

2-1-2017

Turning Contention into Collaboration: Engaging Power, Trust, and Learning in Collaborative Networks

Vanessa Levesque

University of New Hampshire, Durham

Aram J K Calhoun

University of Maine, Calhoun@maine.edu

KATHLEEN P. BELL

University of Maine, kpbell@maine.edu

Teresa R. Johnson

University of Maine - Main, teresa.johnson@maine.edu

Follow this and additional works at: https://digitalcommons.library.umaine.edu/mitchellcenter_pubs



Part of the [Natural Resources Management and Policy Commons](#)

Repository Citation

Levesque, Vanessa; Calhoun, Aram J K; BELL, KATHLEEN P.; and Johnson, Teresa R., "Turning Contention into Collaboration: Engaging Power, Trust, and Learning in Collaborative Networks" (2017). *Publications*. 108.
https://digitalcommons.library.umaine.edu/mitchellcenter_pubs/108

This Article is brought to you for free and open access by DigitalCommons@UMaine. It has been accepted for inclusion in Publications by an authorized administrator of DigitalCommons@UMaine. For more information, please contact um.library.technical.services@maine.edu.

Turning Contention into Collaboration: Engaging Power, Trust, and Learning in Collaborative Networks

Vanessa R. Levesque^a, Aram J. K. Calhoun^b, Kathleen P. Bell^c, and Teresa R. Johnson^d

^aDepartment of Sustainability, University of New Hampshire, Durham, New Hampshire, USA

^bDepartment of Wildlife, Fisheries and Conservation Biology, University of Maine, Orono, Maine, USA

^cSchool of Economics, University of Maine, Orono, Maine, USA

^dSchool of Marine Sciences, University of Maine, Orono, Maine, USA

ABSTRACT

Given the complexity and multiplicity of goals in natural resource governance, it is not surprising that policy debates are often characterized by contention and competition. Yet at times adversaries join together to collaborate to find creative solutions not easily achieved in polarizing forums. We employed qualitative interviews and a quantitative network analysis to investigate a collaborative network that formed to develop a resolution to a challenging natural resource management problem, the conservation of vernal pools. We found that power had become distributed among members, trust had formed across core interests, and social learning had resulted in shared understanding and joint solutions. Furthermore, institutions such as who and when new members joined, norms of inclusion and openness, and the use of small working groups helped create the observed patterns of power, trust, and learning.

KEYWORDS

Collaboration; institution; learning; network; policymaking; power; trust; vernal pool

Introduction

Governance of natural resources is inherently complex, often characterized by contested goals, uncertain science, and distrust (Lachapelle, McCool, and Patterson 2003; Weible and Sabatier 2009). With multiple interest groups vying for control over the outcome, the solutions to these problems are often imperfect (Rittel and Webber 1973; Weber and Khademian 2008), but sometimes public and private actors collaborate to develop better solutions (Acheson and Knight 2000; Schneider et al. 2003). Because collaborative efforts enable participants to create innovative solutions, it is important to better understand how key aspects such as power, trust, and learning influence collaborative outcomes (Innes and Booher 2003; Ansell and Gash 2008; Mandarano 2008; Reed 2008). For example, equalized power can facilitate transparent discussions, trust can promote information sharing, and learning can lead to a common understanding of issues. The extent to which the structure of collaborations and the institutions that govern interactions within them shape power, trust, and learning warrants greater investigation (Ansell and Gash 2008).

Here we examine a collaboration that formed to create a new instrument for vernal pool conservation in Maine, and we assess how specific institutions influenced power, trust, and learning. Drawing on this case and employing qualitative and network analysis methods, we address three sets of questions: (1) Has power become equalized among participants, and, if so, what institutions allowed this to occur? (2) Has trust developed across different interest groups, and, if so, how did trust develop? (3) Has social learning occurred, and, if so, what institutions enabled learning?

We draw on institutional analysis as a guiding framework. Institutions are rules and norms that structure repetitive social situations (North 1990; Knight 1992; Ostrom 2003). Institutions can be formal or informal rules that are written, spoken, or tacitly understood (Ostrom 1999; Hardy and Koontz 2009). Institutions include: boundary rules determining membership; aggregation rules defining the decision-making process; position rules defining who can act; and information rules determining how information is shared (Sell et al. 2004). Institutions can influence a group's ability to achieve policy goals, and therefore, institutional analysis may highlight ways to improve collaborative partnerships (Blom-Hansen 1997; Skelcher and Sullivan 2008; Johnston et al. 2011).

Power

Power is the ability to influence how others act or to gain favorable outcomes (Sell et al. 2004). While getting the right people to the table is important, it is not unusual for participants to arrive with unequal power, compromising collaborative efforts (Emerson, Nabatchi, and Balogh 2011). Unequal power may cause less powerful groups to feel their identity threatened, hamper the ability to mobilize agreement, and result in a lack of commitment to the process (Selsky 2005; Ansell and Gash 2008).

If a goal of collaborations is for all participants to contribute to joint decision making (Armitage 2005; Koontz 2005), power imbalances must be addressed (Mitchell 2005; Bryson, Crosby, and Stone 2006). Existing research has identified a range of factors that can empower participants, including inclusion in the process, access to information, development of status-based power,

and the ability to shape discussions (Huxham et al. 2000; Bryson, Crosby, and Stone 2006; Webler and Tuler 2006). Institutions can influence all of these factors. Boundary rules limit who is allowed to be in a group, aggregation rules shape decision making (e.g., giving voice to those less powerful), position rules decide who has authority to act, and information rules describe how information is shared (Sell et al. 2004; Ansell and Gash 2008).

Trust

Trust refers to the willingness of an actor to assume risk based upon their positive expectations of another's actions (Stern and Coleman 2015). Developing trust may improve collaboration by increasing information sharing, honest participation, and risk taking during negotiations (Lachapelle and McCool 2012; Stern and Coleman 2015). Trust may also affect subsequent implementation of a plan or the likelihood for litigation (Lachapelle and McCool 2012).

Do institutions foster trust? Some scholars stress the psychological dimensions of trust building. For example, the Advocacy Coalition Framework suggests trust is assigned to those who share your core beliefs (Leach and Sabatier 2005; Henry and Dietz 2011). Others have found that institutions can influence trust development. Aggregation rules can allow joint development of procedures, ensuring transparency and encouraging inclusive discussions (Lachapelle and McCool 2012; Stern and Baird 2015; Stern and Coleman 2015). Position rules that provide all participants equal weight and eliminate advisory-only roles can facilitate trust (Koontz 2006). Norms of reciprocity may encourage increased positive interactions and trust development (Raymond 2006).

Social Learning

In contentious natural resource venues, actors use data to promote their interests (Layzer 2012), whereas collaborative efforts often require groups to synthesize expertise from multiple sectors (Newig et al. 2010). The process of participants learning about each other and the issues and then developing a joint understanding and solution is considered social learning (Schusler, Decker, and Pfeffer 2003; Reed et al. 2010; Gerlak and Heikkila 2011). If one of the goals of collaboration is to develop solutions for problems too complex and contentious for one entity, social learning is essential (Koontz 2014).

Existing research has identified a range of factors likely to promote social learning, including inclusiveness, extended engagement, opportunities to exchange information, and process control and equity (Reed et al. 2010; Koontz 2014). Institutions may be instrumental in facilitating learning. Information rules determine how new information is acquired and how information is shared and processed (Newig et al. 2010; Heikkila and Gerlak 2013). Boundary rules can include participants with diverse perspectives and knowledge, and position rules can prevent actors in powerful positions from inhibiting information flow (Heikkila and Gerlak 2013). Aggregation rules that encourage participants to develop their own processes can encourage social learning, especially if the decentralized process facilitates acquisition of information from outside the group and promotes deliberation (Heikkila and Gerlak 2013; Koontz 2014).

Network Structure

Network analysis examines network structures quantitatively to better understand network function (Janssen et al. 2006; DeLeon and Varda 2009; Dempwolf and Lyles 2012). Scholars have used network analysis to show that governments with politically similar constituents are more likely to collaborate because political homophily reduces the transaction costs of establishing connections (Gerber et al. 2013), and that collaborative planning can build social capital by building new relationships between organizations (Mandarano 2009).

In evaluating power, trust, and learning, network analysis has indicated that actors who hold central positions may be more powerful because they are better situated to exert influence over others and to access key information (Bodin and Crona 2009), especially if they hold a brokerage position connecting other actors (Fernandez and Gould 1994; Marcum, Bevc, and Butts 2012). Dense networks are likely to be characterized by trust because connections between members can facilitate feelings of group identity (Coleman 1990; Bodin, Crona, and Ernstson 2006). If participants only trust those who hold similar beliefs, the network would exhibit greater homophily, or groupings of similar individuals (Gerber, Henry, and Lubell 2013). A dense network with low centrality may facilitate social learning because information can be transmitted and deliberated more easily (Newig, Gunther, and Pahl-Wostl 2010). Greater homophily also eases information exchange, but could inhibit acquisition of new information (Granovetter 1973; Granovetter 1983).

Study Context

Our research focuses on a collaboration to develop a new mechanism to conserve vernal pools in Maine. Vernal pools in the northeastern United States are small (generally <0.5 ha), seasonal wetlands in forested landscapes (Calhoun et al. 2014). They support a specialized suite of amphibians, provide habitat for state-listed invertebrates and reptiles, and supply ecosystem services beyond what would be expected by their small size (Hunter 2005). Vernal pools are threatened by development that directly impacts pools and fragments adjacent forests that provide amphibian postbreeding habitat and travel corridors (Calhoun, Miller, and Klemens 2005).

In 2007, the Maine legislature amended the Natural Resources Protection Act to regulate development within 250 ft of exemplary vernal pools. In addition, the Army Corps of Engineers reviews development around vernal pools on properties where waters of the United States will be dredged or filled (Burne and Griffin 2005). Stakeholders believe the regulations either unduly burden individual landowners and hinder development, or, conversely, inadequately protect the resource (Jansujwicz et al. 2013). Tensions came to a head in 2011 when existing regulations were under attack in both legislative and media forums (e.g., Bell 2011).

To address this challenge, University of Maine researcher Calhoun engaged key stakeholders in discussions about alternative regulatory strategies, starting with six people in 2010. Participation grew over time, and by 2014, approximately 50 individuals representing two municipalities, four state agencies, three federal agencies, land trusts, development and real estate interests, private

consultants, and university researchers had participated in the process (Table 1). The collaboration did not include public participation. Members met in a large group to share relevant information and develop a proposed mechanism, as well as in subgroups that emerged as needed: ecologists developing criteria for identifying exemplary vernal pools; a mapping group; developers and economists analyzing market conditions and developing a fee mechanism; a “human dimensions” group focused on policy issues; and a Special Areas Management Plan (SAMP) group writing the new regulatory document. Subgroup meetings were open for anyone to attend. The collaboration is currently in the final stages of adopting a SAMP to enable the proposed mechanism to be implemented and evaluated in two participating municipalities.

Methods

Qualitative Data Collection and Analysis

We employed a sequential mixed-methods approach (Creswell 2014) in which we used participant observation (DeWalt and DeWalt 2011) to inform a targeted collection of qualitative and quantitative data. Authors Levesque and Calhoun were co-participants, attending all 45 collaboration meetings from 2010 through to data analysis in 2014. Calhoun functioned as a coordinator, and Levesque was a graduate student conducting research; both contributed to discussions, provided information, and interacted with other members. As active participants, we influenced the very phenomenon that we studied. A greater degree of participation allowed a more complete grasp of the context from an insider’s perspective and the capacity to draw on

personal experience during formal analysis (Patton 2002). Throughout the analysis, we were aware of our own biases and were careful to ensure findings were grounded in data.

After 3 years of participant observation, the senior author interviewed all members who had attended three or more collaborative meetings as of August 2013. These 28 interviewees spanned the organizations and interests in the collaboration (Table 1). A semistructured interview guide was tested with nonparticipants and revised prior to use. To understand power dynamics we asked questions such as “Who was the most influential and why?”

To explore trust, we asked about process components that are often associated with trust in the literature. For example, given the possible effects of including a wide range of interests on trust development, we asked, “What is the effect of having this particular mix of interests in the group?” To investigate learning, we asked a series of questions about what and how participants learned, such as “What have you learned as a result of participating?” To augment our own observations of institutions, we asked respondents to describe the collaboration with questions such as “What are some distinguishing characteristics of this process?” Additionally, respondents were asked about their core policy beliefs.

Face-to-face interviews lasted 1–2 hours and were recorded and transcribed. Using an iterative coding process (Yin 2010) and NVivo (v.10) software, the senior author initially coded data using a deductive process under broad categories of power, trust, learning, institutions, and policy beliefs. These themes were further coded using an inductive process into subcategories

that explained broad categories (Yin 2010). For example, the broad category trust was further coded into subcategories: trust descriptions, formation, and influence on the process.

Network Data Collection and Analysis

Our network analysis is based on meeting attendance records from January 2010 through June 2013 (after Voets, Van Dooren, and De Rynck 2008; Newig et al. 2010). Attendance provides a two-mode, actor-by-event matrix, which, given our analytical focus on actor relationships, we converted to a one-mode actor-by-actor matrix (Borgatti and Everett 1997; Borgatti 2009). Once converted, our network measures indicate who co-attended meetings. We employed one-mode analysis methods in UCINET (Borgatti 2009; Jasny 2012).

For insights on power, we measured degree centrality, or the number of participants with whom an actor has co-attended meetings (Bodin and Crona 2009; Prell 2012), as well as Freeman's network centralization measure (Sandström and Rova 2010). We also assigned actors to their organization and calculated mean brokerage scores for each organization (Fernandez and Gould 1994; Stevenson and Greenberg 2000).

To measure the extent of trust, we used network density. To test the degree to which participants trust those who hold similar interests, we assigned each actor their core policy belief and used the E-I index, which compares the strength of ties external to each group to those within each group (Vance-Borland and Holley 2011). The index can range from -1 (homophily) to 1 (heterophily). We used an analysis of variance (ANOVA) model to test whether observed

patterns were significant. Because the ties between actors are not independent observations, the ANOVA models used by UCINET uses 5000 trials of random permutations of ties to which the actual network is compared.

We utilized the measures of network density, centralization, and homophily to better understand the network structures associated with social learning.

Results

Power

As expected, some participants entered the collaboration inherently wielding greater power due to their regulatory positions. This was especially true of the Army Corps representatives, as described by one participant, “[She] seems to play an important role but that’s her institution—I mean, she’s the biggest regulatory hammer in the room.” Despite the inherent power of some participants, by 4 years into the process, no one person or organization stood out as being the most powerful:

Obviously the Corps is going to have some element of final say in the Special Area Management Plan because it’s their thing, but the contents will be the product of a lot of interests’ influence, as opposed to the Corps saying this is what we want and this is how it’s going to be, take it or leave it.

In fact, most respondents named six to eight people from multiple organizations when asked who had the most influence.

The network analysis further indicates power was fairly well distributed. Degree centrality scores averaged 22.5 ties across all actors, and ranged from 13.8 to 33.3 within each organization (Figure 1 and Table 2). The Freeman centrality measure for the whole network is 56.29%. The university group members have a high mean brokerage score (549.1) (Table 2), but large standard deviations of brokerage scores suggest that some members in all subgroups are more likely to be brokers, and group affiliation matters less.

We examined the role of institutions in dispersing power. Boundary rules that brought critical thinkers into the process and position rules that enabled multiple types of authority to emerge were both critical for power shifts. In particular, some participants were recognized for providing essential contributions, while others were cited as advancing the discussion by asking critical questions. For example, a developer commanded the attention and respect of others because “he is very good at explaining things from his perspective, knowing that people are coming from different camps.” Some town representatives were identified as powerful because they grounded the proposed mechanism, letting others know whether it would be feasible. Thus, the institutions ensured that the best thinkers and experts were contributing members of the group.

Further, aggregation rules that shaped decision processes ensured these members were afforded the opportunity to participate in a meaningful manner, helping to distribute power. In particular, group discussions were often cited as essential; it was through discussions that participants

learned of each other's expertise. Participants felt that ideas were openly shared and debated during discussions; "this has been one of those discussions ... where leadership is from persuasion rather than authority ... People are continuing to engage in the conversation because they see an opportunity to influence the outcome." Respondents noted that open discussions were due at least partly to those coordinating the group; one university coordinator was described as "not driving the bus," "not ego driven," and "being committed to finding a solution," despite her own expertise. In sum, institutions that helped equalize power were those that included critical thinkers from multiple backgrounds, acknowledged different types of knowledge, and promoted open-minded discussions.

Trust

Respondents identified trust in the process and each other. For example, one respondent stated, "I'm impressed by some of the relationships that [the coordinators] have built up ... Those kinds of relationships take a lot of time and trust ... to develop ... I think because of that, people say things at meetings that they wouldn't otherwise." Another interviewee noted, "It seems like we worked through some initial lack of trust issues. There are some people at the table who are probably used to being adversaries; we worked through all that and everybody came to realize that this was a win-win proposition." This level of trust seems to have established in spite of—or perhaps because of—the range of interests participating in the process. According to one participant, having a full mix of interests has built trust and credibility in the process. Many participants felt the process was more likely to produce good outcomes because trust was present; one respondent stated, "I think it has evolved over time to where everybody feels really

committed to seeing a workable outcome. And I think that only happens when you give the process enough time for trust to develop between stakeholders.”

The network analysis supports the finding that trust developed within the large group. The overall density of the network is 0.457, suggesting a fairly dense network. Within-group densities did show some variation (Table 2), with the most densely tied group being university representatives, three of whom attended almost all the meetings. The E-I index for the network of 0.2563 shows heterophily. Weaker ties are observed within most interest groups (ecology, economics, governance) than between the groups, and the density of ties within interest groups is not significantly different than what is found in a randomly generated network ($R^2 = .071, p = .08$).

Our analysis suggests three key institutions that help build trust. First, respondents named informal norms such as respectful dialogue that strengthened trust. One interviewee said that even at meetings where people get passionate about their ideas, “the way that we talk to each other, the way we listen to each other and respond to other comments and ideas has been very respectful.” These interactions were likely shaped by ground rules that promoted respect: “It’s really kudos to [the coordinators] for infusing and informing the process with a commitment to actually do this in as open and inclusive way as is possible, without which there would be no trust.”

Second, aggregation rules encouraged the use of subgroups that also built trust. A consultant who had been at initial subgroup meetings with developers stated

That first meeting with the developers, I felt like they came in here thinking, “Oh, no, here’s another environmental regulation. We’re going to have to fight this.” ... We spent basically two hours with them explaining the process, answering questions ... Then as we went on, there was much more a sense of trust in each other and trust that we were trying to make something that was going to work for everyone.

The subgroups, while convened to discuss detailed information, allowed participants with similar interests to talk about their concerns. Yet use of subgroups could backfire if the larger group began to question what went on in the small groups. One respondent noted

You provided spaces for people to be a little more candid ... That seems to be working well. You haven’t lost trust. When you bring people together as a full group it doesn’t seem like they’re suspicious of what’s happening at those small meetings and I think it takes a really good process to balance that out.

Finally, trust does not appear to be a function of holding a similar core policy belief. One reason may be that new interests came to the group over time. For example, the initial meeting of developers was suggested by a town official 18 months into the process after initial distrust between regulators and municipalities was resolved. At the time of the interviews, a few participants realized that the large state environmental advocacy group was not represented. An interviewee explained, “The reason not to have involved [the advocacy group earlier] is I think it would have been harder ... to build that level of trust.” Group members saw the value of

bringing in this new perspective and felt ready to allow the dialog. Thus, boundary rules that guide participant selection included an element of time that was essential in trust formation. In brief, ground rules that established respectful discussion, use of subgroups, and staggered inclusion of stakeholder interests are the institutions that promoted trust.

Learning

All respondents reported learning about new subject areas or perspectives. For example, a developer stated, “To me a vernal pool was something I wanted to run a bulldozer over every April so it didn’t exist anymore ... I don’t quite think that way anymore, I go ‘Okay, that’s an important part of an ecosystem. What do we do?’” Respondents also report learning about and developing respect for each other’s expertise. A state regulator stated, “I’m never in a room with a bunch of planners where they are really thinking about [growth planning] ... [Participating town] is not a big built up area ... but they’ve obviously thought about it.”

In addition, participants developed a shared understanding of the issues and joint solutions as a result of group discussions. One respondent, noting how everyone contributed, said, “It seems like there’s a lot of people cooperating to build up a shared understanding.” Others also indicated that they had collectively “bounced ideas” off each other. One respondent noted, as the group grew to include new perspectives, “ideas ... or complications have been introduced, pitfalls have been brought up that have to be overcome, and so the [group’s] ideas evolved.”

We observed that ideas evolved at least partly from deep deliberation about the proposed mechanism, with members expressing strong, conflicting opinions. Debates would continue over the course of multiple meetings before the group would come to an agreement. For example, one contentious decision was how to determine an impact fee. Over the course of many months, participants shared data about development and conservation costs, views on what role the towns should play, and ideas about other conservation funding sources. Eventually, as the members came to understand and accept each other's needs and perspectives, they agreed upon a trial impact fee structure.

Several institutions helped facilitate social learning. First, we observed that boundary rules that determine who participates in the process were flexible; as new experts and perspectives were needed, the relevant participants were invited to join the group. For example, a real estate appraiser was invited as the group was determining a fee structure that depended upon appraised property values. Second, the coordinators instilled informal rules about inclusion and listening, as mentioned by a town representative: "The [coordinators] always allow for everybody to speak ... You don't get this level of information ... in a typical case." This norm of inclusion was reflected by several respondents, such as, "People are listening to one another, hearing different perspectives, trying to synthesize ... I've seen it happen where the agencies are really running things. Here ... the process is letting different types of knowledge emerge."

Finally, aggregation rules encouraged the use of subgroups. These smaller groups enabled in-depth discussion by experts, so that the large group benefited from their deliberations. For example, developing criteria for protecting vernal pools took many meetings of mostly ecologists

relying on biological data that might have been too complicated or uninteresting to the rest of the group. Information and recommendations from subgroups would be presented at the next large group meeting for discussion. One respondent commented on how the subgroups help the larger group move forward, saying, “They bring information to the table that I may be familiar with but I can’t bring it with the authority and direct experience they have.”

Our network measures support the finding that the structure of the collaboration was one that could facilitate social learning. The network’s Freeman centrality score is 56.29% and the density is 0.457; a dense network that isn’t dominated by a central leader is more likely to be able to share information and deliberate. The E-I index of 0.2563 shows the heterogeneity of the large group, where diverse interests are available to contribute different perspectives and knowledge (Newig et al. 2010). Thus, including multiple perspectives, encouraging sharing of ideas, and using subgroups facilitated the social learning that helped the group develop a joint solution.

Discussion

We identified a collaboration in which power was distributed among members, trust formed across core interests, and social learning resulted in shared understanding and joint solutions. We found evidence that the collaboration’s institutions helped achieve these conditions.

Power

We found many nonregulatory participants influenced outcomes because of what they contributed to the process. This finding is consistent with Thye (2000), who suggested that the assignment of power due to status helps equalize power instead of causing a power struggle. Recognizing the influence of members beyond regulators allowed the group to focus on what ideas would best contribute to a successful policy proposal. Three institutional aspects helped participants equalize power: (1) boundary rules that selected participants who were critical thinkers yet open-minded; (2) position rules that allowed different types of authority to emerge; and (3) aggregation rules that valued good ideas from anyone during decision making.

While the network analysis also suggested that power was fairly evenly distributed (e.g., low network centrality, brokers in most subgroups), it was less helpful in exploring why power equalized. The interview responses were necessary to understand the institutions that facilitated power sharing. Additionally, brokerage measures suggested that university representatives yield disproportional influence in the group. While two university members did keep the process moving, interviews suggest they did not exercise greater power over the outcomes. Network analysis overemphasized their power and did not accurately portray status-based power of others. Future work could develop network tests that account for power distribution as a result of status perceptions. In addition, future network analysis could examine how structures change over time to support or challenge qualitative findings that power shifts as collaborations evolve.

Trust

We found that trust developed across individuals with different interests. Both the network structure (i.e., a dense, heterogeneous group), and the qualitative analysis supported this finding. We had expected core beliefs to be a greater determinant of trust, given the highly contentious context from which this group emerged. Lessons from our study may help to elucidate how institutions build trust. First, norms that promote inclusive and respectful dialogue were essential; as participants saw their own and others' opinions taken seriously, trust grew. Second, aggregation rules that determine decision processes included subgroups that allowed participants who share similar interests to express concerns in a safe environment, after which they could participate more constructively in the full group. The use of subgroups was paired with a transparent process so that trust was maintained in the large group. Third, the boundary rules of who participated included an element of time. While the participation of diverse interests made the process credible and trustworthy, the new interests were brought in slowly. This finding supports Johnston et al. (2011), who state that the rapid inclusion of many stakeholders risks the ability to build trust within a group.

While we examined trust broadly, other researchers have separated out different components of trust (e.g., Stern and Coleman 2015). Future research could explore which components of trust are most important for successful collaboration and what institutions support them. Additionally, participants' responses suggested ownership over the process, proposed by others to be critical to trust development (Webler and Tuler 2006; Lachapelle and McCool 2012); future research could examine the way in which institutions support feelings of ownership.

Learning

We found that not only did participants learn content and other perspectives, but also, as a group, they engaged in deep deliberation essential for jointly solving a controversial problem. The network analysis indicated the network was fairly dense without a strong central leader, both of which may suggest that participants are interacting in ways that could expose them to diverse knowledge and ideas. Further, the network exhibited heterophily, enabling the group to benefit from a broad range of expertise. However, again we find that network analysis can identify characteristics of the collaboration associated with learning, but is less helpful in determining the institutions that enabled a diverse group to become deliberative.

Our qualitative results provide greater insight into the development of social learning. First, boundary rules that determine participants were adaptable, bringing in new expertise as needed. Second, the norms of inclusion and listening were well known by participants; by encouraging everyone to share their knowledge, the group as a whole had the opportunity to develop a collective understanding. Third, the use of subgroups allowed experts to delve deeply into specific aspects of issues and bring informed recommendations back to the larger group.

Conclusion

While our research contributes to a growing understanding of collaborative efforts, it also raises new questions. For example, how do coordinators who also participate in a collaboration influence the dynamics of power, trust, and learning? Are rules established by coordinators or do

they emerge from group processes? Power, trust, and learning all appear to change over time, but how do they influence each other and how should collaborations evolve in response? Our research also has some limitations. Because our results are drawn from a single, well-functioning collaboration, future research is needed to explore power, trust, and learning in poorly functioning collaborations. Additionally, like other network analyses that struggle to relate structure to function (Sandström and Carlsson 2008), the use of meeting attendance as basis for analysis limits our understanding of more complex network relationships. However, qualitative data provided additional insight into how institutions govern interactions within the network structures we found.

Interestingly, similar institutions influenced power, trust, and learning. For example, boundary rules selected critical thinkers (equalizing power) and brought in new interests over time (establishing trust), both of which also facilitated social learning. The use of subgroups provided avenues for trust to build and for learning to occur. Likewise, certain network structures were important; this collaboration was dense, decentralized, and heterogeneous, all which facilitate trust and learning. Hence, process dynamics such as power, trust, and learning are likely interdependent. Our results support others who suggest that institutions shape how collaborations function (Sell et al. 2004; Imperial 2005; Hardy and Koontz 2009); future research could focus on how specific institutions simultaneously influence interrelated process components. By better understanding the institutions that enable successful partnership, more policy forums can evolve from contention to collaboration.

Funding

This research was supported by National Science Foundation award EPS-0904155 to Maine EPSCOR Sustainability Solutions Initiative at the University of Maine. This is Maine Agricultural and Forest Experiment Station Publication Number 3473. The project was supported by the U.S. Department of Agriculture (USDA) National Institute of Food and Agriculture, Project Numbers ME0-H-6-00509-13 and ME0-L-7-00524-13.

References

- Acheson, J. M., and J. Knight. 2000. Distribution fights, coordination games, and lobster management. *Comparative Studies in Society and History* 42(1):209–38.
doi:10.1017/s0010417500002656
- Ansell, C., and A. Gash. 2008. Collaborative governance in theory and practice. *Journal of Public Administration Research and Theory* 18(4):543–71. doi:10.1093/jopart/mum032
- Armitage, D. 2005. Adaptive capacity and community-based natural resource management. *Environmental Management* 35(6):703–15. doi:10.1007/s00267-004-0076-z
- Bell, T. 2011. LePage: Ease regulations that protect vernal pools. *Portland Press Herald*, January 19, 2011:A1.
- Blom-Hansen, J. 1997. A ‘New Institutional’ perspective on policy networks. *Public Administration* 75(4):669–93. doi:10.1111/1467-9299.00080
- Bodin, Ö., and B. I. Crona. 2009. The role of social networks in natural resource governance: What relational patterns make a difference? *Global Environmental Change* 19(3):366–74.
doi:10.1016/j.gloenvcha.2009.05.002
- Bodin, Ö., B. I. Crona, and H. Ernstson. 2006. Social networks in natural resource management: What is there to learn from a structural perspective? *Ecology and Society* 11(2):r2.
- Borgatti, S. P. 2009. 2-Mode concepts in social network analysis. In *Encyclopedia of complexity and systems science*, ed. R. A. Meyers 8279–91. New York, NY: Springer.
- Borgatti, S. P., and M. G. Everett. 1997. Network analysis of 2-mode data. *Social Networks* 19(3):243–69. doi:10.1016/S0378-8733(96)00301-2

- Bryson, J. M., B. C. Crosby, and M. M. Stone. 2006. The design and implementation of cross-sector collaborations: Propositions from the literature. *Public Administration Review* 66:44–55. doi:10.1111/j.1540-6210.2006.00665.x
- Burne, M. R., and C. R. Griffin. 2005. Protecting vernal pools: A model from Massachusetts, USA. *Wetlands Ecology & Management* 13(3):367–75. doi:10.1007/s11273-004-7528-3
- Calhoun, A. J. K., J. S. Jansujwicz, K. P. Bell, and M. L. Hunter. 2014. Improving management of small natural features on private lands by negotiating the science-policy boundary: A vernal pool case study. *Proceedings of the National Academy of Sciences of the United States of America* 111(30):11002–06.
- Calhoun, A. J. K., N. A. Miller, and M. W. Klemens. 2005. Conserving pool-breeding amphibians in human-dominated landscapes through local implementation of best development practices. *Wetlands Ecology and Management* 13(3):291–304. doi:10.1007/s11273-004-7523-8
- Coleman, J. S. 1990. Norm-generating structures. In *The limits of rationality*, ed. K. Cook and M. Levi 250–281. Chicago, IL: University of Chicago Press.
- Creswell, J. W. 2014. *Research design: Qualitative, quantitative, and mixed methods approaches*, 4th ed. Thousand Oaks, CA: Sage.
- DeLeon, P., and D. M. Varda. 2009. Toward a theory of collaborative policy networks: Identifying structural tendencies. *Policy Studies Journal* 37(1):59–74. doi:10.1111/j.1541-0072.2008.00295.x
- Dempwolf, C. S., and L. W. Lyles. 2012. The uses of social network analysis in planning: A review of the literature. *Journal of Planning Literature* 27(1):3–21. doi:10.1177/0885412211411092

- DeWalt, K. M., and B. R. DeWalt. 2011. *Participant observation: A guide for fieldworkers*, 2nd ed. New York, NY: AltaMira Press.
- Emerson, K., T. Nabatchi, and S. Balogh. 2011. An integrative framework for collaborative governance. *Journal of Public Administration Research and Theory* 22(1):1–29.
doi:10.1093/jopart/mur011
- Fernandez, R. M., and R. V. Gould. 1994. A dilemma of state power: Brokerage and influence in the national health policy domain. *American Journal of Sociology* 99(6):1455–91.
doi:10.1086/230451
- Gerber, E. R., A. D. Henry, and M. N. Lubell. 2013. Political homophily and collaboration in regional planning networks. *American Journal of Political Science* 57(3):598–610.
doi:10.1111/ajps.12011
- Gerlak, A. K., and T. Heikkila. 2011. Building a theory of learning in collaboratives: Evidence from the Everglades restoration program. *Journal of Public Administration Research and Theory* 21(4):619–44. doi:10.1093/jopart/muq089
- Granovetter, M. S. 1973. The strength of weak ties. *American Journal of Sociology* 78(6):1360–80.
- Granovetter, M. S. 1983. The strength of weak ties: A network theory revisited. *Sociological Theory* 1:201–33. doi:10.2307/202051
- Hardy, S. D., and T. M. Koontz. 2009. Rules for collaboration: Institutional analysis of group membership and levels of action in watershed partnerships. *Policy Studies Journal* 37(3):393–414. doi:10.1111/j.1541-0072.2009.00320.x

- Heikkila, T., and A. K. Gerlak. 2013. Building a conceptual approach to collective learning: Lessons for public policy scholars. *Policy Studies Journal* 41(3):484–512.
doi:10.1111/psj.12026
- Henry, A. D., and T. Dietz. 2011. Information, networks, and the complexity of trust in commons governance. *International Journal of the Commons* 5(2):188–212.
doi:10.18352/ijc.312
- Hunter, M. L. 2005. A mesofilter conservation strategy to complement fine and coarse filters. *Conservation Biology* 19(4):1025–29. doi:10.1111/j.1523-1739.2005.00172.x
- Huxham, C., S. Vangen, C. Huxham, and C. Eden. 2000. The challenge of collaborative governance. *Public Management Review* 2(3):337–58. doi:10.1080/14719030000000021
- Imperial, M. T. 2005. Using collaboration as a governance strategy: Lessons from six watershed management programs. *Administration & Society* 37(3):281–320.
doi:10.1177/0095399705276111
- Innes, J. E., and D. E. Booher. 2003. Collaborative dialogue as a policy making strategy. In *Deliberative policy analysis: Understanding governance in the network society*, ed. M. A. Hajer and H. Wagenaar, 33–59. New York, NY: Cambridge University Press.
- Janssen, M. A., Ö. Bodin, J. M. Anderies, T. Elmqvist, H. Ernstson, R. R. J. Mcallister, P. Olsson, and P. Ryan. 2006. Toward a network perspective of the study of resilience in social-ecological systems. *Ecology and Society* 11(1).
- Jansujwicz, J. S., A. J. K. Calhoun, J. E. Leahy, and R. J. Lillieholm. 2013. Using mixed methods to develop a frame-based private landowner typology. *Society & Natural Resources* 26(8):945–61. doi:10.1080/08941920.2012.729294

- Jasny, L. 2012. Baseline models for two-mode social network data. *Policy Studies Journal* 40(3) 458–91. doi:10.1111/j.1541-0072.2012.00461.x
- Johnston, E. W., D. Hicks, N. Nan, and J. C. Auer. 2011. Managing the inclusion process in collaborative governance. *Journal of Public Administration Research and Theory* 21(4):699–721. doi:10.1093/jopart/muq045
- Knight, J. 1992. *Institutions and social conflict*. Cambridge, UK: Cambridge University Press.
- Koontz, T. M. 2005. We finished the plan, so now what? Impacts of collaborative stakeholder participation on land use policy. *Policy Studies Journal* 33(3):459–81. doi:10.1111/j.1541-0072.2005.00125.x
- Koontz, T. M. 2006. Collaboration for sustainability? A framework for analyzing government impacts in collaborative-environmental management. *Sustainability: Science, Practice and Policy* 1:15.
- Koontz, T. M. 2014. Social learning in collaborative watershed planning: The importance of process control and efficacy. *Journal of Environmental Planning and Management* 57(10):1572–93. doi:10.1080/09640568.2013.820658
- Lachapelle, P. R., and S. F. McCool. 2012. The role of trust in community wildland fire protection planning. *Society & Natural Resources* 25(4):321–35. doi:10.1080/08941920.2011.569855
- Lachapelle, P. R., S. F. McCool, and M. E. Patterson. 2003. Barriers to effective natural resource planning in a ‘messy’ world. *Society & Natural Resources* 16:473–90. doi:10.1080/08941920309151
- Layzer, J. 2012. Defining problems in U.S. environmental politics. In *The environmental case: Translating values into policy*, 2nd ed., 1–23. Washington, DC: CQ Press.

- Leach, W. D., and P. A. Sabatier. 2005. To trust an adversary: Integrating rational and psychological models of collaborative policymaking. *American Political Science Review* 99(04):491–503. doi:10.1017/S000305540505183X
- Mandarano, L. A. 2008. Evaluating collaborative environmental planning outputs and outcomes: Restoring and protecting habitat and the New York–New Jersey Harbor Estuary Program. *Journal of Planning Education and Research* 27(4):456–68. doi:10.1177/0739456X08315888
- Mandarano, L. A. 2009. Social network analysis of social capital in collaborative planning. *Society & Natural Resources* 22(3):245–60. doi:10.1080/08941920801922182
- Marcum, C. S., C. A. Bevc, and C. T. Butts. 2012. Mechanisms of control in emergent interorganizational networks. *Policy Studies Journal* 40(3):516–46. doi:10.1111/j.1541-0072.2012.00463.x
- Mitchell, B. 2005. Participatory partnerships: Engaging and empowering to enhance environmental management and quality of life? *Social Indicators Research* 71(1):123–44. doi:10.1007/s11205-004-8016-0
- Newig, J., D. Gunther, and C. Pahl-Wostl. 2010. Synapses in the network: Learning in governance networks in the context of environmental management. *Ecology and Society* 15(4):24.
- North, D. C. 1990. *Institutions, institutional change and economic performance*. Cambridge, UK: Cambridge University Press.
- Ostrom, E. 1999. Institutional rational choice: An assessment of the institutional analysis and development framework. In *Theories of the policy process*, ed. P. A. Sabatier 35–72. Boulder, CO: Westview Press.

- Ostrom, E. 2003. Doing institutional analysis: Digging deeper than markets and hierarchies. In *Handbook of new institutional economics*, ed. C. Menard and M. Shirley, 819–848. Dordrecht, the Netherlands: Kluwer Academic Press.
- Patton, M. Q. 2002. *Qualitative research and evaluation methods*, 3rd ed. Thousand Oaks, CA: Sage.
- Prell, C. 2012. *Social network analysis*. Thousand Oaks, CA: Sage.
- Raymond, L. 2006. Cooperation without trust: Overcoming collective action barriers to endangered species protection. *Policy Studies Journal* 34(1):37–57.
doi:10.1111/j.1541-0072.2006.00144.x
- Reed, M. S. 2008. Stakeholder participation for environmental management: A literature review. *Biological Conservation* 141(10):2417–31. doi:10.1016/j.biocon.2008.07.014
- Reed, M. S., A. C. Evely, G. Cundill, I. Fazey, J. Glass, A. Laing, J. Newig, B. Parrish, C. Prell, C. Raymond, and L. C. Stringer. 2010. What is social learning? *Ecology and Society* 15(4):10.
- Rittel, H. W. J., and M. M. Webber. 1973. Dilemmas in a general theory of planning. *Policy Sciences* 4:155–169. doi:10.1007/bf01405730
- Sandström, A., and L. Carlsson. 2008. The performance of policy networks: The relation between network structure and network performance. *Policy Studies Journal* 36(4):497–524. doi:10.1111/j.1541-0072.2008.00281.x
- Sandström, A., and C. Rova. 2010. Adaptive co-management networks: A comparative analysis of two fishery conservation areas in Sweden. *Ecology and Society* 15(3):14.
- Schneider, M., J. T. Scholz, M. N. Lubell, D. Mindruta, and M. Edwardsen. 2003. Building consensual institutions: Networks and the national estuary program. *American Journal of Political Science* 47(1):143–58. doi:10.1111/1540-5907.00010

- Schusler, T., D. Decker, and M. Pfeffer. 2003. Social learning for collaborative natural resource management. *Society & Natural Resources* 16(4):309–26.
doi:10.1080/08941920390178874
- Sell, J., M. J. Lovaglia, E. A. Mannix, C. D. Samuelson, and R. K. Wilson. 2004. Investigating conflict, power, and status within and among groups. *Small Group Research* 35(1):44–72.
doi:10.1177/1046496403259813
- Selsky, J. W. 2005. Cross-sector partnerships to address social issues: Challenges to theory and practice. *Journal of Management* 31(6):849–73. doi:10.1177/0149206305279601
- Skelcher, C., and H. Sullivan. 2008. Theory-driven approaches to analysing collaborative performance. *Public Management Review* 10(6):751–71.
doi:10.1080/14719030802423103
- Stern, M. J., and T. D. Baird. 2015. Trust ecology and the resilience of natural resource management institutions. *Ecology and Society* 20(2):14. doi:10.5751/es-07248-200214
- Stern, M. J., and K. J. Coleman. 2015. The multidimensionality of trust: Applications in collaborative natural resource management. *Society & Natural Resources* 28(2):117–32.
doi:10.1080/08941920.2014.945062
- Stevenson, W. B., and D. Greenberg. 2000. Agency and social networks: Strategies of action in a social structure of position, opposition, and opportunity. *Administrative Science Quarterly* 45(4):651. doi:10.2307/2667015
- Thye, S. R. 2000. A status value theory of power in exchange relations. *American Sociological Review* 65(3):407–32. doi:10.2307/2657464
- Vance-Borland, K., and J. Holley. 2011. Conservation stakeholder network mapping, analysis, and weaving. *Conservation Letters* 4(4):278–88. doi:10.1111/j.1755-263X.2011.00176.x

- Voets, J., W. Van Dooren, and F. De Rynck. 2008. A framework for assessing the performance of policy networks. *Public Management Review* 10(6):773–90.
doi:10.1080/14719030802423129
- Weber, E. P., and A. M. Khademian. 2008. Wicked problems, knowledge challenges, and collaborative capacity builders in network settings. *Public Administration Review* 68:334–49. doi:10.1111/j.1540-6210.2007.00866.x
- Webler, T., and S. Tuler. 2006. Four perspectives on public participation process in environmental assessment and decision making: Combined results from 10 case studies. *Policy Studies Journal* 34(4):699–722. doi:10.1111/j.1541-0072.2006.00198.x
- Weible, C. M., and P. A. Sabatier. 2009. Coalitions, science, and belief change: Comparing adversarial and collaborative policy subsystems. *Policy Studies Journal* 37(2):195–212. doi:10.1111/j.1541-0072.2009.00310.x
- Yin, R. K. 2010. *Qualitative research from start to finish*. New York, NY: Guilford Press.

Table 1. Participant organizations and interests.

Participant's organization	Core interest [^]	Meetings attended as of August 2013
*Federal—USACE	Ecology	9
*Federal—USACE	Ecology	3
*Federal—USEPA	Ecology	3
*Federal—USFWS	Ecology	4
Federal—USACE		1
Federal—USACE		1
Federal—USACE		1
Federal—USACE		1
*State—MDACF	Ecology	18
*State—MDIFW	Ecology	12
*State—MDIFW	Ecology	10
*State—MDEP	Ecology	3
*State—MNAP	Ecology	3
State—MDEP		3
State—MDEP		1
State—MDECD		1
*Town A	Governance	13
*Town A	Economics	3
*Town B	Governance	8
*Town B	Governance	17
*Town B	Economics	11
Town C		1
*Developer	Economics	5
*Developer	Economics	3
*Developer	Economics	3
Developer		2
Developer		1
Developer		1
Developer		1
Developer		1
*University A	Ecology	27
*University A	Ecology	27
*University A	Governance	32
*University A	None	4
*University B	Governance	10
University A		2
University C		2
*Land trust A	Ecology	4
*Land trust A	Ecology	4
*Land trust A	Ecology	3
Land trust B		2
Land trust C		1
*Consultant/independent	Economics	3
*Consultant/independent	None	10
*Consultant/independent	Governance	6
Consultant/independent		2
Consultant/independent		1
Consultant/independent		1
Consultant/independent		1
Consultant/independent		1

Note. USACE: U.S. Army Corps of Engineers; USEPA: U.S. Environmental Protection Agency; USFWS: U.S. Fish and Wildlife Service; MDACF: Maine Department of Agriculture, Conservation and Forestry; MDIFW: Maine Department of Inland Fisheries and Wildlife; MDEP: Maine Department of Environmental Protection; MNAP: Maine Natural Areas Program; MDECD: Maine Department of Economic & Community Development.

*Participant was interviewed; ^core interest determined during interviews.

Table 2. Mean degree centrality, mean brokerage, and subgroup density by organization type.

Organization type	Centrality	Brokerage	Density
University	33.3 (13.7)	549.1 (561.3)	0.857
Town	30.7 (11.1)	303.5 (258.4)	0.733
State	24.4 (14.1)	235.0 (375.6)	0.607
Federal	21.3 (8.3)	57.9 (113.2)	0.500
Consultant	19.4 (11.8)	113.3 (179.0)	0.405
Developer	15.4 (9.2)	44.3 (108.1)	0.393
Land trust	13.8 (13.5)	44.5 (65.6)	0.267

Note. Mean centrality and brokerage are the sum of all individual scores per organization type, divided by the number of people who represent that type of organization. Standard deviation is in parentheses. Density is a measure of the number of ties between actors within a group divided by the total possible number of ties for that group, and can range from zero to one.

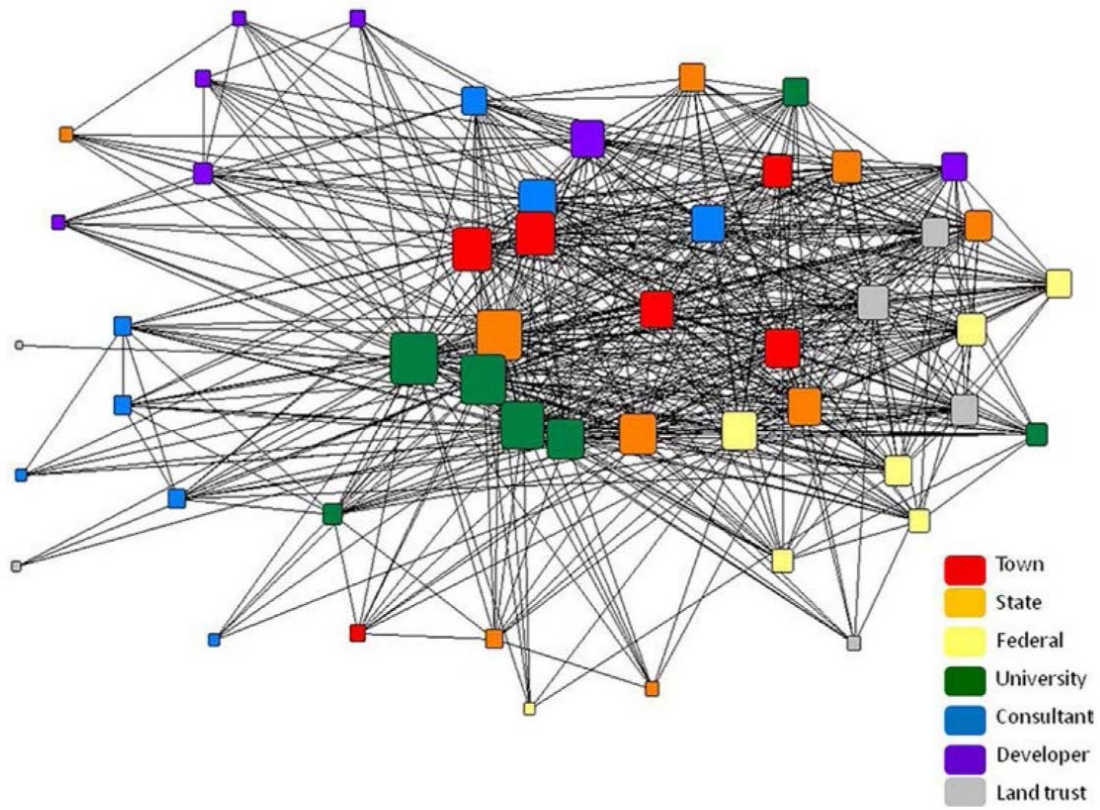


Figure 1 Actors in vernal pool collaborative network. Size of square indicates degree centrality.