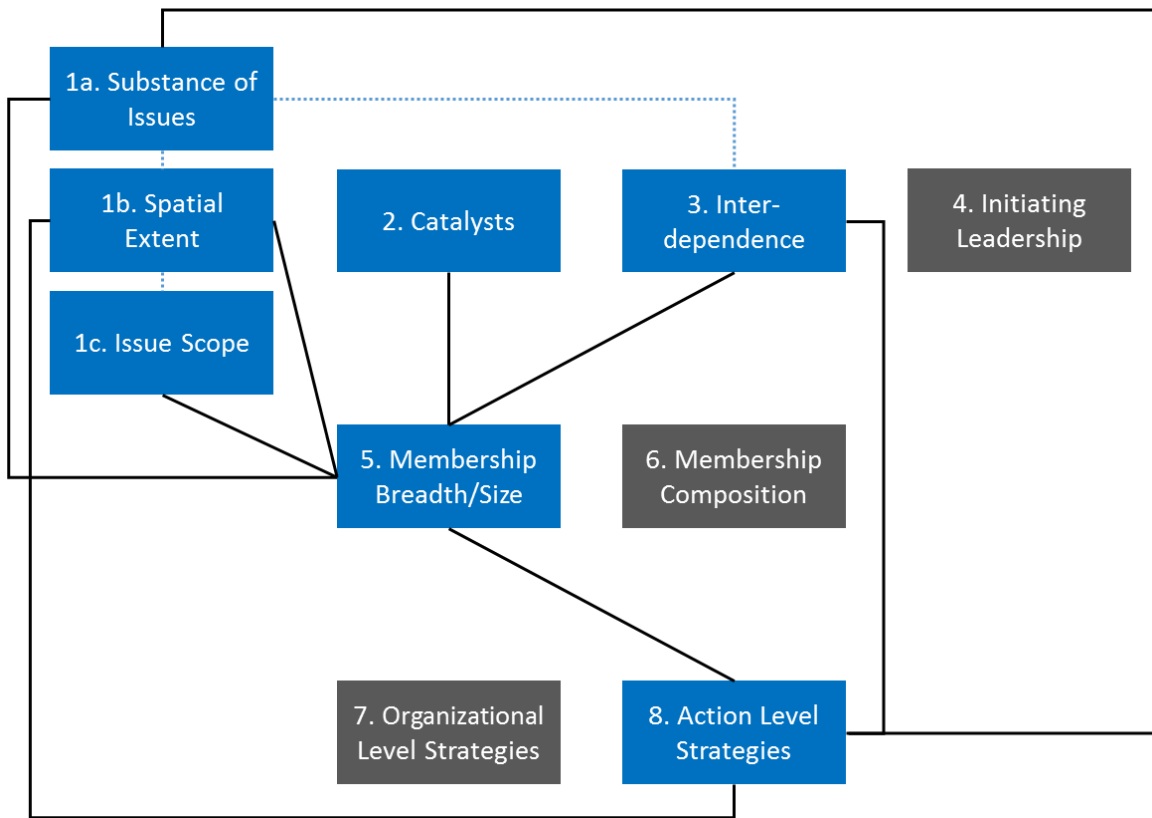


Figure 4.6. Initial conditions (with nature of the problem broken into component variables; 6 boxes, top row); membership (2 boxes, middle row), and strategies (two boxes, bottom row) analyzed throughout this study. Blue boxes and lines indicate variables and relationships used to characterize acute policy challenges (Emerson & Nabatchi, 2015), highlighting a proposed link to action level strategies, as suggested by Margerum (2008). Dotted lines indicate relevant relationships discussed in Chapter 3.

Given the explicit spatial component of acute policy challenges, I made the case in Chapter 3 for incorporating spatial extent into the conceptualization of **extensive policy challenges**, and showed that mandates play an important role in driving collaboration when spatial scale is large. Membership was broader and larger (Box 5, Figure 4.7) for collaboratives driven by mandate or recommendation catalysts (Box 2) as well as those working at a larger spatial scale (Box 1b). This is consistent with findings from research applying the social ecological systems framework to cases of collective action, which found that self-organization is less likely if membership becomes too heterogeneous or large, and which implies that an external catalyst, such as a mandate, may be necessary (Poteete, et al., 2010; Wondolleck & Lurie, 2016). Increasing distance between stakeholders and spatial extent raises the transaction costs of

participating consistently in collaboration (Daraganova et al., 2012; Kark et al., 2015), presenting logistical challenges to meeting and possibly favoring some types of members over others (Bonnell & Koontz, 2007; Cheng & Daniels, 2005). Increasing spatial scale also increases heterogeneity as increasingly large problems affect more and different kinds of people (Diaz-Kope & Miller-Stevens, 2014), and increases the number of relevant jurisdictional stakeholders (Heikkila & Gerlak, 2005). In cases where heterogeneity is high, but the problem is otherwise well suited to collaboration, mandates (ideally paired with incentives and strong issue salience) may be necessary to catalyze collaboration (Heikkila & Gerlak, 2005; Wondolleck & Lurie, 2016).

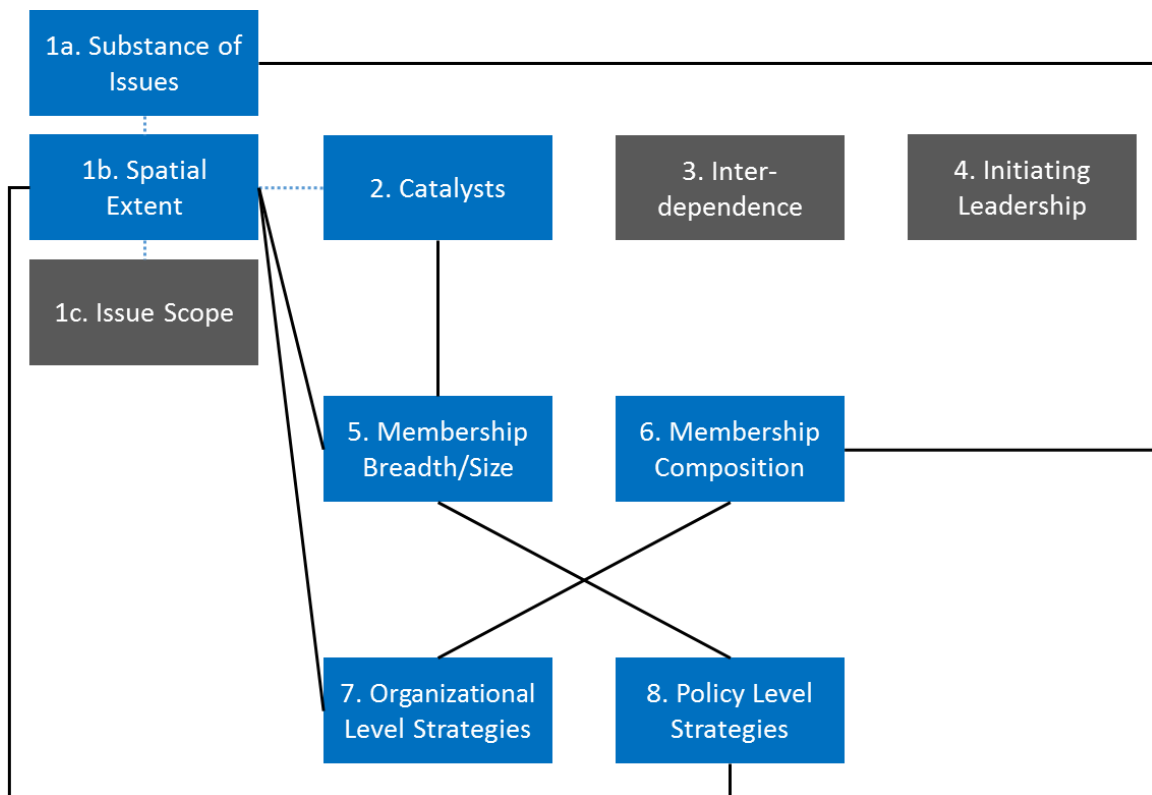


Figure 4.7. Initial conditions (with nature of the problem broken into component variables; 6 boxes, top row); membership (2 boxes, middle row), and strategies (two boxes, bottom row) analyzed throughout this study. Blue boxes and lines indicate variables and relationships used to characterize extensive policy challenges (Emerson & Nabatchi, 2015), highlighting proposed links to organizational and policy level strategies, as suggested by Margerum (2008). Dotted lines indicate relevant relationships discussed in Chapter 3.

While some issues may tend to manifest at larger or smaller scales, theoretically any of the primary issues may be framed as an extensive policy challenge (Emerson & Nabatchi, 2015). Instead, the role of issues in defining extensive policy challenges is likely its interactions with spatial scale and jurisdiction, which together shift membership composition towards government-based. The emphasis on both organizational and policy level strategies (Boxes 7 and 8, Figure 4.7) increases with spatial extent (Box 1b) of concern to the collaborative, a finding consistent with expectations from the typologies of Diaz-Kope and Miller-Stevens (2014) and Margerum (2008). However, collaboratives focused on organizational-level strategies are unique in having both high government membership composition and a large spatial extent.

Distinguishing **complex policy challenges**, particularly from extensive policy challenges, has been particularly difficult using my methodology. As suggested above, catalysts like government mandates and recommendations may be a distinguishing feature of extensive policy challenges, and Emerson and Nabatchi (2015) indicate that concentration of decision-making authority with regard to the resource is another, with greater concentration of authority for extensive policy challenges (I explore this further below in relation to initiating leadership). Although increasing spatial extent likely increases complexity in ways not explored here, like information needs, the patterns identified suggest that its contributions to complexity are largely through increasing membership size and heterogeneity, already discussed within extensive policy challenges.

Information needs, membership diversity and size, and conflict can all increase transaction costs and the need for more formal institutional arrangements (Imperial & Koontz, 2007; Poteete et al., 2010). Using the variables that I measured, I propose that problem complexity is a function of issue scope (Box 1c, Figure 4.8), membership breadth and size (Box 5), and interdependence (Box 3), and is modified by the substance of the primary natural resource issues and their sub-issues (Box 1a). Based on the insights from Figure 4.4 and 4.5, I would expect that water supply issues, fish and wildlife conservation, and land

use issues have the potential to be more complex in terms of two main factors. First, they often have a larger scope of natural resource issues (i.e., they tend to address more natural resource issues than collaboratives focused on the other three primary natural resource issues). Second, they are more likely to address sub-issues around which stakeholders have competing interests and cooperative orientation (such as property rights, or economic/ livelihoods concerns, see Chapter 3 Discussion). In addition, collaboratives focused on fish and wildlife conservation issues tend to have somewhat broader representation, and both water supply and fish and wildlife tend to have more members.

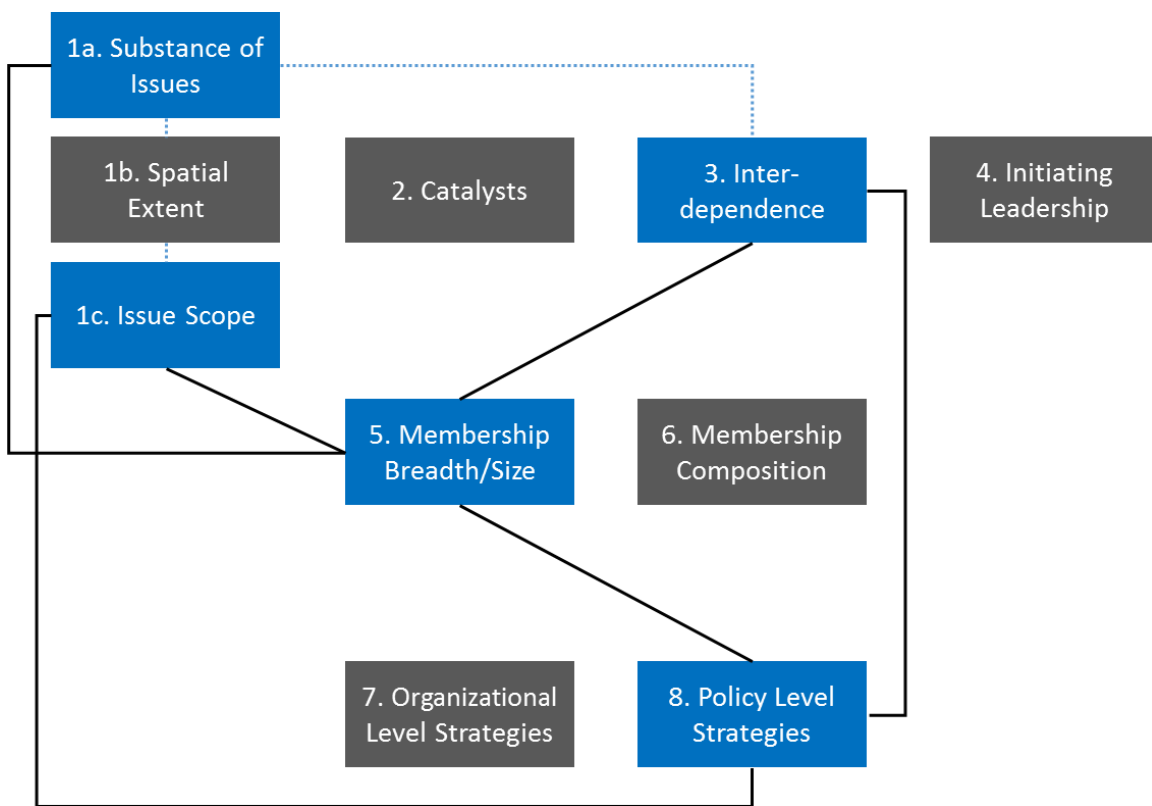


Figure 4.8. Initial conditions (with nature of the problem broken into component variables; 6 boxes, top row); membership (2 boxes, middle row), and strategies (two boxes, bottom row) analyzed throughout this study. Blue boxes and lines indicate variables and relationships used to characterize complex policy challenges (Emerson & Nabatchi, 2015), highlighting a proposed link to policy level strategies. Dotted lines indicate relevant relationships discussed in Chapter 3.

I do not suggest that some primary natural resource issues are inherently more or less complex than others, and I encountered examples of what could be described as acute, complex and extensive policy

challenges for each primary issue. Instead, I propose that complexity in membership and issue scope increase when the combination and substance of issues and sub-issues create competing interdependence. Further, these parameters also influence strategies. Increasing issue scope, competing interdependence, and broader/larger membership all correspond to a decreasing proportion of action-level strategies (particularly project implementation and monitoring), and increased focus on policy-level strategies.

I have attempted to make the distinction of acute, extensive, and complex policy challenges more explicit, setting the stage for the next discussion about the role of initiating leadership in shaping membership and strategies. I address some of the assumptions of the formative typology, and also discuss more direct linkages between membership and both levels and individual strategies.

Initiating leaders, membership, and strategies

Leadership takes many forms in collaboratives, but initiating leadership is of greatest interest in this study because the focus is on the role of initial conditions in shaping membership and strategies. The typologies of membership (Diaz-Kope & Miller-Stevens, 2014; Moore & Koontz, 2003, Table 4.1) do not distinguish between the roles of initiating leaders and the composition of membership, which either ignores the role of initiators or implies parity of initiators and members (e.g., that citizen-based or grassroots partnerships are driven from within by entities at that level). However, I have observed collaboratives described as grassroots and that feature grassroots characteristics (like non-government composition with many unaffiliated members and informal structures), but which were driven not driven internally, and which may have had greater capacity at the outset of collaboration as a result. The formative typology (Emerson and Nabatchi, 2015) indirectly acknowledges the difference between leaders and members, classifying collaboratives based on the locus of their initiating leadership: self-initiated, independently convened, or externally driven (which the authors propose will correspond to acute, complex, and extensive policy challenges). As above, I use these typologies to structure my

interpretation of the findings, and also examine how well the typologies fit the data. Relationships between variables discussed in this section are illustrated in Figure 4.9.

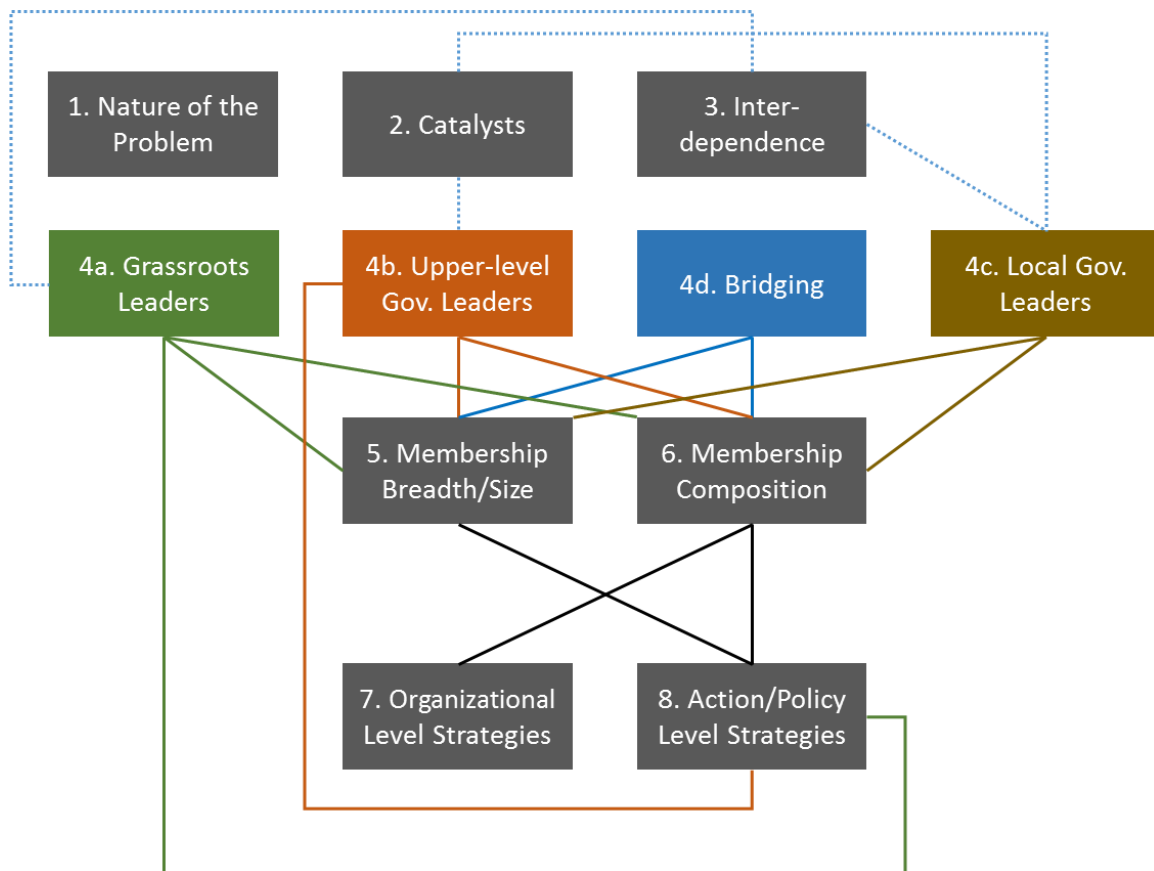


Figure 4.9. Initial conditions (3 boxes, top row; with initiating leadership broken out as 4 boxes color coded by category, second row); membership (2 boxes, third row), and strategies (two boxes, bottom row) analyzed throughout this study. Relationships between membership characteristics and strategy levels are in black. Dotted lines indicate relevant relationships discussed in Chapter 3.

Initiating leadership was strongly linked to membership characteristics, not only membership breadth and size, but also membership composition. Grassroots initiating leaders in Colorado (Box 1a, Figure 4.9) tend to have fewer kinds of members and smaller membership (Box 5). They also have more non-government members (particularly individuals, homeowners, citizens, or otherwise unaffiliated people), fewer local government representatives, and fewer upper-level government representatives (Box 6). Results of Chapter 3 showed that share collective interdependence (Box 3). So far, the findings provide

support for self-initiated collaboratives that are grassroots-driven and citizen-based (Diaz-Kope & Miller-Stevens, 2014; Emerson & Nabatchi, 2015; Moore & Koontz, 2003). The connection between self-initiated collaboratives and acute policy challenges (Figure 4.6) can be seen through their patterns of collective interdependence and narrow and small membership. In addition, both grassroots leadership and high non-government membership (Figure 4.9, Box 6) were linked to action-level strategies (Figure 4.9, Box 8).

Upper-level government initiators (Box 4b, Figure 4.9) start collaboratives with broader and larger membership (Box 5), fewer non-government and more upper-level government members (Box 6). As described in Chapter 3, upper-level government initiators often coincide with catalysts involving mandates or recommendations (Box 2). In some cases, broadly representative membership requirements are laid out in statute, as in guidelines of the Federal Advisory Committee Act or the Colorado Water for the 21st Century Act; alternatively, leaders at this level may aim for widely representative membership because they are seeking to build alliance or increase buy-in for management decisions (Mitchell et al., 2015). Thus, the characteristics of collaboratives initiated by upper-level government coincide with the description of the external drivers described by Emerson and Nabatchi's formative typology (2015). While this may seem obvious, the distinction is ambiguous in the description by the authors (Table 4.1), and the pattern is only observable when they are analyzed separately from collaboratives initiated by local governments or by mixed government/non-government leaders. External drivers map onto extensive policy challenges (Figure 4.7) through membership breadth/size (Box 5, Figure 4.9) and composition (Box 6, Figure 4.9). As discussed earlier, mandate/recommendation catalysts also correspond to larger areas.

Upper-level government often served as *initiators* (Box 4b, Figure 4.9) of collaboratives working on policy level strategies, but tribal, state, and federal government representatives were not as commonly represented as *members* (Box 6) of collaboratives working at the policy level (Box 8). For problems in

which upper level government agencies have decision authority, their role is more likely to be that of convener, funder, and/or policy development partner (rather than member) for collaboratives working at the policy level (Diaz-Kope & Miller-Stevens, 2014; Margerum, 2008). Instead, upper-level government representatives were more common as members of collaboratives working at the organizational level (Box 7). Mitchell et al. (2015) found that federal level managers differed from local government and NGO representatives in their most commonly stated purpose for collaborating, which was to develop, re-design, or “improve performance of shared programs and policies” (p.700). This purpose is similar to the definition of organizational-level collaboratives (Margerum, 2008). At this level, partners are working to share and coordinate financial, technical, and other resources to achieve shared objectives with partners from other agencies at different jurisdictional levels or across jurisdictional boundaries, as well as with NGOs. Externally driven, extensive policy challenges are often also complex (competing interdependence linked to many of its characteristics elements, which why external drivers are necessary). However, even with competing interests or a large spatial area, complexity may be less of a barrier when membership is more homogeneously government-based and the aim of collaboration is to coordinate programs or resources.

The typologies presented earlier (Table 4.1) are ambiguous about how leaders from local government and bridging organizations acting in an official capacity fit in. Are local governments more likely to externally drive collaboration, independently convene, or self-initiate? Do bridging organizations act more like grassroots leaders, or do they fit the description of independent conveners?

Collaboratives led by local governments (Box 4c, Figure 4.9) are similar in several ways to those with grassroots leaders. They both have higher proportions of members representing their level (i.e., grassroots leaders recruit more non-government members, and local government leaders recruit more local government members), as well as lower representation from upper-level government (Box 6). They both tend to have fewer numbers of members (Box 5). As discussed in Chapter 3, local government and

non-government initiators tend to lead collaboratives with collective interdependence (Box 3). Local government initiators were also more likely to respond to high severity risk and crisis events than other kinds of initiators (Box 2). Beyond that, patterns are less discernable. The issues with the highest local government membership composition, water quality and water supply, lie on opposite ends of the complexity spectrum as described earlier. As both initiators and members, local governments collaborate on strategies at all levels. None of the typologies of collaboratives described earlier quite fit this configuration, but the pattern suggests that local governments may self-initiate government-based or interagency partnerships in response to acute policy challenges (Diaz-Kope & Miller-Stevens, 2014; Emerson & Nabatchi, 2015).

Initiators from bridging organizations (Box 4d, Figure 4.9) were more similar to upper-level government initiators in terms of having greater membership breadth and size (Box 5) than the other kinds of initiators. While grassroots and local government leaders (and even upper-level government leaders to a lesser degree) had more of their own kinds of entities represented in membership composition, this was not the case for bridging organizations. Bridging organizations and upper-level government were also more likely than other kinds of initiators to include representatives from universities as members (included in Box 6), which could indicate increased access to specialized knowledge and expertise for complex problems.

Theory suggests that bridging organizations shape membership through their access to diverse networks and capitals (Bodin & Crona, 2009), which may help explain what sets them apart from other kinds of leaders. Social network research suggests that these organizations are often positioned within a large network of disconnected or weakly connected sub-groups in a way that allows them to broker new relationships, create 'bridging ties' between groups (like government agencies, private industry, and civilians), and access external knowledge and resources (Bodin & Crona, 2009; Crona & Parker, 2012). They often bring with them skills associated with collaborative capacity, such as grant writing or

facilitation (Cheng & Sturtevant, 2012). When leadership comes from these kinds of organizations, playing a convening role in collaboration often aligns with a programmatic mission or project-driven objective, and initiators are at least partially compensated for their role. This, in addition to their network connectedness, may allow them to tackle problems with more diverse stakeholder interests (and more complex problems in general). This is the proposition implied by Emerson and Nabatchi (2015) when they anticipate that third parties will independently convene collaboratives to address complex policy challenges, for which knowledge and information is a critical component of capacity for joint action (Emerson & Nabatchi, 2015). Unfortunately, there were too few cases of collaboratives driven solely by bridging organizations to detect significant relationships with other variables that might indicate problem complexity (such as interdependence or primary natural resource issue). Thus, the extent to which complex policy challenges (Figure 4.8) are in fact independently convened by these kinds of organizations remains unclear. Still, the need to access information may partly explain why collaboratives with bridging leaders had more university representation in their membership.

Another source of difference in membership across initiating leaders might be purposeful motivations for collaborating. Research suggests that there are similarities, but also important differences between representatives of local governments, federal governments, and transnational non-government organizations (NGOs) based in the U.S. (such as the Nature Conservancy, which has led collaboratives in Colorado) in their motivations for collaborating (Mitchell, O'Leary & Gerard, 2015). Both local government and NGO respondents collaborate in order to improve outcomes and leverage resources. However, while NGOs emphasized organizational learning and knowledge sharing as motivations for collaborating, local government managers emphasized implicit mandates to collaborate rooted in community values, normative expectations that collaboration is the right thing to do, and collaboration as a means to build relationships and credibility (Mitchell et al., 2015). While bridging organizations may literally bridge networks to access new information and diverse members, bonding ties (associated with

trust and redundant relationship) may play a bigger role in shape the membership networks of local governments. Local governments are prominent as both leaders and members of collaboratives in Colorado (as discussed in Chapter 2). Further research mapping collaborative networks led by local governments, as has been done for bridging organizations (Crona & Parker, 2012) and grassroots organizations (Bodin & Crona, 2008; Lauber, Decker & Knuth, 2008), would be valuable for understanding unique, scale-dependent challenges and opportunities for collaboratives led at this level.

Before concluding, I will briefly touch on relationships between membership and individual strategies (not illustrated). Several of the relationships between strategies and membership I expected to see based on previous research were not supported by the data. Collaboratives employing resource management planning strategies did not have wider membership and more members (as suggested by Koontz & Johnson, 2004). Nor were collaboratives made up largely of non-government members more likely to pursue education/outreach/training. Instead, this strategy was common across all collaboratives, and was not related to any membership characteristics. This is likely due to differences in data collection methods between my study (document analysis) and the survey method used by Koontz and Johnson (2004). In analyzing the set of strategies undertaken by each collaborative over time, I found that, regardless of their relative importance to the overall goals of a collaborative at a given time, the majority of collaboratives had undertaken education and the resource management planning strategies at least once (see Chapter 2 for the relative frequencies of each strategy).

The inclusion of the policy influence strategy was not related to government (local or upper-level) or non-government membership composition. My findings differ from (but do not refute) those of Koontz and Johnson (2004), who found that citizen-based groups were more likely to engage in policy influence and advocacy than collaboratives with mixed or government-based membership. Again, this may be due to differences in methods of data collection between my study and theirs. By relying largely on documents that describe the activities of each collaborative (strategic plans, annual reports,

newsletters, and so forth) rather than surveys, I may have under-counted this strategy, though this is only speculation. The documents generated by collaboratives and presented to the public are often intended to create a sense of “unity, continuity, and value” among members or potential members (Koschmann, Kuhn & Pfarrer, 2012, p. 336), as well as help define the group’s identity to non-members (Krippendorff, 2004). Many collaboratives are careful to distinguish themselves from advocacy groups because they value diverse participation, and thus may under-emphasize a strategy that influences policy, at least on paper, even if they actually use this strategy. Alternatively, many collaboratives may influence policy through activities like commenting on draft Environmental Impact Statements, but may not report on this activity as much as other activities that are more attractive to potential members, partners, or funders, like project implementation, resource management planning, or education and outreach activities.

Conclusions

The initial conditions that drive the formation of collaboratives make a difference in the kinds, quantities, and composition of members, as well as for the kinds of strategies they pursue. Mandates and recommendations help catalyze collaboratives addressing large-scale problems, regardless of natural resource sector, that bring together many heterogeneous members with competing interests. The greater its spatial scale, the less likely the collaborative is to pursue many action-level strategies, and instead focus at the organizational and policy levels.

Grassroots and local government initiators are similar in that the collaboratives they bring together are often smaller and collectively oriented, and member composition is more likely to reflect the level of the initiator (non-government for grassroots initiators, local government for local government initiators). Bridging and upper-level government initiators drive collaboratives with broader and larger membership, and they are both more likely to recruit university representatives as members (not just partners).

I have drawn on the typologies in Table 4.1 to interpret my findings, placing a particular emphasis on the formative typology and nature of the policy challenge typologies of Emerson and Nabatchi (2015). The typologies could not be applied directly to my study because, when study design was underway, the concepts were underdeveloped and in need of clarification. Thus, part of the aim of this chapter was to clarify the distinctions between formative types and the nature of the policy challenge by supplementing missing information with other insights from the literature, and proposing measurable variables that are feasible for large sample studies such as this one.

In the process, I have identified support for linking self-initiated, acute policy challenges and externally-directed, extensive policy challenges. Distinctions between complex and extensive policy challenges are fuzzy, and several examples (like the Basin Roundtables) display characteristics of both. The Wetland Focus Area Committees may serve as an example of an extensive policy challenge that is less complex, and their function is primarily to provide input on plans, identify projects, and connect those projects with (mostly state) funding. Support for independently convened, complex policy challenges was unclear, though bridging organizations do tend to lead larger and more heterogeneous collaboratives; analysis of more cases may improve support for this type of collaborative. Further research is also necessary to understand patterns across mixed government/non-government initiators with other initial conditions, membership and strategies; few patterns were discernable beyond broad yet small membership.

Many frameworks and typologies do not distinguish between local government and upper-level government (as initiators or members). For example, their role as initiators in the formative typology (Emerson & Nabatchi, 2015) goes unstated, but my findings suggest they may be just as likely to ‘self-initiate’ in response to an acute policy challenge as grassroots leaders, if not more so (due to their positive association with high severity catalysts, discussed in Chapter 3). Further research should be directed towards how local government initiators’ networks affect collaborative membership and

broader capacity for joint action, as well as their strategies and outcomes, relative to other kinds of initiators. The abundance of local and quasi-government actors as both leaders and members of collaboratives in Colorado (see Chapter 2) suggests that they play an important role in institutionalized collaboration and may have different needs and constraints than other kinds of leaders.

This study highlights both the value and limits of typologies. As cited in the introduction, Koontz (2015) suggests that the value of typologies is in grouping loose collections of lessons learned in a systematic way. The appeal of the formative typology (in conjunction with its parameters of the nature of the policy challenge and determining authority) is in its systematic elegance. The authors hypothesize differences between each formative type in terms of the development of their shared motivation, principled engagement, and capacity for joint action (the three domains of collaborative dynamics proposed by the Collaborative Governance Framework, see Chapter 1), which could be tested if the typology were more amenable to large sample studies. Even more valuable is its potential utility for improving the design of collaborative purpose, process, and structures. If, for example, a collaboration scenario could be easily classified as a self-initiated, acute policy challenge with diffuse determining authority, then those hypotheses could inform the planning and design of the collaborative model.

This potential can be fully recognized at the case study or situational level, but the direct application of this typology to a large dataset for research purposes would require further refinements, such as better metrics for assessing information needs, a finer grain of sub-issue information, and more cases to accommodate multivariate analysis. For example, forest health issues are particularly difficult to characterize with this typology. Forest ecological processes operate over larger spatial scales and longer times scales and are in many ways socially and ecologically complex (Chapin, Kofinas & Folke, 2009). They are managed for multiple uses and users often have divergent or competing interests, but at the same time, risks to forest health present risks to all users, which may be why forest collaboratives were slightly more likely to have collective interdependence. With so many of Colorado forests located on

public lands, authority to make decisions may be concentrated in ways that constrain membership and limit the autonomy of these collaboratives (this is also the case with some land use collaboratives focused on federally owned public lands) (Emerson & Nabatchi, 2015). Determining authority is a piece of the formative typology that was not addressed in this study (again due to challenges of measurement), and its absence limited my ability to accurately characterize each collaborative. Further clarification of this concept is needed.

With the incorporation of determining authority, the formative typology (and particularly the nature of the policy challenge) would also be helpful for examining long term changes in the formation of collaboratives, and how changes in how issues are framed affects form, function, and outcomes. Returning to forest-focused collaboratives as an example, early forest collaboratives in Colorado overlapped with land use groups in their public lands and livelihoods focus, featuring a greater tendency towards competing interdependence. However, increasingly devastating wildfires have begun to break down the walls between forest health and water resource issues, one the one hand reducing the barriers to collaboration by making the problem more acute, but on the other making it more complex by increasing the scope of issues and information needs. Sourcewater protection from wildfire has brought more of a watershed focus to forest collaboratives, and cross-pollination seems to have increased in recent years between collaboratives focused on forest health, water supply, water quality, and wetlands health. This is great news from a social-ecological systems standpoint!

From a practical standpoint, however, it suggests that the application of typologies as rote to the design of collaboratives should be avoided. The governance arrangements and membership configurations that work well for grassroots partnerships with a wetlands or water quality focus and diffuse authority to make decisions and implement projects may meet with frustration when applied to forest health issues with larger spatial scales, longer temporal scales, and concentrated decision authority. Typologies are useful heuristics for comparing and contrasting multi-dimensional concepts, but I found that the

distinctions are often under-developed and difficult to interpret. In the process of attempting to synthesize the insights of several typologies, I have inadvertently developed a taxonomy based on empirically observable characteristics that can be measured (Smith, 2002), and the insights it generated may be useful. For example, patterns suggest that water supply, fish and wildlife conservation, and land use may be particularly complex due to their tendency to address a larger scope of issues and to include issues that often involve competing interdependence, such as property rights. Stakeholder analysis and assessment of the context and situation prior to convening collaboratives (while always recommended), may be even more important for these issues.

CHAPTER 5. CONCLUSIONS AND IMPLICATIONS

Colorado's landscape of natural resource collaboration

The overarching purpose of this research was to address the gaps in large sample studies comparing diverse cases of collaboration formed to manage a variety of natural resource problems. In the inventory portion of the study, I found that, between the mid-to-late 1970s to 2015, no fewer than 183 long-term collaborative initiatives (meeting the criteria presented in chapter 2) formed in Colorado to address forest, wetland/riparian and rangeland ecosystem health issues, water quantity and water quality, land use and fish and wildlife conservation issues, with at least 157 still active as of 2018. This number is not far off from the 143 identified so far in Oregon (B. Cochran, National Policy Consensus Center, personal communication) and the 107 collaboratives in Arizona, when adjusted for the year of the study (Fernández-Giménez et al., 2004). Unfortunately data are not yet available for the study in Oregon, but soon a comparison of the geographic distribution between Colorado and Oregon will be possible, and hopefully others (like New Mexico and North Carolina, where there are similar studies underway).

The location and distribution of collaborative groups is important because it has implications for who can participate and who benefits from their activities. Lubell et al. (2002) found that watershed partnerships in the U.S. were more likely to be found in watersheds that correspond to higher per capita income and were less likely to be found in watersheds with high percentages of minority populations. The authors conclude that the benefits of watershed partnerships can suffer from social justice problems "associated with command-and-control approaches—benefits accrue primarily to those who are already better off," (p.159). The clustering of collaboratives along Colorado's Front Range was striking. Many collaboratives have project sites or meeting locations along the Front Range urban corridor and smaller cities in the west and southwest (particularly around Durango), with fewer found

on the eastern plains. Because so much of the work of collaboration happens in meetings, they likely cluster in areas that are accessible to member organizations and agencies. High population density in the institutionally thick corridor of the Front Range may increase the likelihood of partnership forming there (Daraganova et al., 2012; Hardy & Koontz, 2010; Lubell et al., 2002). Also, previous partnerships may spin off new partnerships (Scott & Thomas, 2015). It is possible that collaboratives in other parts of the state are more likely to form coalitions or advocacy groups rather than multi-stakeholder collaboratives and thus do not fit my definition of a collaborative here. Or they may have fewer resources and thus simply lack a presence on the internet, and thus I never encountered them. Future research could incorporate social network analysis with spatial analysis as a logical next step to investigate why and how collaboratives are distributed across the state as they are. For example, this could be used to investigate where investments in collaborative capacity may yield the highest returns. It could also be applied to chart an evolving institutional landscape and investigate how collaboratives across the state interact, overlap, cooperate, and compete for resources.

Initial conditions, membership, and strategies: Reflections and theoretical implications

Laws, policies, regulations, and government programs play a large role in the formation of collaboratives in Colorado, but the role of mandates/recommendations, threats, and incentives differs depending on the initiating leaders and the nature of the problem addressed. Collaboratives driven by mandates and policy recommendations very much resemble the *externally driven* formative type proposed by Emerson and Nabatchi (2015); they address, as the authors proposed, *extensive policy challenges* that are large in spatial extent. They sometimes involve multiple, similarly structured collaboratives in different locations coordinated through a government agency (such as the Basin Roundtables, Wetland Focus Area Committees, and Resource Advisory Councils), another characteristic of extensive policy challenge. Like the large-scale collaborative resource management institutions studied by Heikkila and Gerlak (2005), collaboratives catalyzed by mandates/ recommendations have more members and a broader range of

members represented. Upper level government agencies usually respond to these catalysts and lead collaboration, often bringing resources and capacity that can help overcome the constraints to collective action imposed by geographic scale and heterogeneity (Kark et al., 2015; Mitchell et al., 2015). All six types of primary natural resource issue had at least one mandated/recommended example, but I did not find strong relationships between mandates and primary issues. Externally-driven, extensive policy challenges is a problem ‘type’ that fits a wide range of natural resource issues. However, many of the issues addressed at this scale also appear to be quite complex (due to the scope and contentious nature of sub-issues that they commonly address, as well as increased membership size and heterogeneity). Thus, it is unclear how distinct extensive policy challenges are from the *complex policy challenges* proposed within the formative typology (Emerson & Nabatchi, 2015). I discuss the other kind of policy challenge they propose (acute challenges) below.

Threats and concerns about policies and regulations were more common catalysts than mandates, particularly for the strongly regulated issues of fish and wildlife conservation and water quality (and particularly the former). The most pertinent regulation for the conservation of biodiversity at the federal level (but with potential implications at all levels of jurisdiction) is the Endangered Species Act of 1973 (ESA). When enforced, ESA has been one of the most powerful regulations to come out of the so-called ‘Green State,’ a term used to describe the set of largely uncoordinated regulatory statutes that emerged in the U.S. beginning in the late 1960s and throughout the 1970s to address various environmental problems coming to light as the environmental movement got underway (Souza & Klyza, 2007). Section 10 of the ESA provides a process through which landowners can apply for an incidental take permit, provided that they prepare and submit a Habitat Conservation Plan (HCP) detailing actions they will take to mitigate take and jeopardy. HCPs require landowners to work with relevant agencies to develop the plan, though the planning and implementation process can involve collaboration among a broader set of stakeholders. Candidate Conservation Agreements with Assurances (CCAA) and without assurances

(CCA) provide tools similar to HCPs, but for species that have not yet been listed (the former comes with protections similar to the safe harbor and no surprises rules, the latter does not). These are formal agreements between landowners, the Service, and other relevant entities or agencies, voluntarily agreeing to conserve habitat for species that are either candidates for listing or are otherwise likely to be listed. In Colorado, HCPs, CCAs, and CCAAs have been used to conserve the Preble's meadow jumping mouse, boreal toad, yellow-billed cuckoo, southwestern willow flycatcher, and Gunnison sage-grouse, with several spawning or resulting from long-term collaboration.

Water quality issues were commonly driven by a combination of non-crisis biophysical catalysts and concerns about negative impacts of listing under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), or state-imposed water quality standards and total maximum daily load requirements. Funding incentives from government programs (not paired with threats or mandates) have also helped catalyze at least 21 of Colorado's 123 collaboratives. For example, many collaboratives working to implement restoration projects got their start with Environmental Protection Program's Section 319 grants, designed to support state and local efforts to address nonpoint source pollution. New forest collaboratives have spun off from parent collaboratives as a result of funding incentives from the Collaborative Forest Landscape Restoration Program National Cohesive Wildland Fire Management Strategy. At the state level, funding from Colorado's state trust fund Great Outdoors Colorado has helped several collaboratives get started, as have funds from the state's Wetlands Program and Wildlife Habitat Protection Program. Unfortunately fully coding of all the data on sources of funding for collaboratives was beyond the scope of this study, but this is clearly an important piece of the puzzle for understanding why some kinds of collaborative are more prevalent than others, and why some collaboratives decide to pursue some strategies over others.

Incentives and opportunities from both government and non-government sources together were important catalysts for collaboratives led by non-government and mixed government/non-government

initiators. This combined opportunity/incentive catalyst was also particularly important for collaboratives focused on ecosystem health (both forest and wetland/riparian), both largely unregulated public goods problems (Rasband et al., 2009).

There were fewer collaboratives catalyzed by crisis than I anticipated, but early insights from a separate study suggest that this may be because they did not become common until the mid-2000s, and are still on the rise (Huayhuaca, unpublished data). Theory suggests that severe events increase the likelihood of collaboration in part because they are relatively rare, affect many people, are highly visible, and receive a lot of media coverage (Prokopy et al., 2014, citing Birkland, 1997). Prokopy et al. (2014) suggest high severity catalysts inherently manifest quickly (as natural disasters or industrial accidents), but I have argued that the rate at which a severe biophysical event emerges as a catalyst depends on the temporal and spatial scale of the ecological processes affecting the primary natural resource issue of interest. The threat of a future crisis can also galvanize collaboration, even if the threat is slow to manifest, like widespread beetle epidemics. However collaboratives driven by risk of future crisis face challenges that crisis-driven collaboratives do not, such as finding funding for proactive stewardship.

On the other hand, collaboratives driven by crisis events face their own challenges, including sustaining interest and momentum as memory of the crisis fades. Crisis-driven collaboratives must “hit the ground running, simultaneously developing the structures necessary to support a collaborative organization, building trust among stakeholders, planning and implementing post-disaster restoration projects, all while navigating complex grant requirements and constraints,” (Huayhuaca & Reid, 2019, p. 27). State-level planning documents and reports indicate that government officials and decision-makers are well aware of the importance of supporting proactive collaboration before crisis occurs, which is in part why the long-term, nonprofit watershed group model has been promoted so widely.

The question remains whether Prokopy et al. (2014) are correct in their assumption that other catalysts must be at work when gradual or less severe environmental problems appear to catalyze collaboration. The fact that many of the collaboratives with low severity catalysts had additional catalysts suggests that a combination of catalysts may at least necessary to motivate collective action. However, as collaboration becomes more common and institutionalized, the presumed barriers to collaboration may be diminishing, making it more likely that collaboration will form in the absence of dramatic focusing events. Severity is also subjective. While erosion may not directly threaten life and health, it may threaten livelihoods and affect communities in acute ways. Thus, the findings lent support to the *acute policy challenges* concept (Emerson & Nabatchi 2015) in some ways but not in others. Collaboratives driven by low severity biophysical catalysts are spatially localized, but unrelated to membership. Those driven by risk/crisis tend to have narrower representation and have fewer members, but are not necessarily 'acute' in time and space.

Several catalysts were difficult to code and classify in a reliable way based on available documents and the kinds of information they contained, such as catalysts involving conflict. One catalyst that was easier to recognize was the threat of land development or the sale and subdivision of ranchlands. At least nine collaboratives were motivated to work together to avoid development and/or mediate conflict related to land development. There were too few of these collaboratives in Colorado to analyze statistically, but several conveyed a degree of localization, urgency, and issue salience characteristic of acute challenges. However, some might be better classified as a complex challenge, given competing interdependence and conflict potential associated with the sub-issues of property rights and landscape fragmentation. Competing interdependence emerged as an important conditioning variable within initial conditions, particularly when combined with the nature of the problem variables. Competing interdependence increases diversity of perspectives and can decrease shared motivation, and potentially trust and shared commitment. It can increase the need for processes of debate and deliberating on tradeoffs. These

processes can be more expensive in terms of the structures and arrangements necessary to guide engagement, as well as the investment of time and money. Accounting for how initial conditions influence interdependence could help collaborators plan for appropriate processes and structures needed to tackle different kinds of problems.

Unlike many studies incorporating membership (see the review in Chapter 4), this study separated initiating leaders from members, and differentiated between local government and upper-level government. This allowed me to explore assumptions of several typologies presented in Chapter 4. For example, Emerson and Nabatchi (2015) propose that collaboratives responding to acute policy challenges will be self-initiated, which (while not explicit) does imply grassroots or non-government initiators. I did not find a direct relationship between initiators and any variables within the nature of the problem. However, like the patterns supporting extensive policy challenges, the link between initiating leadership and the nature of the problem is in the way they shape membership diversity and composition. The 'grassroots' type of partnership described by Diaz-Kope and Miller-Stevens (2014) was also evident in the data. The authors described several key characteristics of grassroots partnership: they tend to have a geographically localized focus; they consist largely of citizens and non-government stakeholders, with a small group of members at the core; they are effective at building trust and social capital, changing environmental and/or social values, and bringing together stakeholders with shared interests to work towards a common goal (Diaz-Kope & Miller-Stevens, 2014). Collaboratives initiated at the grassroots level had more non-government members (particularly the category of 'individuals/citizens/homeowners'), and their membership tended to be narrow and small. Collaboratives with large non-government composition focused on problems at smaller geographic scales and tended to have collective interdependence.

By synthesizing the typologies in Chapter 4, I was able to link initial conditions to membership to strategies. Action level strategies like education, monitoring, and on-the-ground projects were

associated with collective interdependence, grassroots leaders and higher non-government participation. The primary issues of water quality and wetland ecosystem health aligned with collective interdependence, few members, action-level strategies, and small spatial extent. However, patterns in membership differentiated these two species of watershed group, with the former having more local government composition. This insight points to another unique contribution of this study, the role of local governments as both initiators and members.

The patterns for collaboratives initiated by local government did not have a clear home in any of the typologies explored in Chapter 4. Local and quasi government representatives were more likely to lead collaboratives in response to risk/crisis catalysts. This may be related their authority to respond to emergencies, as well as their vested interests in avoiding future crises that may damage the infrastructure they must maintain (for example, several water utilities have led or co-led several collaboratives that addressing wildfire threats to water sources). The relationships between local government initiators to localized and intense catalysts suggests that 'self-initiated' should include collaboratives initiated by local governments. However, their membership and strategies look quite different than those of grassroots partnerships. The role of local government as leaders and members of collaboration in Colorado is substantial, but they are rarely analyzed separately from other kinds of government representatives (or they are simply lumped with non-government), and thus there is little research available on how they might influence and shape collaborative capacity for joint action. As suggested in Chapter 4, this would benefit from more research.

Much of this dissertation has focused on differences between problems and initial conditions. As I stated in the introduction, initial conditions matter because they influence and shape the form and function of collaboratives through their effects on membership and resulting capacity for joint action, which in turn shapes the collaborative's potential outcomes and impacts. A better understanding of how differences between these issues and other initial conditions affect collaboration dynamics could help practitioners

and supporters of collaboration develop more appropriate governance arrangements that fit both the problem and the people investing their time to make a difference, resulting in strategies that are more likely to be successfully implemented.

Implications for practice and policy

Collaboration remains an important avenue for environmental governance and management in Colorado, as it does around the world. It can be effective for many kinds of issues, but there are big differences across collaboratives in terms of their problems and initial conditions, membership and strategies, that should be considered when designing services, trainings, and financial mechanisms to support them.

Grassroots initiators tackling primary resource issues other than water quality and wetland ecosystems (and even within these domains, depending on sub-issues and context) may run into frustrating challenges when they try to address issues in which they have little decision authority (as when issues involve public lands or water supply). Understanding how affiliation and power influence their ability to make a difference through collaboration is important for the success of their efforts. Initiating collaboration with an understanding of the scale of the problem and the particular scale-dependent constraints and advantages could improve the effectiveness of grassroots collaboratives. For grassroots conveners and collaborators, but also community-based bridging organizations, I advocate for training on how to conduct situation assessments that include an assessment of decision-making authority and power, so that early in the process, collaborators understand their 'decision space' and get a sense of the range of strategies they can reasonably achieve through collaboration. This may also require a better understanding of the policy frameworks surrounding their issues of interest (from how local zoning and planning codes work to the constraints that their federal partners may face as a result of the Federal Advisory Committee Act).

The classic grassroots 'watershed group' model is familiar, well studied, and normatively appealing, but there are many collaboratives that do not fit this mold. Watershed groups are well represented in Colorado and have a voice in informing decision-makers about the needs of collaboratives in general. In many cases the needs they identify may be shared across other kinds of groups as well, but the kinds of issues they address shape the kinds of challenges they face. For example, property rights (in land or water), as well as direct economic dependence on issues increases salience and but also member heterogeneity, and groups addressing these kinds of issues (like land use groups) may need to invest more in trust building and conflict resolution. In addition to membership heterogeneity, the scope of issues may increase complexity and the need for more information and more expertise.

The organizations that exist to support collaborative groups should encourage conveners of collaboratives to carefully consider the nature of the problem being addressed and avoid prescribing a one-size-fits-all model. This is commonly discussed in the literature (Koontz & Johnson, 2004), but in practice I saw examples of 'borrowed' bylaws taken from one group and applied to another. This may work in some situations, but I believe it contributed to the failure of at least two of the collaboratives I analyzed.

Financial support and incentives catalyze many collaboratives, and agencies and organizations that fund and support these efforts often call for more precise definitions of collaboration and specific metrics to evaluate process, productivity, and outcomes. However, one of the advantages of collaborative conservation over other management arrangements is that its form and function evolve to "fit" the problem it needs to address. Collaboratives working on strategies at different levels will have different membership composition, different organizational and capacity needs, and different kinds of outcomes. Evaluative metrics for collaboration should be sensitive to these differences, and universal metrics for the success of collaborative outcomes should be avoided.

As demonized as they are, strong regulations like the Endangered Species Act and the Clean Water Act have played a big role as a backstop that makes collaboration more appealing than not collaborating (Nie, 2008). My results suggest this is particularly true for fish and wildlife and water quality focused collaboratives. As discussed in Chapter 2, the prevalence of policy drivers may be changing, and there are indications that the substantive issues addressed through collaboration are changing as the catalysts change. Longitudinal research on the formation of collaboratives could reveal large-scale trends and insights into the future of collaboration in environmental governance. The data collection phase ended before I could see the effects of the current era of relaxing regulations play out in the natural resource sectors of collaboration, but this will likely have significant implications for collaboratives.

Incentive-driven collaboration is common and particularly important for the kinds of initiators and resource problems discussed above. My findings support anecdotal accounts that an increasingly common motivation for collaborating is access to funding and resources not otherwise available. However, in the absence of interdependence and uncertainty, incentives (especially large sums of money) may drive collaboration before the other 'streams' of context and initial conditions are ready, resulting in greater difficulty arriving at a shared theory of change. Collaboration is a means to an end that takes valuable time and social capital, which should not be wasted. Care should be taken to avoid creating collaborative partnerships where there is not a need.

The increasing number of collaboratives has led to what some have called a 'crowded playing field' and increased territoriality and competition (even, and perhaps ironically, among collaboratives with collective interdependence). Work is being done in the practitioner community to find ways to 'expand the pie' to promote more willing coordination and information sharing across collaboratives (a cornerstone of collaboration). It would be valuable to compare whether this phenomenon is happening in other states as well.

For all their differences, Colorado's collaboratives also shared common challenges, such as a perennial lack of financial and human capital, as well as sustained funding. More funding is usually available for projects than for supporting coordinators or facilitators, and many groups rely heavily on volunteers as their main source of collaborative capacity. Flexibility to use grants to pay for staff and organizational capacity could help with this.

This dissertation was ambitious in scope, and would have been well suited to a team of researchers. In addition to tackling a large sample study across a wide variety of natural resource sectors, I synthesized insights across a large body of literature, several frameworks, and multiple typologies. Existing comprehensive frameworks, such as Collaborative Governance Regime Framework (Emerson et al., 2012) presented in Chapter 1, are excellent for developing hypotheses to illuminate patterns in a large sample study, but adaptations were necessary to accommodate a large number of cases and the novel methodology reliant on document analysis. The methodology had big tradeoffs. I was able to gain a level of familiarity with the history and purpose of each collaborative that would not have been possible for such a large number had I relied on survey or interview data. Low response rates were not a problem, and I was only limited by the amount of information available on the internet and my tenacity in finding it (and I am very tenacious). It reduced bias associated with memory and recall, and achieved a broader perspective of each group than I would have obtained had I only interviewed or surveyed a coordinator or a few members of each collaborative.

On the other hand, I had less control over the variables I could measure. This, in addition to the number of cases, prevented me from using a single, established conceptual framework. As I gained familiarity with the documentation and the kinds of information available, my conceptual models evolved, requiring multiple cycles of coding. Analysis of the data took three years. Many documents containing valuable data about membership and decision rules, sources of financial support, and information about how issues and membership changed over time remains 'on the cutting room floor.' If I were to extend

this study using the same methodology, I would analyze a smaller number of cases using the CGR Framework to trace the influence of initial conditions to adaptation and change. Documents can provide a rich picture of the context, emergence, and evolution of collaborative form and function, and the CGR Framework is well suited to analyzing change and dynamics with a collaborative initiative as the unit of analysis. Despite its constraints, the study was novel in its scope and methodology, and it contributes to a better understanding of how and why collaboratives get started across different natural resources sectors in Colorado.

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APPENDIX

Variables and Categories

Boundaries

I recorded the boundary as described by the initiative, and later categorized each using the following categories:

- **Watershed:** Boundary describes or outlines single or multiple geophysical watersheds or natural river basin (not cut off by jurisdiction, and usually defined at some Hydrological Unit Code, e.g., HUC 10 or 12)
- **Ecological/Problem:** Boundary describes an ecological extent or outlines an area encompassing the problem of concern (such as a migratory bird fly-way); or describes the area within which the group has chosen to prioritize because that is where the problem is most severe or most treatable (such as a zone of concern, a river reach, or an amalgamation of different kinds of boundaries indicating the extent of the problem or prioritized area)
- **Jurisdictional:** Boundary describes or outlines an area owned or administrated by one or more discrete jurisdictional entities, such as fed, state, tribal, county, muni or private lands, or a mixture of these. Note that basin roundtable boundaries, though river basins, actually correspond to the jurisdictions of river districts
- **Hybrid:** Boundary combines any of the above two or three types

If the collaborative described multiple kinds of boundaries, I selected the boundary that best fit the scale of the strategies and specific activities described in documents about the collaborative.

Spatial extent

Spatial extent was recorded as the number of km² within the boundary defined by the collaborative. If the collaborative described the area within their boundary in other units, these were converted. If no area was given, but the boundary was a watershed or jurisdiction, I searched online to find the area within the boundary. In other cases, I traced boundary outlines in Google Maps Engine and estimated the size within the boundary by visual inspection.

Location

Coordinates of a point within the boundary of the collaborative representing their main project sites, meeting locations, headquarters, or mailing addresses, depending on the information available.

Year of formation

Year of formation was recorded as the first year that the collaboratives began working together, using the more recent year if multiple start years were found in documents. For initiatives that changed their name or even their purpose, but identified as a continuation of a previous collaborative (rather than a separate spinoff) I used the year of formation for the original group. For example, the Mixed Conifer Working Group, formed in 2010, was renamed the San Juan Headwaters Forest Health Task Force in 2015; their start year is 2010.

Issues and sub-issues

I analyzed statements about missions, goals, and major activities to develop categories and code cases for natural resource issues, social sub-issues, and the ecological sub-issues of concern to collaboratives.

I used the following six categories to code each collaborative's natural resource issues:

- **Water quality:** Focused on pollution or poor water quality in flows of surface or subsurface waters, or surface and groundwater reservoirs

- **Forests and rangelands:** Focused on forested ecosystems (montane/sub-alpine forests and montane shrublands) and/or rangeland or grassland ecosystems (pasture and grasslands, semi-desert shrublands, pinyon-juniper woodlands, or plains agricultural lands)
- **Wetlands:** Focused on aquatic ecosystems (wetlands and marshes, riparian areas, stream channels, or natural/manmade reservoirs)
- **Species and wildlife:** Focused on management or conservation of mobile wildlife or populations of species (like fish, birds, or elk)
- **Water supply:** Focused on the administration of water quantity, water rights, water storage and infrastructure, and changing or redirecting water flows
- **Land use:** Focused on real estate or the transfer of surface or sub-surface rights; with rights to use and access land for different purposes, including energy development; or with land use change, local/regional identity and sense of place

While there is overlap between the categories, they are fairly distinct in terms of the policies and regulations associated with their management. For environmental issues, I recorded each issue a collaborative addressed, as well as their single *primary* natural resource issue. Primary environmental issues can change over time, so I recorded this variable at two points in time: prior to formation (the driving issue), and upon formation (the primary issue). The driving issue is defined as the category that best characterizes the problem (i.e., departure from desired conditions) that was initially recognized by initiators or early participants as a problem requiring collaboration to solve. The primary issue is the category that best characterizes the problem of concern to the collaborative within the first 1-2 years of formation. In cases where multiple natural resource issues were of interest to the collaborative at a given time, categories were assigned based on where the greatest emphasis was placed in terms of planned or actualized strategies. Intercoder agreement was 83% for both driving issues and primary issues. There was a change from driving to primary issue in 17 cases, with all primary issue categories

gaining and/or losing up to four cases each. Analyses were run using both driving and primary issues; patterns were the same, but fewer analytical assumptions were violated using the primary issue, so this variable was selected for reporting.

I used the seven categories below to record social issues addressed by the collaborative. I did not record primary social-economic issues because the relative importance of this variable was more difficult to reliably interpret. Thus, the following categories were non-mutually exclusive:

- **Livelihoods/economy:** Protecting or improving economic conditions, usually associated with resource-based livelihoods like agriculture, ranching, logging, mining, or tourism
- **Recreation/cultural values:** Protecting or improving recreation opportunities, aesthetics or other cultural values associated with the environment
- **Infrastructure:** Maintaining, improving physical infrastructure, such as water delivery mechanisms, power lines, reservoirs and canals, trails, or buildings
- **Property rights:** Protecting or expanding land, water, or sub-surface property rights
- **Safety/vulnerability:** Protecting safety, health, life, and property (including infrastructure); reducing exposure to hazards or improving a community's ability to respond to and recover from emergencies and disturbance events
- **Liability/compliance:** Increasing a community's ability to comply with rules and regulations, enhancing local control, or reducing potential for liability
- **Relationships/trust:** Enhanced trust, reduced conflict, new/improved relationships between stakeholders at any level, beyond core members or strategic partners

I used the following nine categories to code each collaborative's ecological sub-issues:

- **Land management impacts:** Degradation of a resource system (regardless of ownership) caused by resource management practices (such as timber harvesting); recreational uses like hiking,

boating, fishing, camping; farming/agricultural practices (like pesticide application or irrigation); livestock grazing practices (like soil compaction or over-grazing); or mineral/metals extraction, coal/oil/gas extraction, or the generation of renewable energy

- **Altered streamflows:** Degradation caused by 1) straightened streams, dams, paved waterways, or other engineered hydrological modifications (such as erosion, sedimentation, sinking water tables, flooding, or aquatic habitat fragmentation); or 2) vegetation loss and resulting erosion, streambank instability or loss of sinuosity
- **Impacts of drought, climate change, and water use:** degradation caused by long-term drought, altered climate regimes, over-appropriation of ground and surface water, or diversion of water to a different location/ adjudication for different use and resulting impacts.
- **Weeds/woody invasives:** Undesirable plant species whose presence compromises the desired use(s) of a given resource system
- **Pollution:** degradation caused by point source, non-point source, and terrestrial pollution, including landfills
- **Altered fire regimes:** Impacts to a resource system caused by long-term fire suppression yielding fuel build-up, susceptibility to disease/infestation, and increased risk of wildfire
- **Land conversion:** Fragmentation of landscapes/ecosystems through real estate transactions and subdivision (usually urban or exurban housing or private sector development) that physically alters the landscape. Common examples are the sale and subdivision of large ranches that are no longer economically viable for their owners, as well as forest conversion and development in the wildland urban interface (WUI)
- **Disturbance impacts:** Impacts to a resource system caused by fire, flood, post-fire debris flows, or other natural disturbances

- **Wildlife impacts:** Degradation of a resource system caused by native or non-native wildlife, such as over-grazing and subsequent erosion (elk) or predation of native species (game fish) (also includes human-wildlife conflict or undesirable effects of wildlife management)

Strategies

Sixteen strategy codes emerged during early cycle coding, four of which were not included in this analysis due to either near ubiquity (organizational administration and organizational legitimization) or low intercoder reliability (paid service provision and long-term studies/technology development). All categories were non-mutually exclusive and binary (i.e., a group may use multiple strategies). While initially separated, I eventually combined my data on intended and completed strategies due to variability in available documentation for collaboratives. I also combined data from multiple points in time for the same reason.

Education/outreach/training: Combines three strategies that were highly correlated. Education-related activities include developing and distributing educational materials online, providing information at festivals and public events, and delivering targeted educational programs in classrooms and other venues. Groups conducting outreach activities coordinate their members to deliver services and expertise to particular stakeholders. Training-related activities include coordinating and delivering skill-building activities, facilitating peer-to-peer training, coordinating field trips and site visits, and providing student internships.

Develop plans: Does not include strategic plans. The role of collaboration in management planning varies. Sometimes existing collaboratives lead the development of the plan, often (but not always) involving a public process. Several short-term collaborations have been established to convene a public planning process, eventually spinning-off into longer-term collaborative organizations. Collaboratives often contract with an external party to write the plan, but some groups develop plans themselves, or

even help others plan. Finally, sometimes government agencies establish a collaborative process or committee to provide formal input into their planning process.

Coordinate/implement on-the-ground projects: Strategies include restoring or reclaiming damaged or polluted sites, managing weeds and invasive species, improving habitat, and reducing environmental risks (like fire) to people and infrastructure. Collaborators may plan larger pilot projects, reach wider agreement on priority project sites, or raise and leverage more funding or in-kind services.

Collaboratives often coordinate permits and contracts, track accountability measures, and report on progress. Collaboratives can also coordinate volunteer work teams, or work together more directly to break ground on a project.

- **Implement on-the-ground projects only:** Members of collaborative conduct site protection, restoration, reclamation, fuels treatments, wildfire mitigation, etc., and may also coordinate projects of partners. The group must be lead implementer for at least one project. Can be selected if they implement AND coordinate across partners, if it best characterizes their work.
- **Coordinate projects only:** Members coordinate or oversee the planned on-the-ground management actions/ projects across member entities, but do not directly participate in or have direct responsibility for implementation as a collaborative entity. Cannot be selected in addition to implementing OTG projects.

Convene external process: All collaboratives included in this study learn, negotiate, and make decisions among members. However, many also do relationship-building, trust-building, or collaborative learning for a broader set of stakeholders. They coordinate public discussions, debates, and opportunities for participants to learn about issues together. Convening strategies like these differ from education/outreach/training because meetings recur over some period of time and (theoretically) involve more interaction.

Influence/change policy: Sometimes governments convene formal advisory committees to provide input on public policy, like the long-standing Resource Advisory Councils convened by the Bureau of Land Management. Sometimes collaboratives develop binding or non-binding standards to guide their members' behavior to avoid or pre-empt the government making decisions for them. One example is the Animas River Stakeholders Group's early work developing water quality standards; another is the efforts of the Colorado Renewables and Conservation Collaborative to develop wind energy industry best management practices to protect wildlife. While many collaboratives prefer to remain politically neutral in order to appeal to a broader audience, sometimes they advocate for policies that affect their issues of concern. Here they influence the actions or decisions of government through lobbying, endorsements, recommendations, public comments or otherwise working together to put pressure on government. A few collaboratives (like the Bear Creek Watershed Association) have vested authority from government to implement regulations to control water pollution, essentially acting as agencies with government and non-government members.

- Influence policy only: Collaborative works to Influence local, state, or federal level laws or policy through lobbying, advocacy, endorsements, public comments on scoping letters/EIS, or otherwise pressuring government.
- Changing/developing policy only: Collaboratives work to change or co-create policy through formal advising on government agency decisions, formal policy or legislative recommendations directed at government officials, drafting/developing binding or non-binding standards (e.g. Total Maximum Daily Loads). While planning activities are considered elsewhere, it does include activities associated with developing strategies to satisfy state or federal regulatory requirements (e.g. Habitat Conservation Plans), "alternatives" to federal plans/actions (reasonable/prudent alternatives, community alternative plans), and providing formal

recommendations considered in agency led planning processes (e.g. county-led land use planning).

- Exercise authority to manage and enforce: Lead system-wide program of management with devolved/vested authority to review/ accept/deny proposals, implement regulations, or otherwise make/enforce decisions.

Acquire/transfer property: Includes conservation, protection, or enhancement of resource value through acquiring or supporting the acquisition or transfer of land/ water/ resource rights, or establishing easements to modify development/ access rights. Does not include documenting/reporting existing easements.

- Examples: Collaboratives like the Laramie Foothills Project, the Chama Peak Land Alliance, and the Yampa River System Legacy Project have used property easements to “stitch together” larger areas of habitat, preserve landscapes, and improve access to recreational opportunities. The Upper Colorado River Endangered Fish Recovery Program provides an interesting example of a long-standing collaboration between water rights holders (including irrigators and the state), managers, anglers, and other organizations to coordinate storage and release of water at critical times during the year to support biodiversity conservation and recreation in a section of the Colorado River known as the 15-mile reach.

Develop new markets: Includes developing, delivering, or promoting market-based innovations/ incentives/ new solutions related to problems. Includes water quality trading or markets for beetle kill, but does not include tax incentives. Includes mitigation banking if the emphasis is on offsetting market externalities or creating capital (if emphasis is on preserving/protecting land, coded as **acquire/transfer property**).

- Examples: Some collaboratives work on creating new markets for over-abundant commodities like dead and dying timber in forests, or they incentivize species conservation or reduce pollution. Some groups only investigate the potential for market-based solutions, while others create new programs to carry out their solutions, such as the Peaks to People Water Fund or the Colorado Habitat Exchange.

Select/fund projects: Involves finding and selecting on-the-ground projects that fit goals associated with a (usually government) funding source and helping to connect project proponents with funds. Does not include prioritizing/ selecting/ funding internal (member-only) projects; does not include merely identifying/ documenting/ reporting existing projects.

- Examples: The state’s nine Basin Roundtables identified existing water supply projects within each basin, some of which have been funded through the state’s Water Supply Reserve Fund. The state also has several active Wetland Focus Area Committees that help find projects to conserve or enhance wetland habitats. They then work with landowners and partners to obtain funding, often leveraged with funds from the state’s Wetlands Program, to get projects done on the ground.

Initiators and members

The following categories (Table A1) of individual or organizational entities and affiliations were used to 1) determine whether a collaborative met the participant diversity criterion for inclusion; 2) code initiating leadership; and 3) code membership.

Table A1. Initiating leadership levels and examples of entities in each level for Colorado’s collaboratives.

Initiating Leadership Levels	Entity Types
Upper-Level Government	<ul style="list-style-type: none"> • Tribal (like the Water Quality Division of the Ute Mountain Ute Tribe) • Federal (like Natural Resources Conservation Service, U.S. Forest Service, or Bureau of Reclamation) • State (like Colorado Parks & Wildlife, or the Colorado Water Conservation Board)

Local Government	<ul style="list-style-type: none"> Local governments include regional, county and municipal governmental agencies, and quasi-government organizations like soil conservation districts, water conservancy and conservation districts, utilities, ditch and reservoir companies, and other special districts
Non-Government	<ul style="list-style-type: none"> Private industry and business (including trade and business associations) Farmers, ranchers and large landowners (including agricultural associations) Environmental and recreational nonprofits Colleges and universities (including Extension) Other organizations (like church groups or historical societies) Other collaboratives Individuals, private citizens, homeowners (including HOAs)
Mixed Government and Non-Government	<ul style="list-style-type: none"> Includes non-government individuals or organizations plus local and/or upper level governments

Initiating leadership categories grouped the 11 membership categories into four broader categories in Chapter 2 and 3; non-government initiators are split into ‘grassroots’ and bridging organization initiators in Chapter 4 (see Chapter 4 Methods).

Since collaboratives are not consistent in the way they report membership, I classified participation at three levels, depending on the information available: 1) general participants (when participants were listed as “members,” without reference to their roles), 2) members (when lists specified which participants had some level of decision-making authority within the collaborative), and 3) core members (when only boards or steering committees were listed. **Membership breadth** is the number of different kinds of member categories represented (using the 11 categories in Table A1). When detailed member lists were available, I was able to include a count of total number of individuals representing each kind of entity (e.g. tribal agency representatives = 2, individuals = 18). This provided count data for the number of members (**membership size**). Count data was then aggregated by upper-level government agencies (tribal, federal, and state government), local government, and non-government entity types (environment and recreation organizations, private industry, farming/ranching interests, individuals, academia/extension, collaboratives, and other kinds of NGOs) in order to calculate three variables

measuring the % of **non-government members**, % **local government members**, and % **upper-level government members**.

Interdependence

I looked for indicators in texts that the source of interdependence that motivated collaboration fell into one two categories: collective or competing interdependence.

- **Collective Interdependence:** Initiators and/or early participants had shared needs or shared objectives, or the initial aim of collaboration was to work collectively to achieve mutually beneficial results.
- **Competing Interdependence:** Initiators and/or early participants had competing needs or objectives, or the initial aim of collaboration was to resolve contested/conflicting/competing values or perceptions of the problem, or to negotiate trade-offs between stakeholders.

Catalysts

I analyzed three kinds of **catalysts** (policy-related, biophysical, or opportunities/constraints), each of which had two mutually exclusive categories. Although Prokopy et al. (2014) assert that, with sufficient information, a single catalyst of collaboration should be identifiable for each case, only 44% of Colorado's collaboratives had a single kind of catalyst (whereas 50% had two and 6% had three). This study considers all three kinds of catalysts, regardless of whether they were the sole catalyst or one of a multiple behind the formation of a collaborative. I used the following categories of **catalysts**:

- Policy-related
 - **Policy threats/concerns:** Collaboration triggered by concerns about the implications of a regulation or government policy, including lawsuits, regulatory takings, imposed standards, or penalties associated with non-compliance

- **Mandates or recommendations:** Collaboration is induced by legislation, recommended by a government agency or a policy, usually accompanied by funding or in-kind support
- Biophysical
 - **Low-severity biophysical catalysts:** Environmental degradation reaches a point sufficient to garner attention but has not yet reached the point of risk or crisis
 - **Severe biophysical catalysts:** Combines high severity events (like floods, fires, or major contaminant spills), that affect well-being, life and property as well as medium-severity events, such as beetle epidemics that present a risk of future crisis that could impact human health and wellbeing
- Opportunities/Constraints
 - **Opportunities and incentives:** Combines government and non-government sources of financial or human capital, such as grants that encourage collaboration, non-government organization (NGO) initiatives or missions that push for collaboration, events intentionally designed to promote new collaborations; or intentional re-organizations of past collaborations (such as spinoffs)
 - **Land development pressures:** Proposed or actual construction projects to develop land or overland infrastructure (did not include infrastructure in waterways)

List of Colorado Collaboratives

Table A2. List of active and inactive collaborative initiatives in Colorado meeting, to the best of my knowledge, the criteria outlined in Chapter 2. Collaboratives with ID# 1-123 fit all 7 criteria and were included in the sample; #124-183 met fit criteria 1-6 and were considered the population as of 2017. Collaboratives #184-192 identified after 2017 and are therefore missing from the population.

ID	Name	Sample or Population
1	Alamosa River Watershed Restoration Foundation, Inc.	Sample
2	Animas River Stakeholder Group	Sample
3	Animas Watershed Partnership	Sample
4	Arkansas Basin Roundtable	Sample

5	Barr Lake and Milton Reservoir Watershed Association	Sample
6	Bear Creek Watershed Association	Sample
7	Big Dry Creek Watershed Association	Sample
8	Big Thompson Watershed Coalition	Sample
9	Big Thompson Watershed Forum	Sample
10	Blue River Watershed Group	Sample
11	Bonanza Stakeholders Group/ Kerber Creek Restoration Project	Sample
12	Chama Peak Land Alliance	Sample
13	Chatfield Watershed Authority	Sample
14	Clear Creek Watershed Forum/ Foundation	Sample
15	Coal Creek Canyon Watershed Partnership	Sample
16	Coal Creek Watershed Coalition	Sample
17	Coalition for the Poudre River Watershed	Sample
18	Coalition for the Upper South Platte	Sample
19	Sangre de Cristo Acequia Association	Sample
20	Colorado Basin Roundtable	Sample
21	Colorado Renewables and Conservation Collaborative	Sample
22	Crawford Area Gunnison Sage-Grouse Working Group	Sample
23	Culebra Range Community Coalition	Sample
24	Desert Rivers Collaborative	Sample
25	Dolores River Dialogue	Sample
26	Dolores River Restoration Partnership	Sample
27	Dolores River Watershed Forum	Sample
28	Dolores Watershed Resilient Forest Collaborative	Sample
29	Dove Creek Sage Grouse Working Group	Sample
30	Dry Creek Basin CRMP	Sample
31	Eagle River Watershed Council	Sample
32	Emerald Mountain Partnership	Sample
33	Estes Valley Watershed Coalition	Sample
34	Wildfire Adapted Partnership (formerly Firewise of Southwest Colorado)	Sample
35	Front Range Collaborative Forest Landscape Restoration Program	Sample
36	Front Range Roundtable	Sample
37	Gunnison Basin and Grand Valley Selenium Task Forces	Sample
38	Gunnison Basin Roundtable	Sample
39	Gunnison Basin Sage-Grouse Strategic Committee	Sample
40	Gunnison Basin/Grand Valley Water Quality Forum	Sample
41	Gunnison Climate Working Group	Sample
42	Gunnison Sage-Grouse Working Group	Sample
43	Headwaters of the Arkansas Working Group	Sample
44	High Country Forest Collaborative	Sample
45	Intermountain West Joint Venture	Sample

46	James Creek Watershed Initiative	Sample
47	Lake County Open Space Initiative	Sample
48	Laramie Foothills Project	Sample
49	Lefthand Watershed Oversight Group	Sample
50	Little Thompson Watershed Coalition	Sample
51	Metro Basin Roundtable	Sample
52	Middle Colorado Watershed Council	Sample
53	Middle Park Sage Grouse Committee	Sample
54	Middle South Platte River Alliance	Sample
55	North Fork Coal Working Group	Sample
56	North Fork River Improvement Association	Sample
57	North Platte Basin Roundtable	Sample
58	Northern Eagle/Southern Routt Greater Sage-Grouse Work Group	Sample
59	Northwest Colorado Riparian Restoration Partnership	Sample
60	Northwest Colorado Stewardship	Sample
61	Northwest Resource Advisory Council (RAC)	Sample
62	Owl Mountain Partnership	Sample
63	Parachute-Piceance-Roan Greater Sage-Grouse Work Group	Sample
64	Patterson Hollow Watershed Project	Sample
65	Pine River Watershed Group	Sample
66	Pinyon Mesa Gunnison Sage Grouse Partnership	Sample
67	Playa Lakes Joint Venture	Sample
68	Ponderosa Pine Forest Partnership	Sample
69	Public Lands Partnership	Sample
70	Purgatoire Watershed Partnership	Sample
71	Rio Grande Basin Roundtable	Sample
72	Rio Grande Watershed Emergency Action Coordination Team	Sample
73	River Protection Workgroup	Sample
74	Roaring Fork Future Forest Roundtable	Sample
75	Roaring Fork Conservancy	Sample
76	Routt County Water Committee	Sample
77	San Juan Headwaters Forest Health Partnership	Sample
78	San Luis Valley Regional Habitat Conservation Plan	Sample
79	San Luis Valley Wetlands Focus Area Committee	Sample
80	San Miguel Watershed Coalition	Sample
81	Saws and Slaws	Sample
82	Snake River Watershed Task Force	Sample
83	South Park Wetlands Focus Area Committee	Sample
84	South Platte Basin Roundtable	Sample
85	South Platte Coalition for Urban River Evaluation	Sample
86	The South Platte Lower River Group, Inc.	Sample

87	South Platte Urban Waters Partnership	Sample
88	South Platte Wetland Focus Area Committee	Sample
89	Southwest Basin Roundtable	Sample
90	Southwest Resource Advisory Council (RAC)	Sample
91	Southwest Wetland Focus Area Committee	Sample
92	Saint Vrain Creek Coalition	Sample
93	Summit County Forest Health Task Force	Sample
94	Three Rivers Alliance	Sample
95	Uncompahgre Partnership	Sample
96	Uncompahgre Plateau Collaborative Landscape Restoration Program	Sample
97	Uncompahgre Watershed Partnership	Sample
98	Upper Arkansas River Restoration Core Team	Sample
99	Upper Colorado River Endangered Fish Recovery Program	Sample
100	Upper South Platte Partnership	Sample
101	Upper Yampa River Watershed Group	Sample
102	Watershed Wildfire Protection Group	Sample
103	West Region Wildfire Council	Sample
104	Western Colorado Landscape Collaborative	Sample
105	Willow Creek Reclamation Committee	Sample
106	Yampa River System Legacy Project	Sample
107	Yampa/White/Green Basin Roundtable	Sample
108	Roaring Fork Watershed Collaborative	Sample
109	Northwest Colorado Columbian Sharp Tailed Grouse Working Group	Sample
110	Boulder County Wildfire Mitigation Group	Sample
111	Peaks to People Water Fund	Sample
112	French Gulch Remediation Opportunities Group	Sample
113	Rocky Mountain Resource Advisory Council (RAC)	Sample
115	Arkansas River Watershed Collaborative	Sample
116	Arkansas River Watershed Invasive Plants Partnership	Sample
116	Fourmile Watershed Coalition	Sample
117	Tackling Tamarisk on the Purgatoire	Sample
118	Poudre Runs Through It	Sample
119	North Park Sage Grouse Working Group	Sample
120	North Park Wetland Focus Area Committee	Sample
121	Northwest Colorado Sage Grouse Working Group	Sample
122	Poncha Pass Gunnison Sage Grouse Work Group	Sample
123	San Miguel Basin Gunnison Sage Grouse Working Group	Sample
124	Alamosa River Foundation	Population
125	Animas River Community Forum	Population
126	Axial Basin Coordinated Resource Management	Population
127	Badger Creek Watershed Project	Population

128	Bonanza Group	Population
129	Boulder County Ecosystem Cooperative and Winiger Ridge Project	Population
130	Boulder Creek Watershed Initiative	Population
131	Cache la Poudre Watershed Stakeholders	Population
132	Chalk Creek Watershed Project	Population
133	Cherry Creek Basin Water Quality Authority	Population
134	Cherry Creek Stewardship Partners	Population
135	Colorado Water Quality Forum	Population
136	Colorado River Headwaters Forum	Population
137	Colorado Water Bank Work Group	Population
138	Dolores River Source Water Protection Group	Population
139	Eagle River Assembly	Population
140	East Grande Water Quality Board	Population
141	El Paso County Regional Resiliency Collaborative	Population
142	Fountain Creek Restoration Committee	Population
143	Fountain Creek Vision Task Force	Population
144	Front Range Fuels Treatment Partnership	Population
145	Fruitgrowers Reservoir Coalition	Population
146	Geothermal Greenhouse Partnership	Population
147	Gore Creek Restoration Committee	Population
148	Lake County Forest Health Task Force	Population
149	Lake Fork Valley Conservancy	Population
150	Left Hand Creek Coalition	Population
151	Mancos Valley Watershed Group	Population
152	Mountains to Plains Energy By Design	Population
153	2-3-2 Cohesive Strategy Partnership	Population
154	North Fork of the South Platte River Foundation	Population
155	North Park Natural Resources Community Group	Population
156	North Rim Landscape Strategy Workgroup	Population
157	Northern Front Range Mountain Pine Beetle Working Group	Population
158	Pikes Peak Wildfire Prevention Partners	Population
159	Poudre Basin Water Sharing Working Group	Population
160	Rio Grande Corridor Advisory Committee	Population
161	Rio Grande Headwaters Restoration Project	Population
162	San Juan Clean Water Coalition	Population
163	San Juan Fen Partnership	Population
164	San Juan Watershed Group	Population
165	San Juan Watershed Woody Invasives Initiative	Population
166	San Juan-Chama Watershed Partnership	Population
167	Standley Lake and Clear Creek Source Water Protection Plan	Population
168	Dolores River Instream Flow Partnership	Population

169	Three Lakes Watershed Association	Population
170	Upper Arkansas Watershed Council	Population
171	Upper Fountain and Cheyenne Creek Coalition	Population
172	Upper Monument Creek Landscape Restoration Initiative	Population
173	Yampa River Basin Partnership	Population
174	Interbasin Compact Committee	Population
175	Colorado Nonpoint Source Alliance	Population
176	Colorado Water Quality Monitoring Council	Population
177	Mesa Creek Coordinated Resource Management Plan	Population
178	Upper Huerfano Ecosystem Project	Population
179	Ruby Canyon and Black Ridge Ecosystem Management Plan	Population
180	Trout Mountain Roadless Area Working Group	Population
181	Colorado-Big Thompson Headwaters Partnership	Population
182	Colorado Habitat Exchange	Population
183	Upper Clear Creek Watershed Association	Population
184	Purgatoire Watershed Weed Management Collaborative	Missing from Population (found after 2017)
185	Collaborative Adaptive Rangeland Management (CARM) Experiment	Missing from Population (found after 2017)
186	Water Preservation Partnership	Missing from Population (found after 2017)
187	Community Agriculture Alliance	Missing from Population (found after 2017)
188	Sand Wash Coordinated Resource Management	Missing from Population (found after 2017)
189	Bald Mountain Basin Coordinated Resource Management	Missing from Population (found after 2017)
190	Colorado Coalition to Enhance Working Lands	Missing from Population (found after 2017)
191	Western Slope Conservation Center	Missing from Population (found after 2017)
192	Karval Community Alliance	Missing from Population (found after 2017)