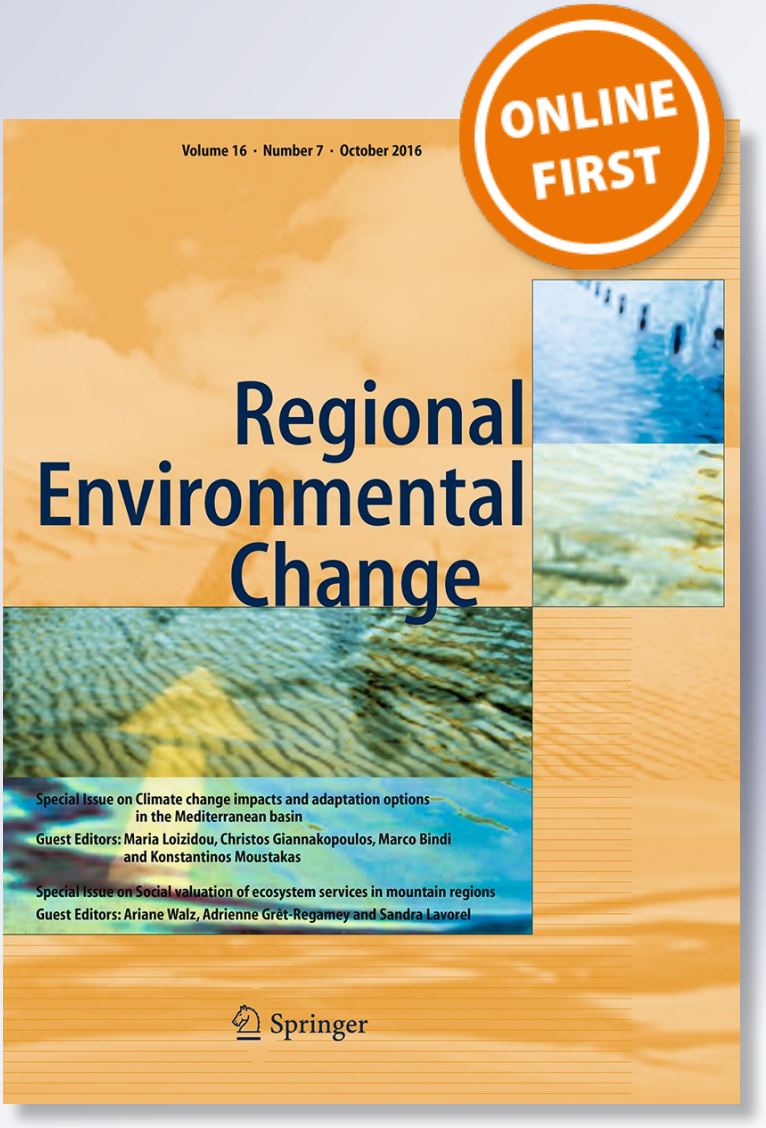
The emergence of an environmental governance network: the case of the Arizona borderlands

Michael Schoon, Abigail York, Abigail Sullivan & Jacopo Baggio

Regional Environmental Change

ISSN 1436-3798

Reg Environ Change
DOI 10.1007/s10113-016-1060-x



Springer

Reg Environ Change
DOI 10.1007/s10113-016-1060-x

ORIGINAL ARTICLE

The emergence of an environmental governance network: the case of the Arizona borderlands

Michael Schoon[1] · **Abigail York**[2] · **Abigail Sullivan**[2] · **Jacopo Baggio**[3]

Received: 15 December 2015 / Accepted: 28 September 2016

Abstract Across the country, government agencies increasingly collaborate with non-governmental actors on environmental dilemmas to gain access to resources, expertise, and local knowledge; to mitigate conflict; and to share risks in a changing environmental context. Collectively, these often overlapping collaborations form a complex and dynamic governance network (GNet). This paper examines the establishment and growth of an environmental GNet over a period of 15 years in conflict-ridden southeastern Arizona, USA. Using social network analysis, we detect the emergence of several influential organizations acting as political entrepreneurs and observe an overall change in network composition. We describe three phases: (1) a newly emerged network, (2) a network dominated by national non-governmental organizations, and finally (3) a shift toward local non-governmental organization involvement. Using institutional analysis, we explore how conflict over natural resource use, decreasing public and private monies for management, and increasing tensions over border security, leads to the establishment of new collaborations and new network participants. While this research focuses on environmental governance in southeastern Arizona, this methodological approach—and insights into the key role of organizations acting as political entrepreneurs—provides a useful starting place for analyzing networks of collaborative governance in other geographic and political contexts. Organizations' perceptions of risk and trust are keys to understanding the dynamics of collaboration within a GNet.

Keywords Collaboration · Institutional analysis · Political entrepreneur · Network analysis · Collaborative governance · Network governance

Editor: Helmut Haberl.

Electronic supplementary material The online version of this article (doi:10.1007/s10113-016-1060-x) contains supplementary material, which is available to authorized users.

✉ Michael Schoon
michael.schoon@asu.edu

[1] School of Sustainability, Arizona State University, Tempe, AZ, USA

[2] School of Human Evolution and Social Change, Arizona State University, Tempe, AZ, USA

[3] Utah State University, Logan, UT, USA

Introduction

Over the last four decades, environmental governance in the USA has moved beyond top-down federal agency action to incorporation of public comment and finally to an increasingly collaborative approach. Diverse sets of stakeholders come together within collaborative institutions to collectively manage natural resources. These decisions to create and join networks do not occur in a vacuum; agencies, non-governmental organizations (NGOs), and individual citizens are part of an environmental governance network (GNet). The characteristics of these networks, such as density, cohesiveness, and composition of network ties, affect the ability to solve collective action problems surrounding environmental resources (Bodin and Crona 2009). Better understanding of social networks is increasingly considered vital to successful environmental collaborations (Bodin and Crona 2008). However, it is also critical to understand how organizations within these networks make decisions about collaborations (Berardo and Scholz 2010; Lubell et al. 2012). Specific organizations strategically position themselves within the

Published online: 08 October 2016

GNets to take on influential and essential roles within multiple collaborations, acting as political entrepreneurs (Schneider and Teske 1992) and fostering specific agendas that may or may not align with the general interest regarding environmental resources.

Building upon the growing literature using social network analysis to understand environmental governance, we observe the changing network characteristics and the evolution of a complex network of environmental collaborations in southeastern Arizona between 1996 and 2011. The region chosen for this endeavor is known for its dynamic collaborative governance of environmental and natural resources (Sayre 2005; York and Schoon 2011a, b). The changes in the GNet are twofold: changes in collaborations between existing organizations, and changes in the composition of the organizations themselves. In other words, changes in the GNet affect the collaboration structure but also the number and type of organizations that compose the network. The analysis of such changes allows us to highlight the emergence of central actors as political entrepreneurs within the GNet and the importance of trust and risk factors in affecting entry and exiting the GNet and the creation/deletion of collaboration within the GNet.

The paper is structured as follows: We first explore the extant literature focusing on new institutional economics and political entrepreneurship within collaborative environmental governance. We then offer a methodological overview and an introduction to our study site. Through the analysis of the changing environmental GNet over time, we are able to examine the emergence of political entrepreneurs and the changes in actual governance structure. Using ethnographic approaches to institutional analysis, we are able to tie such network changes to strategic decisions. In order to facilitate the comprehension of the changing governance structure over time, we highlight three different discrete phases. The evolution of the GNet over time allows us to investigate how and why these patterns change over time, the role of political entrepreneurs in this process, and how risk and trust influence collaboration patterns.

Literature review

Our study extends the theory of the political entrepreneur to organizations within an environmental governance context. The theory of the political entrepreneur has been widely used in political science and is defined as an individual with the resources and ability to change the dynamic of a given political atmosphere or direction (Schneider and Teske 1992). Related to the concept of the political entrepreneur is that of the institutional entrepreneur. This idea refers to individuals with an interest in, and the resources to initiate, the formation of new (or transformation of existing) organizations (DiMaggio 1988). Maguire et al. (2004) find that successful institutional entrepreneurs have widespread legitimacy and are capable of acting as bridging organizations and as decision-making motivators when diverse stakeholders are present (Stiller and Meijerink 2016). This entrepreneurial approach also resonates with the advocacy coalition framework (ACF), particularly the key unit of analysis as a policy subsystem comprised of public and private groups focused on a specific issue (Sabatier and Jenkins-Smith 1988). However, our approach places more emphasis on governance of all types than formal policy, as is often done in ACF. For our purposes, we will use the term political entrepreneur to encompass all of these ideas. Organizations with greater access to resources and information within a network of environmental collaborations are more likely to shift and shape the outcomes and dynamics of these collaborations (Westley and Miller 2003; Hanger et al. 2013). Successful environmental management initiatives often require leadership (Bodin and Crona 2008). These leaders often must create multi-organizational cross-sector social partnerships to solve complex issues that cannot be resolved by a single organization (Clarke and Fuller 2010).

We build upon the concept of political and institutional entrepreneurs extending this idea to organizations that are acting as entrepreneurs within the context of environmental collaborations. These organizations emerge as influential leaders in the network, altering the structure of the network and influencing policy outcomes, precisely the role performed by political entrepreneurs. These entrepreneurs are often necessary to attempt to solve collective action problems (Ménard and Shirley 2008). However, these entrepreneurs are also able to block collective action and steer it toward a desired path (Bodin and Crona 2009, Holcombe 2002). Through examining how organizations acting as political entrepreneurs work within the institutions—the shared rules, norms, and strategies (Ostrom 2005)—created by the GNet in which they exist, the motivations behind an organization's emergence as an influential political entrepreneur are better understood.

Collaborative resource management has largely focused on the establishment of singular collaborations between governments and local resource users (see for example co-management as in Berkes 2009 or collaborative governance as in Childs et al. 2013) or self-organized collaborations among individual users of open-access and common pool resources (Ostrom 1990 for example). As we move beyond singular efforts at collaboration, it is imperative that we explore social networks including diverse stakeholders (Bodin and Crona 2009; Luthe et al. 2012; Baird et al. 2016). In this study, we look at networks of organizations involved in one or more collaborations. Because informal agreements and understanding within a social network are often more important than the presence of

formal institutions (Scholz and Wang 2006), the formation of collaborations is often dependent upon the presence of bridging organizations (Schultz 2009). Bridging organizations are historically important in crossing institutional boundaries to bring together organizations and stakeholders with diverse backgrounds for collaboration on problems or projects of mutual interest, yet often there are challenges to the creation and maintenance of network governance across governance scales and across sectors (Guerrero et al. 2015). Berardo and Scholz (2010) note the role of risk of others defecting from a collaborative arrangement in the emergence of new networks. Organizations seek to reduce their exposure to risk by maintaining redundant ties, connecting with well-connected organizations, and reducing the brokerage role that other organizations may play. In contrast, when in high-risk situations (i.e., defection from collaborative arrangements), organizations tie to known organizations where trust is already well established (Berardo and Scholz 2010). Some political entrepreneur organizations are members of numerous inter-organizational collaborations, forming networks or supra-organizations. The formation of supra-organizations is not uncommon in environmental management collaborations (Westley and Vredenburg 1997). Studies have examined the formation of supra-organizations (Pasquero 1991), but few investigate change in the structure of such supra-organizations and collaborations within natural resource management (see exceptions Cohen et al. 2012; Lauber et al. 2011; Guerrero et al. 2015).

There is growing consensus on the importance of networks in individual or organizational strategic choices and the aggregation of these choices that form the dynamics of the policymaking process (Feiock et al. 2010; Henry et al. 2012; Thurner and Binder 2009; Berardo and Scholz 2010; Shrestha and Feiock 2009; Luthe et al. 2012). As Lubell et al. (2012) have argued, networks form the connection between macro-level institutional arrangements and the micro-level individual decisions. Multi-level linkages between national and local actors provide access to resources and learning (Cohen et al. 2012). Here, we contribute to the literature on collaborative institutions, including both government and non-governmental organizations at multiple levels, through the analysis of 16 formally established environmental collaborations including 125 total participating organizations. Additionally, we build upon the literature regarding the dynamics of collaborative governance works (see for example Lauber et al. 2011). By extending our study beyond a single collaboration, we are better able to understand the strategic choices that organizations are making within the context of a GNet. Within this network, organizations make choices about entering or exiting new agreements, sharing or not of resources, and forming or ceasing new/existing partnerships. We evaluate the pattern of multiple, overlapping collaborations between 1996 and 2011 (15 years). The evolution of the GNet over time allows us to investigate how and why these patterns change over time, the role of political entrepreneurs in this process, and how risk and trust influence collaboration patterns.

Methodology

In order to understand collaborative land management, we selected a county in Arizona with high levels of environmental interest and conflict, a fragmented pattern of land ownership, and a wide range of organizational actors, resulting in numerous and diverse collaborative efforts. In 2009–2010, we conducted semi-structured interviews with 78 individuals including: prominent landowners, leaders of collaborative organizations, non-governmental natural resource or environmental organizations, federal agency personnel involved in collaborations, and local government officials. Most interviews lasted between 1 and 2 h, with some lasting up to a day in the field. In 2010–2011, we conducted follow-up phone calls and emails with key informants to determine whether and how the network had changed or to resolve any incongruence in our existing network data. In addition, we engaged in participant observation, which allowed us to more actively work with and observe the community of natural resource managers and the wider borderlands community. By building rapport within the community through this engagement, we established trust needed to explore the nuances of collaboration. Additionally, our interviews with organizations opting not to collaborate, but instead pursue scientific research, litigation, or independent natural resource management gave us insight into the strategies beyond collaboration within the region.

Using field notes and archival analysis of Web sites and documents, we constructed organizational participation networks for sixteen collaborations from 1996 to 2011. There were 125 organizations that participated in these collaborations. Organizational participation in our study includes: signing a memorandum of understanding, filling a seat on the governing board of the collaboration, or being considered a regular partner by the other collaborating organizations. From the organizational participation, we built bipartite networks in which ties represent the participation of organizations to specific collaborative projects. In order to finalize the network construction, we used the snowball interviewing technique and asked interviewees to list any environmental collaborations they knew existed, and the interviews were stopped when information saturation was reached (no new environmental collaborations were listed) (Guest et al. 2006). This methodology provides construction of the entire network, rather than an elicitation

of the most commonly named network members, and minimizes recall bias (Guest et al. 2006).

Social network analysis

Social network analysis (SNA) is a tool for exploring linkages between actors, including individuals, households, or formal organizations. SNA is an ideal tool to explore the evolution and emergence of environmental collaborations over time, as it allows us to explicitly analyze the structure of the network in different time periods. In our study, we assessed collaborations from 1996 to 2011 and analyzed the GNet annually. Given that we are interested in changes over time, we assume that collaborative projects and organizations are always present (albeit they can be inactive) in all the temporal networks. That is, a collaborative project that attracts organizations in 2011 will be also artificially inserted in the 1996 network and assumed to have 0 linkages to all organizations. In this way, we can assess the actual growth of collaborative ties within the network controlling for the number of existing collaborative projects. We also assess the increase in collaborative projects that is the most likely cause of increased collaborative ties. In order to assess its evolution, we focus on four well-known network metrics: density, clustering, degree, and betweenness centrality. The analysis was performed using Ucinet 6 (for the visual representation) and Python, NetworkX bipartite algorithms. Given our interest in collaborations between organizations, we center our metrics on the set of nodes belonging to organizations and follow the work of Borgatti and others (Borgatti and Everett 1997; Borgatti and Halgin 2011; Faust (1997); Latapy et al. (2008)) to calculate metrics developed to analyze bipartite networks.

Density represents the degree to which a GNet is cohesive. In other words, density is defined as the number of ties between organizations that exist in the GNet, with respect to the maximum number of possible ties. Increased density may increase trust within the network; however, if the network density is too high, it has the potential to inhibit new strategies and innovation that could benefit the GNet (Dakos et al. 2015; Gilsing et al. 2008). Formally, density is calculated as follows (Borgatti and Everett 1997): $D = M_{\text{org}}/N_{\text{org}} * N_{\text{proj}}$ where D = density, M_{org} = total number of ties from organizations to projects, N_{org} = the number of organizations in the network, and N_{proj} = the number of collaborative projects in the network.

Another metric that has been related to trust is the clustering of the collaborative network. As with density, higher clustering may relate to higher pockets of trust and more collaboration within the network. However, high clustering could also be a synonym of a closed group that could potentially form a clique (here used in its general meaning), preventing the participation of others in future collaborative projects. Clustering is calculated following Latapy et al.'s (2008) concept asking "how many of my friends are also friends of themselves" (see Latapy et al. 2008 for a formal mathematical description of clustering coefficient in bipartite networks).

Degree centrality represents the number of collaborations that a specific organization has. Degree centrality is a way to measure the relative level of influence that a particular organization may have within the overall GNet. Degree can be normalized by the number of nodes (-1) in the network; however, when dealing with bipartite graphs, both sets of nodes must be accounted for (Borgatti and Halgin 2011, Faust 1997). We normalize the degree of an "organization node" by the number of collaborative projects in the network: $dn_{i,\text{org}} = d_{i,\text{org}}/N_{\text{proj}}$

Betweenness centrality represents the degree to which an actor is connected to or integrated in the network of all other actors, or their bridging capacity (Freeman 1978). Betweenness centrality describes the importance of a node in a network based on the flow (of information, resources, and so on) it can control. Organizations that have high betweenness are also unique in their ability to bridge the network and have the potential to emerge as political entrepreneurs (Bodin and Crona 2009; Dakos et al. 2015; Baggio et al. 2015). Betweenness centrality can be related to the ability of an organization to act as a gatekeeper: Organizations that bridge different clusters (i.e., have high betweenness centrality) can take advantage by controlling and benefitting from the flow of information between clusters. Such bridging organizations often have access to greater resources, are more influential, and are generally better positioned to assume brokerage roles where they can take advantage of the information benefits offered by their structural position (Burt 2001). Formally, for a bipartite network, the denominator by which we calculate betweenness centrality is the same as for a uni-partite network (Borgatti and Halgin 2011): $b_i = \sum \frac{L_{h,i,j}}{L_{h,j}}$ where $L_{h,j}$ represents the total number of shortest paths from organization h to organization j and $L_{h,i,j}$ represents the number of those paths that will pass through organization i. We also normalize b_i to reflect that maximum b_i is related to the relative size of the node-sets (see Borgatti and Halgin 2011 for a formal description of the normalization process).

Institutional analysis

Prior work has demonstrated the importance of institutions in shaping the incentives for natural resource managers (Schoon 2008) and their ability to work across jurisdictional or

property ownership boundaries (Schoon and York 2011). In fact, managers (or individuals) often have the power of crafting institutions—rules, norms, and shared strategies—by creating and changing collaboratives. These collaboratives attempt to solve a diverse array of natural resource management issues (Wondolleck and Yaffee 2000) such as scale mismatches and knowledge gaps. Using an institutional analysis approach, we identify the relevant actors and their goals in creating collaborative institutions (Clark et al. 2005; Ostrom 2005). We focus on how natural resource managers respond to environmental dilemmas through the development of institutions. We constructed the policy networks based on collaborative institutions using archival and ethnographic field methods. Using institutional analysis, we explore the nature of the problems that collaborations tackle and the roles of the organizations within such collaborations.

The combination of an in-depth study of institutional processes and social network analysis increases our ability to understand complex environmental governance. This approach has been successfully implemented by Lienert et al. (2013) who conducted a study of collaborations surrounding the planning for long-term water infrastructure in Sweden, combining social network analysis with institutional analysis. Complementing structural information (from social network analysis) with in-depth information on motivations (e.g., risk levels, social capital) that lead to the establishment of such networks is key to understanding policy networks, the role of political entrepreneurs, and ultimately the adoption of specific policies. This mixed-methods approach increases our understanding of the GNet dynamics and the role of actors within it.

Study site

Cochise County, located in southeastern Arizona, is a region with a rich history of environmental politics surrounding ranching, the military, border security and migration on the USA–Mexico border, and exurban development. In identifying the study site, we were interested in the intersection of unique ecosystems, diverse jurisdictional and land tenure divisions, and creative political responses emerging from the social–ecological interactions that span jurisdictional borders. There have been numerous heated debates in this area near the USA–Mexico border regarding land use rights, wildlife, and environmental management practices (York and Schoon 2011a, b; Bahre and Shelton 1996; Sheridan 2007). The Sky Islands area encompassing southeastern Arizona and southwestern New Mexico, extending into Mexico, is considered an ecological hotspot, one of the most ecologically diverse places in the world. Within this relatively small area, traveling the span of a few miles will produce ecosystems as varied as pine forests, deserts, mountains, marshes, and grassland (Sayre 2005).

Ranchers have traditionally fought for their right to ranch deeded land, whereas numerous environmental organizations have historically sought, both through legal and informal measures, land preservation or conservation. The differential land use stances (e.g., use vs. conservation) and the level of community integration (whether the organization is viewed as an insider or an outsider) of environmental organizations have led to various partnerships or feuds with rancher-led organizations in the region (Hutchinson et al. 2000). Such feuds between different interest groups have been further complicated by land ownership fragmentation (see Supplementary Figure 1). Because of the interconnected land ownership patterns, the challenging environmental issues, and dwindling resources for agencies, collaboration has become a critical approach for land management in the area.

The ecological hotspots found throughout Cochise County create numerous opportunities and challenges for the region's natural resource managers. These include creation of conservation corridors (Baggio et al. 2011; Salau et al. 2012) and landscape-level management (Schoon et al. 2014). These forms of inter-organizational environmental collaboration are increasing throughout the western USA (Wondolleck and Yaffee 2000; White 2008), usurping traditional management approaches to handling environmental problems on their own. One respondent summed up the need to collaborate by saying, "Fires don't read parcel maps".

Between 1996 and 2011, 16 major collaborations emerged in Cochise County (Table 1). Groups formalized to manage distinct resources and resource issues, including wildfires, river water resources, habitat for endangered species, and bee population and pollination issues. Of our 16 collaborations, the Malpai Borderlands Group was the first to form, in 1996. The Malpai Borderlands Group was a unique partnership formed between a diverse array of stakeholders, including ranchers, government agencies (US Forest Service or USFS), and environmental organizations (such as TNC). The collaboration emerged after long-standing disagreements between ranchers, local people, government bureaus, and environmental organizations on wildfire management in the area. Several in-depth studies have been published on this fascinating environmental collaboration (see Sayre 2005), detailing the atmosphere in which the Malpai Borderlands Group was established. Table 1 summarizes environmental collaborations in the area and the aim of these collaborations.

Results and discussion

The social network analysis revealed several major trends within the GNet between the years 1996 and 2011. Beginning with a focus on the top five organizations, as

Table 1 Environmental collaborations

Collaboration	Environmental resource concern
Malpai Borderlands Group	Wildfire management
Upper San Pedro Partnership	Watershed resources
Middle San Pedro Partnership	Watershed resources
Huachuca Firescape	Wildfire management
Chiricahua Firescape	Wildfire management
Wildlands Network Conservation Plan	Wildlife habitat
Upper San Pedro Water District	Watershed resources
Northern Jaguar Project	Wildlife reserves; habitats
International Pollinators Initiative	Wildlife/habitat critical to pollinators
Cuenca Los Ojos	Wildlife habitat; biological diversity
Willcox Playa Watershed Group	Watershed resources
Gila-Yaqui Watershed	Watershed resources
Borderlands Taskforce Group	Facilitating land use concerns
Sonoran Joint Venture	Sonoran bird habitat
Endangered Species Monitoring	Endangered species
Borderlands Management Taskforce	Facilitating land use concerns

defined by betweenness centrality, among government agencies, local NGOs, and national NGOs, we identify three phases (Fig. 1). In Phase I, from 1996 to 2002, there is a strong government agency presence, with a secondary participation by national NGOs, and no local NGO participation in the collaborations.

In Phase II, 2003–2008, we begin to see an increase in local NGO participation as well as participation of national NGOs surpassing that of government agencies in the network. The final phase, 2009–2011, presents a large spike in local NGO participation, with the average number of ties greatly surpassing those of the government agencies. The presence of the national NGOs also increases accordingly.

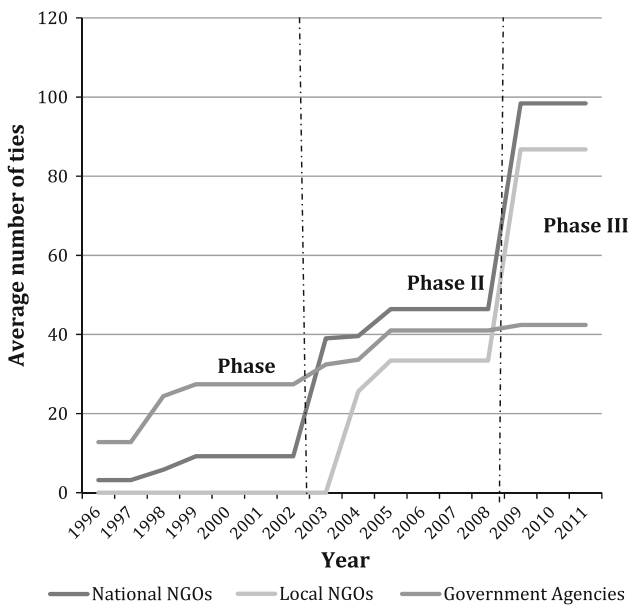


Fig. 1 Average number of ties for leading organizations

National NGOs had a presence in the network very early on, while local NGOs were not well connected until 2004. After this point, the presence of local NGOs in the network rapidly increases until the average number of ties held by the top five local NGOs surpasses the average ties held by the top five government agencies in the network.

To understand the evolution of the network structure over time, we calculated specific network metrics: density, degree, betweenness, and clustering (see Supplementary Table 2; Fig. 2a). Overall, density, degree, and betweenness centrality increased on average, while clustering declined on average. In the first phase, from 1996 to 2002, we see that the network density increases incrementally and slowly, while in the same time frame clustering steeply decreases. From 2002 to 2008, density increases slightly; however, in the shift from Phase II to Phase III, between 2008 and 2009, there is a steep increase in density and average betweenness centrality, while average degree slightly increases and clustering remains stable.

Density, as well as clustering, gives an indication of group formation and possible levels of trust within the network. However, it is important to notice that network density, although increasing (sharply between 2008 and 2009), is still far from being considered high. Sandström and Carlsson (2008) relate network density and the actual tie composition to collaboration success. They found that ties linking different types of actors aided joint action efforts. Wider diversity of actors combined with increased network density may ultimately increase the likelihood of success of the GNet in dealing with complex issues. On the other hand, Oh et al. (2004) find that excessively high

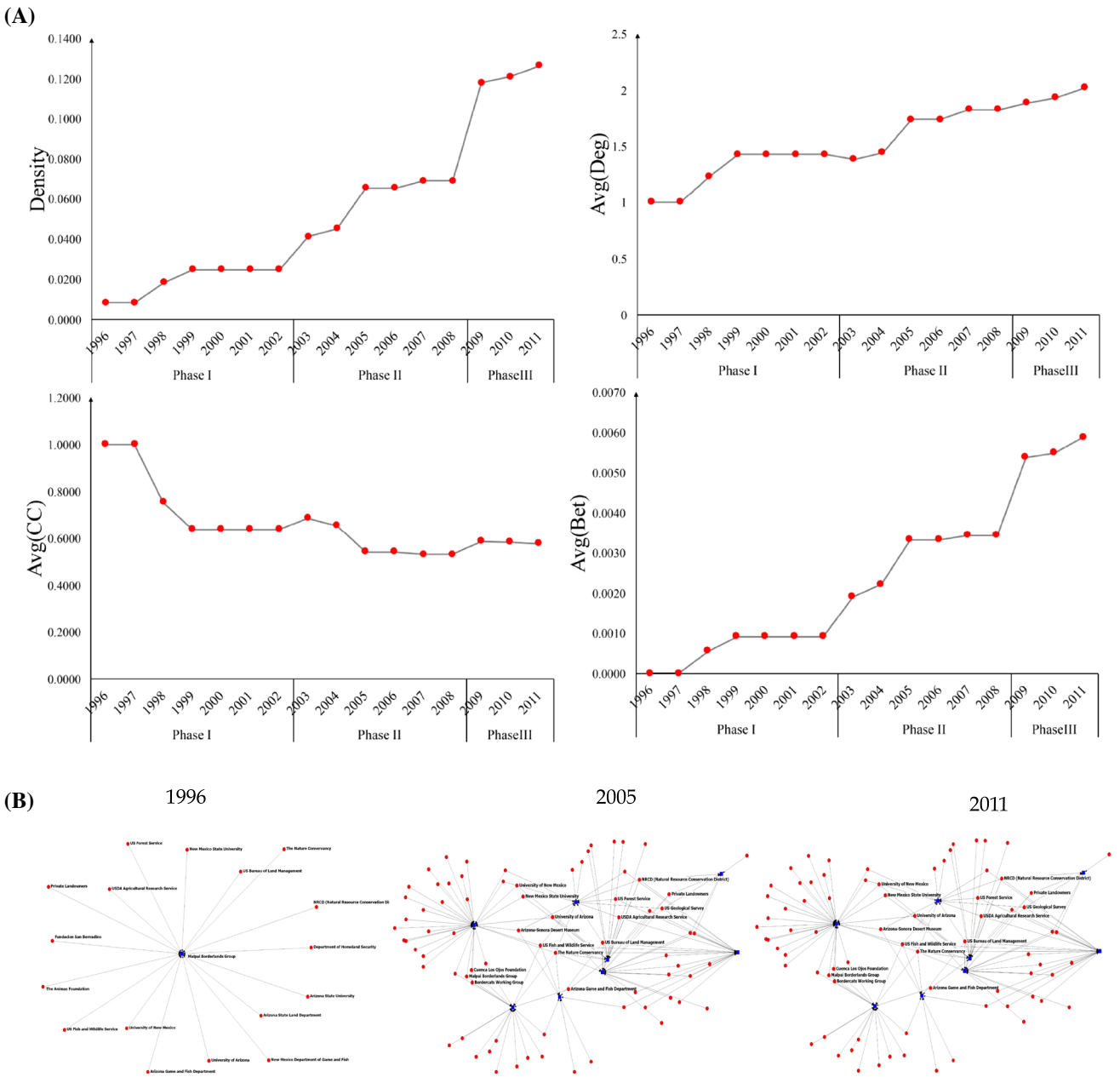


Fig. 2 Network metrics evolution

levels of density can actually decrease the network effectiveness in terms of collective action and increase the homogenization of information technology (this is especially true when density approaches its maximum, 1). It is possible that in the future, if new collaborations are continuously formed without other collaborations terminating and the network trend of increasing density and interconnectedness continues, the potential for collective action will decline. Based on interview responses, there was evidence of collaboration fatigue among participants that could indicate a weariness for future collaboration (Schoon 2012).

While there is an increase in network density, the average clustering coefficient decreased over time. A growth in total projects has supported collaboration with different partners, thus avoiding the sense of closure and possible problems related to "idea exclusion." We also observe an escalation in average betweenness centrality that may be a result of some organizations increasingly assuming leadership roles in coordinating or executing projects. However, the same increase in betweenness centrality could also signify that some organizations may take advantage of their position and promote specific agendas. The relationship between network metrics and success of

collaboration is, however, not explored here nor in the literature, although work is underway to start disentangling the relationship between density, centralization, and collaboration productivity, but our results do follow literature indicating that the structure of networks evolves over time (Lauber et al. 2011).

Phase I

During interviews, network members discussed the reasons for joining (and not joining) collaborations, which helped us interpret the meaning behind changes in network metrics and why we see shifts in the composition and role of actors over 15 years. In the first phase, federal land policy and money played a critical role. The Malpai Borderlands began to work with the federal agencies because of problems associated with fire policy on state and federal lands. The Malpai Borderlands Group was created through collaboration between ranchers, USFS, and Arizona Land Department managers over fire management issues, starting in Phase I (Fig. 2b). This approach was not just innovative for the region, but also influenced federal policy for public–private land management in the west (White 2008). Prior to the formalization of fire planning with the Malpai Borderlands Group, according to a federal land manager, the willingness of the local USFS ranger to allow burns was a combination of the individual ranger's perspective and state or federal policy. Ranchers often wanted fires to continue burning, resulting in frequent conflict between ranchers and agency officials. An especially testy exchange occurred in 1994, which ultimately led to the formation of the Malpai Borderlands Group to resolve this and other conflicts surrounding land management. Joining the Malpai group early on was a risk for ranchers; one local policymaker noted that when the Malpai first began meeting "they (the Malpai) were frightening to other ranchers." Eventually, ranchers became worried about losing their way of life if they continued to forgo the partnership. These early ties partially were based on trust built over time, but because of the perceived high risk (sensu Berardo and Scholz 2010) the collaboration was slowly built. Several issues have recently threatened the Malpai, particularly issues associated with the USA–Mexico border and the contentious debates surrounding designation of critical habitat for the jaguar, but so far the group has withstood these conflicts, even in the face of partners' dissenting views.

Another highly contested environmental issue led to the establishment of the second major collaboration in the county. The San Pedro River runs through this region and is an important ecological hotspot. In 2002, the Center for Biological Diversity won a lawsuit against the federal government, including Fort Huachuca, over lack of instream flow and the resultant habitat loss for the endangered water umbel. This first resulted in great controversy and later in collaboration through the Upper San Pedro Partnership (USPP), which focused on reducing groundwater overdraft and maintaining the river. The USPP includes public agencies from multiple levels of government as well as local and national NGOs to manage the river, but the efficacy of their efforts is the topic of frequent debate, particularly among environmental legal organizations. A local planner noted that the USPP was a huge turning point for collaboration in the region, but many of the substantive changes occurring through the USPP take place in the second phase of network evolution. According to participating officials, in 2005, there was a push to the local level, with politicians arguing that "the Fort had to work with Sierra Vista" to fix the problem. USPP is an important collaboration that continues to impact the regional GNet. Federal biologists involved with the USPP worried where the collaboration was headed in the future. They felt that there was a sentiment that the "federal government should solve the problem" by sending money to support the efforts by the city and other entities, but that the federal government should not be directly involved. The federal biologists noted that this was the "mantra of the west," an issue testing levels of trust in the collaboration. They also discussed the strong emphasis placed on federal agencies by state offices and in DC to cooperate with other agencies and NGOs. Thus, top-down initiatives regarding collaboration between agencies and other actors prompted continued federal involvement in collaborative efforts.

In contrast, the International Pollinators Initiative grew out of a global concern about the decline in agricultural production and biodiversity loss. The global initiative is led by the Food and Agriculture Organization of the United Nations at the international level, but regional and local partners create local projects. At our study site, the projects are largely led by government partners, the US Fish and Wildlife Service and National Park Service, on federal land. Although there are on-the-ground projects, this collaboration did not generate much discussion among our study participants. The issues associated with pollinators were recognized by almost everyone we talked to, so we would argue that, unlike the previous collaborations, this was a relatively low-risk initiative leading to swift adoption (Berardo and Scholz 2010).

Between 1996 and 1999, two of the collaborations were the result of crisis: controversy over fire management (Malpai Borderlands Group) and a lawsuit over maintaining water for an endangered species (Upper San Pedro Partnership), and one collaboration is based on local projects under a global initiative (International Pollinators). These early collaborations set the stage for the

development and evolution of the GNet through the next two phases with high levels of risk in collaborating and relatively low levels of trust and social capital in the network. At the end of Phase I in 2000, a new collaboration, the Wildlands Network Conservation Plan, grew out of efforts by the Sky Islands Alliance, a local NGO, to conserve critical habitats and largely involved environmental NGOs. This marked the transition to a new phase of NGO-led initiatives in the environmental GNet. Thus, we find that gaining access to resources was critical in the formation of the high-risk ties (Berardo and Scholz 2010) and enabled a shift in the network toward more collaborative approaches (Westley and Miller 2003; Hanger et al. 2013).

Phase II

The second phase introduces an increased number of government ties, more national NGO ties, and a small number of local NGOs extending opportunities for multi-level learning and management (Cohen et al. 2012). Between 2003 and 2008, six additional collaborative groups were added to the network: Borderlands Management Taskforce, Northern Jaguar Project, Sonoran Joint Venture, Cuenca Los Ojos, Middle San Pedro Partnership, and Willcox Playa Watershed Group (Fig. 2b; Supplementary Table 2). During this period, there was a continuation of the international nature of environmental governance collaborations as evidenced by the International Pollinators Initiative and Wildlands Network. NGOs became increasingly involved, filling gaps in the network left by governmental agencies.

The Northern Jaguar Project works to educate communities and maintain habitat for the jaguar in Mexico, Arizona, and New Mexico on both public and private lands. It partners US and Mexican NGOs to link habitat from Central America into the USA. The Sonoran Joint Venture has similar goals, focusing on the conservation of birdlife through habitat connectivity in Mexico and the USA by partnering governmental agencies with NGOs in both countries. Cuenca Los Ojos also coordinates NGOs in the USA and Mexico for habitat and riparian restoration and conservation. Similarly, the Borderlands Management Taskforce joins 15 federal, local, and tribal government agencies to monitor environmental issues along the border, including following National Environmental Policy Act (NEPA) regulations and coordinating between government agencies on environmental issues along the border like erosion from illegal migration and cleaning up border trash. The Middle San Pedro Partnership and the Willcox Playa Watershed Group are both driven by community members and local governments concerned about water conditions in their surroundings. Both link community activists with the Arizona Department of Environmental Quality (ADEQ) and the Arizona Department of Water Resources (ADWR) and their local Natural Resource Conservation District (NRCD). Each struggles to maintain momentum without the impetus of the USPP's legal challenges or NGO players that can support a collaborative infrastructure. The risk to water quality, biodiversity, and habitat led to the introduction of new NGO-led initiatives, which greatly changed the collaborations from the previously government-driven projects regarding financial resources, project infrastructure, and nature of the collaborations (building on shared ideals rather than perceived threats or lawsuits). Thus, during this phase we see a shift toward bottom-up types of collaboration (Ostrom 1990), but also maintenance and expansion of ties build during prior phases Lauber et al. 2011).

Phase III

In Phase III, between 2009 and 2011, six collaborations began: Gila-Yaqui Watershed Partnership, Huachuca Firescape, Upper San Pedro Water District, Chiricahua Firescape, Endangered Species Monitoring Project, and the Cascabel Working Group (Fig. 2b; Supplementary Table 3).

During this period, we see an expansion in the number of projects, but many of the collaborations emerge from existing partnerships; for instance, the Chiricahua Firescape is an expansion of the Malpai Borderlands Group fire plan, including more actors and land. The Gila-Yaqui Watershed grew out of discussions that began within Cuenca Los Ojos projects. Similarly, the Huachuca Firescape and the Upper San Pedro Water District began in discussions between organizations already active in longer-running collaborations like the USPP and Malpai.

In the final phase, national NGOs remain prominent, but the ties of local NGOs surpass those of government organizations, which stands in contrast to the difficulty found by Guerrero et al. (2015) in maintaining and expanding GNets both at the same level and at across levels. This pattern of change in the composition of the network over time points to the shifting political context of the region. In addition to the changing network composition, the overall network became denser over time, with a large increase in the third phase. Networks that have higher density levels offer more opportunities for collective action and communication, leading to higher levels of trust over time (Bodin and Crona 2009; Janssen and Ostrom 2006). These factors, particularly mutual trust, have an important impact on the outcomes of environmental collaborations (Bodin and Crona 2009), with outcomes tending to be more successful with greater mutual trust.

Evolution of strategic decision-making and political entrepreneurs

Examining the 125 organizations in the network, several emerged as political entrepreneurs. That is, some organizations played important roles in influencing the structure of the network over time. Betweenness centrality and degree centrality are shown in Supplementary Tables 2 and 3 for the 15 organizations with the highest measures in the 3 years. Rank was determined by betweenness, degree and clustering. The emergence of organizations acting as political entrepreneurs and influencing the GNet is supported by a small number of organizations with the highest levels of degree and betweenness centrality. However, such organizations also display a decreasing clustering, suggesting that their role is one of coordination rather than "control" of the network. It is apparent that TNC, a national NGO, is ranked first in terms of betweenness each year, and throughout each phase, in the network. From the network diagrams (Fig. 2), it is clear that the structural position of TNC is one of bridging, coordinating, and possibly mobilizing resources and other organizations around multiple projects in the area. The observations from Supplementary Tables 2 and 3 support the notion that the positions of some organizations acting as political entrepreneurs change over time, while others, like TNC, remain static (since 1999). For example, in 2003, the year that the multi-way tie for the highest level of betweenness changes, we see the US Fish and Wildlife Service (USFWS) tie with TNC for the highest level of betweenness.

USFWS officials began to engage with the Malpai Borderlands Group in 1996–1997. Specifically, they sent individuals to group meetings to "keep a finger on the pulse". They augmented their original goals not only to "get the cattle out of riparian areas," but also to improve relationships with ranchers frustrated with the amount of time spent consulting with the BLM and the USFS. This also marked an explicit shift in USFWS doctrine from the role of monitor and enforcer to a position of facilitator and enabler. This shift increased their role in the network through the mid-2000s potentially increasing and strengthening management mission through their influence on collaborators (Cohen et al. 2012).

An interesting temporal gap where no new collaborations were formed is present between 1999 and 2003. This large temporal gap may be the result of political and government administrations and legislation at the time, reflecting a shift from the Clinton administration to the aftermath of September 11, 2001, the Bush administration, and policy surrounding the USA–Mexico Border. This new political environment shifted the network composition from government led to one with a strong local NGO presence, not only changing the network structure but the type of political entrepreneur that emerged (York and Schoon 2011a, b). No new collaborations are developed during 2000–2002, and the network configuration does not change. In 2005, TNC assumes a prominent role in the environmental GNet (reflected in its structural position shown in Supplementary Table 2—betweenness and degree). At the same time, we notice an increasing number of local NGOs also becoming instrumental in the network. These include the Cuencas Los Ojos Foundation and the Bordercats Working Group. The next major change in the network appears in 2009 and continues up to 2011, when private landowners not only emerge in the top 15, but are ranked second in the network in terms of betweenness (see Supplementary Table 3). At the same time, TNC consolidates its prominent role as a political entrepreneur in the region, having a betweenness centrality measure more than twice the next-ranked organization. More local NGOs begin to dominate the top organizations in the network including the Sky Island Alliance, Chiricahua Regional Council, and Coalition for Sonoran Desert Protection. In turn, several government agencies seem to reduce the influence they have in the network: Only the USFWS and the BLM remain in the top 15.

The types of collaborations vary across the region including agreements about land management on private property and government allotments, as well as new partnerships with agencies involved in land management. In the 15 years since the Malpai Borderlands Group began, the collaborative environmental GNet in southeastern Arizona has expanded to include 125 organizations and 15 additional formal collaborations. Through our interviews and research, we were able to construct the GNet and simultaneously understand the origin of the collaborations. Our study highlights two key findings. First, we are able to examine the role that specific organizations as political entrepreneurs, such as The Nature Conservancy, have played in the GNet by initiating new collaborations and bridging existing collaborations together into supra-organizations. Second, we find that strategic decision-making associated with risk and trust by these entrepreneurs dominates collaboration and entry/exit choices within the GNet. Because of the diverse origins and types of actors engaged in collaborative governance within our study, we find support for several different, sometimes competing, ideas about the dynamics of collaborative governance. During Phase I, Federal agencies began collaborating in the 1990s as a response to a reduction in budgetary resources and top-down pressure to work with other agencies. High-risk ties slowly emerged (Berardo and Scholz 2010), while low-risk groups were able to quickly build connections. These pressures continued after 2005 due to increasing demands for non-core missions associated with border security, but this allowed the groups to continue building

relationships established during Phase I (Lauber et al. 2011). National NGOs began to dominate the second phase, but in the final phase we see growth of local NGOs that are increasingly connected and entrepreneurial often engaging in multiple groups in order to advance different priorities (Lubell et al. 2012), but also that local NGOs continue to advance and emerge as important players both regionally and connecting to national actors (which stands in contrast to Guerrero et al. 2015).

Conclusions

As an ecological hotspot with a long history of ranching conflict, abundant environmental management issues, and a diverse set of stakeholders, Cochise County is an ideal area to explore the emergence and evolution of an environmental GNet. We analyzed the evolution of the network in three phases, exploring the changes in the composition of the ties and the overall expansion of the network through the addition of new collaborations and partners. The network displayed the emergence of organizations acting as political entrepreneurs influencing the direction and type of collaborations within the network, including the ever-present TNC, the highly influential USFWS, and several influential local NGOs such as Cuenca Los Ojos and the Sky Islands Alliance. The emergence and continued influence of these organizations are strongly affected by external policy and government administration factors in a given temporal period, an observation that likely applies to the formation of other environmental GNets beyond southeastern Arizona. We find evidence of shifting roles of national versus local actors with the importance of new, local NGOs growing throughout the study period.

The case study presented here illustrates network dynamics by examining when new collaborations emerged and which players played a central role in creating new collaborations and "steering" the GNet. Although some actors maintained an important position central to the network (i.e., TNC), others shifted between central and marginal roles (local NGOs, private landowners, government agencies). Interviews with key stakeholders suggest that these shifts are due to perceptions of risks and potential benefits associated with establishing new ties; high-risk collaborations took time and commitment to building trust, while low-risk collaborations formed quickly, yet perhaps played a less important role in the overall GNet. Furthermore, the external factors such as pending litigation, policy changes, and emerging funding opportunities in all likelihood shaped the network evolution and the decision-making process.

In our study, we found that litigation motivated collaboration, especially with regard to water resources in southeastern Arizona. The role of litigation associated with biodiversity is mixed; it has sometimes been a source of some conflict between partners in the Malpai Borderlands group, while on other occasions it has motivated cooperative activity. Biodiversity litigation has also affected the ability of some environmental groups to partner with other interests. Thus, it is imperative that we consider conflict as both a potential impediment and stimulus when we evaluate strategic decision-making within a GNet. Future research will investigate the factors that contribute to the formation of environmental collaborations in Cochise County using legal data concerning lawsuits in the region and historical data.

Over time, the density of this network has continually increased, potentially creating a network with more opportunities for collective action and possibly increasing trust between actors. Although still low, continuous increase in network density has the potential to amplify costs associated with meetings, information, and redundancy of organizational action, possibly diminishing the ability to adapt to novel changes (Dakos et al. 2015). The three phases identified in the network evolution, and connecting this evolution to policy changes, may provide a general framework for others seeking to understand the beginning, establishment, and end of collaborations. Our in-depth institutional analysis highlighted the role that perceptions of risk play in creating or joining a collaborative institution. Organizations frequently recounted the importance of trust in working on particularly risky topics. History, both good and bad, between individuals and organizations allowed some collaborations to move forward even in the face of conflict or potential for lawsuits, while other collaborations stalled before formalization. In this region, none of the collaborations have disbanded yet, but the level of activity in some collaborative groups has slowed.

Until very recently, conflict reigned between private citizens and government agents. Likewise, environmentalists squared off against federal agencies through lawsuits and argued with ranchers over land management. However, in the 1990s, daring individuals from these disparate groups began to cross ideological divides and work together on issues of shared interest. In our cases, collaborative groups emerged and expanded dramatically, incorporating a wide range of actors in the region on a diverse set of issues. Strategic choices by agencies and NGOs led to the formation of collaboration as a means to deal with both complex and contested, risky issues. For other groups, this risk and a preference for individual action or litigation or lack of trust with other collaborators reduced participation. As the world becomes increasingly interconnected, and the management of resources incorporates interconnected stakeholders in larger collaborations, the evaluation of these networks in their institutional and political context

can provide valuable insights for future management efforts. Collaboration is not a panacea for environmental challenges, but understanding how groups leverage resources, address conflict, and manage complex collective action problems through a GNet is imperative. We envision our findings regarding the role of high- versus low-risk collaboration, extension of existing relationships, and importance of both local–national and local–local ties extending beyond our southeastern Arizona case study and hope that a better understanding of the decision-making processes in environmental collaborations will provide insight to researchers and practitioners working in a wide variety of contexts.

References

Baggio J, Salau K, Janssen M, Schoon M, Bodin Ö (2011) Landscape connectivity and predator–prey population dynamics. Landsc Ecol 26(1):33–45. doi:10.1007/s10980-010-9493-y

Baggio J, Brown K, Hellebrandt D (2015) Boundary object or bridging concept? A citation network analysis of resilience. Ecol Soc 20(2):2. doi:10.5751/ES-07484-200202

Bahre C, Shelton M (1996) Rangeland destruction: cattle and drought in southeastern Arizona at the turn of the century. J Southwest 38(1):1–22

Baird J, Plummer R, Bodin Ö (2016) Collaborative governance for climate change adaptation in Canada: experimenting with adaptive co-management. Reg Environ Change 16(3):747–758. doi:10.1007/s10113-015-0790-5

Berardo R, Scholz J (2010) Self-organizing policy networks: risk, partner selection and cooperation in estuaries. Am J Polit Sci 54(3):632–649. doi:10.1111/j.1540-5907.2010.00451.x

Berkes F (2009) Evolution of co-management: role of knowledge generation, bridging organizations and social learning. J Environ Manag 90(5):1692–1702. doi:10.1016/j.jenvman.2008.12.001

Bodin Ö, Crona B (2008) Management of natural resources at the community level: exploring the role of social capital and leadership in a rural fishing community. World Dev 36(12):2763–2779. doi:10.1016/j.worlddev.2007.12.002

Bodin Ö, Crona B (2009) The role of social networks in natural resource governance: what relational patterns make a difference? Glob Environ Change 19(3):366–374. doi:10.1016/j.gloenvcha.2009.05.002

Borgatti S, Everett M (1997) Network analysis of 2–mode data. Soc Netw 19(3):243–269. doi:10.1016/S0378-8733(96)00301-2

Borgatti S, Halgin D (2011) Analyzing affiliation networks. In: Carrington P, Scott J (eds) The Sage handbook of social network analysis. Sage Publications, Thousand Oaks, pp 417–433

Burt R (2001) Structural holes versus network closure as social capital. In: Lin N, Cook K, Burt R (eds) Social capital: theory and research. Aldine de Gruyter, London

Childs C, York A, White D, Schoon M, Bodner G (2013) The emergence of adaptive co-management in the Agua Fria watershed, Arizona, USA. Ecol Soc 18(4):11. doi:10.5751/ES-05636-180411

Clark B, Burkardt N, King M (2005) Watershed management and organizational dynamics: nationwide findings and regional variation. Environ Manag 36(2):297–310. doi:10.1007/s00267-004-1039-0

Clarke A, Fuller M (2010) Collaborative strategic management: strategy formulation and implementation by multi-organizational cross-sector social partnerships. J Bus Ethics 94(1):85–101. doi:10.1007/s10551-011-0781-5

Cohen P, Evans L, Mills M (2012) Social networks supporting governance of coastal ecosystems in Solomon Islands. Conserv Lett 5(5):376–386. doi:10.1111/j.1755-263X.2012.00255.x

Dakos V, Quinlan A, Baggio J, Bennett E, Bodin Ö, BurnSilver S (2015) Chapter 4 principle 2–manage connectivity. In: Biggs R, Schuelter M, Schoon M (eds) Principles for building resilience: sustaining ecosystem services in social-ecological systems. Cambridge University Press, Cambridge, pp 80–97

DiMaggio P (1988) Interest and agency in institutional theory. In: Zucker L (ed) Institutional patterns and organizations: culture and environment. Ballinger, Cambridge, pp 3–22

Faust K (1997) Centrality in affiliation networks. Soc Netw 19(2):157–191. doi:10.1016/S0378-8733(96)00300-0

Feiock R, Lee W, Park H, Lee K (2010) Collaboration networks among local elected officials: information, commitment, and risk aversion. Urban Aff Rev 46(2):241–262. doi:10.1177/1078087409360509

Freeman L (1978) Centrality in social networks conceptual clarification. Soc Netw 1(3):215–239. doi:10.1016/0378-8733(78)90021-7

Gilsing V, Nooteboom B, Vanhaverbeke W, Duysters G, van den Oord A (2008) Network embeddedness and the exploration of novel technologies: technological distance, betweenness centrality and density. Res Policy 37(10):1717–1731. doi:10.1016/0378-8733(78)90021-7

Guerrero A, McAllister R, Wilson K (2015) Achieving cross-scale collaboration for large-scale conservation initiatives. Conserv Lett 8(2):107–117. doi:10.1111/conl.12112

Guest G, Bunce A, Johnson L (2006) How many interviews are enough? An experiment with data saturation and variability. Field Meth 18(1):59–82. doi:10.1177/1525822X05279903

Hanger S, Pfenninger S, Dreyfus M, Patt A (2013) Knowledge and information needs of adaptation policy-makers: a European study. Reg Environ Change 13(1):91–101. doi:10.1007/s10113-012-0317-2

Henry A, Lubell M, McCoy M (2012) Survey-based measurement of public management and policy networks. J Policy Anal Manag 31(2):432–452. doi:10.1002/pam.21623

Holcombe R (2002) Political entrepreneurship and the democratic allocation of economic resources. Rev Austrian Econ 15(2–3):143–159. doi:10.1023/A:1015758419984

Hutchinson C, Unruh J, Bahre C (2000) Land use vs. climate as causes of vegetation change: a study in SE Arizona. Glob Environ Change 10(1):47–55. doi:10.1016/S0959-3780(00)00009-1

Janssen M, Ostrom E (2006) Empirically based, agent-based models. Ecol Soc 11(2):37

Latapy M, Magnien C, Del Vecchio N (2008) Basic notions for the analysis of large two-mode networks. Soc Netw 30(1):31–48. doi:10.1016/j.socnet.2007.04.006

Lauber T, Stedman R, Decker D, Knuth B, Simon C (2011) Social network dynamics in collaborative conservation. Hum Dimens Wildl 16(4):259–272. doi:10.1080/10871209.2011.542556

Lienert J, Schnetzer F, Ingold K (2013) Stakeholder analysis combined with social network analysis provides fine-grained insights into water infrastructure planning processes. J Environ Manag 125:134–148. doi:10.1080/10871209.2011.542556

Lubell M, Scholz J, Robins G, Berardo R (2012) Testing policy theory with statistical models of networks. Policy Stud J 40(3):351–374. doi:10.1111/j.1541-0072.2012.00457.x

Luthe T, Wyss R, Schuckert M (2012) Network governance and regional resilience to climate change: empirical evidence from mountain tourism communities in the Swiss Gotthard region. Reg Environ Change 12(4):839–854. doi:10.1007/s10113-012-0294-5

Maguire S, Hardy C, Lawrence T (2004) Institutional entrepreneurship in emerging fields: HIV/AIDS treatment advocacy in Canada. Acad Manag J 47(5):657–679. doi:10.2307/20159610

Ménard C, Shirley M (2008) Handbook of new institutional economics. Springer, Berlin

Oh H, Chung M, Labianca G (2004) Group social capital and group effectiveness: the role of informal socializing ties. Acad Manag J 47(6):860–875. doi:10.2307/20159627

Ostrom E (1990) Governing the commons: the evolution of institutions for collective action. Cambridge University Press, Cambridge

Ostrom E (2005) Understanding institutional diversity. Princeton University Press, Princeton

Pasquero J (1991) Supraorganizational collaboration: the Canadian environmental experiment. J Appl Behav Sci 27(1):38–64. doi:10.1177/0021886391271003

Sabatier P, Jenkins-Smith H (1988) Symposium editors' introduction. Policy Sci 21(2–3):123–127. doi:10.1007/BF00136405

Salau K, Schoon M, Baggio J, Janssen M (2012) Varying effects of connectivity and dispersal on interacting species dynamics. Ecol Model 242:81–91. doi:10.1016/j.ecolmodel.2012.04.028

Sandström A, Carlsson L (2008) The performance of policy networks: the relation between network structure and network performance. Policy Stud J 36(4):497–524. doi:10.1111/j.1541-0072.2008.00281.x

Sayre N (2005) Working wilderness: the Malpai Borderlands Group and the future of the western range. Rio Nuevo Publishers, Tucson

Schneider M, Teske P (1992) Toward a theory of the political entrepreneur: evidence from local government. Am Polit Sci Rev 86(3):737–747. doi:10.2307/1964135

Scholz J, Wang C (2006) Cooptation or transformation? Local policy networks and federal regulatory enforcement. Am J Polit Sci 50(1):81–97. doi:10.1111/j.1540-5907.2006.00171.x

Schoon M (2008) Building robustness to disturbance: Governance in southern African peace parks. Dissertation, Indiana University-Bloomington

Schoon M (2012) Governance in southern african transboundary protected areas. In: Quinn M, Broberg L, Freimund W (eds) Parks, peace, and partnerships. University of Calgary Press, Calgary, pp 205–236

Schoon ML, York AM (2011) Cooperation across boundaries: the role of political entrepreneurs in environmental collaboration. J Nat Resour Policy Res 3(2):113–123

Schoon M, Baggio J, Salau K, Janssen M (2014) Insights for managers from modeling species interactions across multiple scales in an idealized landscape. Environ Model Softw 54:53–59. doi:10.1016/j.envsoft.2013.12.010

Schultz L (2009) Nurturing resilience in social-ecological systems: Lessons learned from bridging organizations. Dissertation, Stockholm University

Sheridan T (2007) Embattled ranchers, endangered species, and urban sprawl: the political ecology of the new American west. Annu Rev Anthropol 36(2007):121–138. doi:10.1146/annurev.anthro.36.081406.094413

Shrestha M, Feiock R (2009) Governing U.S. metropolitan areas: self-organizing and multiplex service networks. Am Polit Res 37(5):801–823. doi:10.1177/1532673X09337466

Stiller S, Meijerink S (2016) Leadership within regional climate change adaptation networks: the case of climate adaptation officers in Northern Hesse, Germany. Reg Environ Change 16(6):1543–1555. doi:10.1007/s10113-015-0886-y

Thurner P, Binder M (2009) The comparative value of transgovernmental administrative networking (SSRN Scholarly Paper No. ID 1450397). Social Science Research Network, Rochester. http://papers.ssrn.com/abstract=1450397

Westley F, Miller P (2003) Experiments in consilience integrating social and scientific responses to save endangered species. Island Press, Washington, DC

Westley F, Vredenburg H (1997) Interorganizational collaboration and the preservation of global biodiversity. Organ Sci 8(4):381–403. doi:10.1287/orsc.8.4.381

White C (2008) Revolution on the range: the rise of a new ranch in the American west. Island Press, Washington DC

Wondolleck J, Yaffee S (2000) Making collaboration work: lessons from innovation in natural resource management. Island Press, Washington DC

York A, Schoon M (2011a) Collective action on the western range: coping with external and internal threats. Int J Commons 5(2):388–409

York A, Schoon M (2011b) Collaboration in the shadow of the wall: shifting power in the borderlands. Policy Sci 44(4):345–365. doi:10.1007/s11077-011-9138-2