Navigating governance networks for community-based conservation

Steven M Alexander[1,2,3*†], Mark Andrachuk[3,4†], and Derek Armitage[3,5†]

Governance networks can facilitate coordinated action and shared opportunities for learning among conservation scientists, policy makers, and communities. However, governance networks that link local, regional, and international actors just as often reflect social relationships and arrangements that can undermine conservation efforts, particularly those concerning community-level priorities. Here, we identify three "waypoints" or navigational guides to help researchers and practitioners explore these networks, and to inspire them to consider in a more systematic manner the social rules and relationships that influence conservation outcomes. These waypoints encourage those engaged in community-based conservation (CBC) to: (1) think about the networks in which they are embedded and the constellation of actors that influence conservation practice; (2) examine the values and interests of diverse actors in governance, and the implications of different perspectives for conservation; and (3) consider how the structure and dynamics of networks can reveal helpful insights for conservation efforts. The three waypoints we highlight synthesize an interdisciplinary literature on governance networks and provide key insights for conservation actors navigating the challenges of CBC at multiple scales and levels.

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A little over a decade ago, Berkes (2004) argued that community conservation "starts from the ground up but deals with cross-scale relations", and that a more nuanced understanding is needed of "people, communities, institutions, and their interrelations at various levels". This perspective of community-based conservation (CBC) leads us into the realm of governance networks. We define governance as the formal and informal rules, rule-making systems, and actor networks at all levels (local, regional, global) that influence how societies identify, design, and implement conservation actions (adapted from Biermann *et al.* 2009; see also Lebel *et al.* 2006 and Scarlett and McKinney 2016). A focus on governance networks helps to draw attention to the relationships (or lack thereof) among individuals (eg harvesters, policy makers), organizations (eg local conservation committees, government agencies), and conservation objectives (eg restoration, protection, multi-use) (see Scarlett and McKinney 2016, and specifically Panel 1 therein, for more on governance networks, or network governance). Such a focus also highlights the interplay (good and bad) of values and interests among a diverse range of conservation actors.

Governance networks are presumed to generate benefits by promoting interaction between organizations, agencies, and other actors through which conservation decisions are made and actions are taken (eg within and between the state, civil society, and the private sector; see Torfing 2005; Evans 2012; Panel 1 in Scarlett and McKinney 2016). These benefits may include opportunities to identify and resolve social conflicts – for example, between resource users and enforcement officers – that would otherwise undermine biodiversity protection or the cooperation necessary to establish protected areas (Redpath *et al.* 2013). However, such benefits may not always exist in practice, or the network arrangements that do exist may exacerbate unequal social relationships and obstruct conservation efforts, as is the case where powerful interests in the network (eg industry) can overwhelm the priorities of community-based actors (Agrawal and Gibson 1999; Raik *et al.* 2008; see also WebPanel 1).

In a nutshell:

- Community-based conservation (CBC) initiatives are embedded in governance networks (local to global) that include a diversity of actors
- We identify three "waypoints" to help those involved in conservation (eg researchers, practitioners) navigate the governance networks in which they work, and to understand how those networks influence conservation objectives
- A better understanding of governance networks can improve implementation of CBC efforts and help to integrate those efforts within landscape-scale conservation practices

[1]*National Socio-Environmental Synthesis Center, University of Maryland, Annapolis, MD* [*]*(salexander@sesync.org)*; [2]*Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden*; [3]*Environmental Change and Governance Group, University of Waterloo, Waterloo, Canada*; [4]*Department of Geography and Environmental Management, University of Waterloo, Waterloo, Canada*; [5]*School of Environment, Resources and Sustainability, University of Waterloo, Waterloo, Canada*; [†]*these authors contributed equally to this work*

Our objective here is to help conservation actors (eg researchers, practitioners) navigate the formal and informal governance networks in which their work is embedded. We do this by identifying several "waypoints" (defined below; Figure 1) for conservation actors to understand the broader set of relationships in which they are embedded and seek to influence. For purposes of navigation, a waypoint can be a useful point of reference along a journey. Waypoints include, in the most traditional sense, a set of geographic coordinates (such as longitude and latitude) that identify a physical location and help a traveler to consider where they are in relation to other features on the landscape. Just as these waypoints can serve as markers that travelers use to confirm their path, we suggest that waypoints provide a good analogy for community-based practitioners navigating networks.

The three waypoints we highlight here connect with specific questions and debates about governance networks, emphasize what features of governance networks to examine, and generate insights to critically reflect on and navigate the social relationships that affect CBC. There is no single pathway or approach to considering governance networks, but the waypoints offered here serve as a starting point for the practical evaluation of CBC in a landscape context (eg Bixler *et al.* 2016).

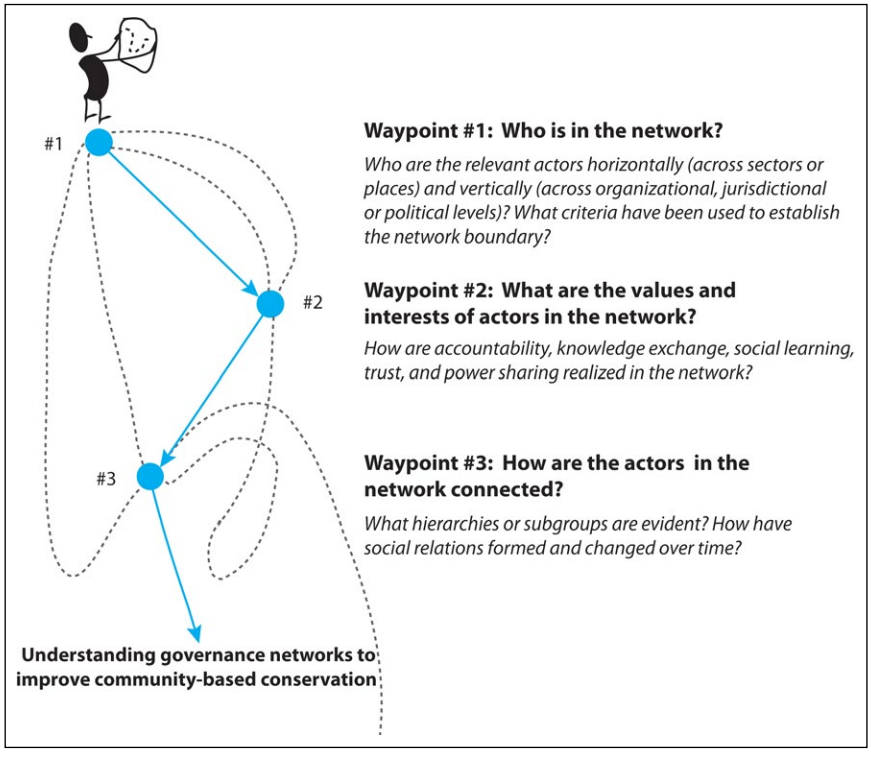

Figure 1. *Questions at each waypoint require choices about the nature and role of social interactions that influence our understanding of networks. Knowing and enhancing governance networks can lead toward improved community-based conservation outcomes.*

Three waypoints to help navigate networks for CBC

Community-based conservation can include a suite of activities, actions, and initiatives that range from biodiversity protection to restoration and stewardship. This type of conservation emphasizes the coexistence of humans and the environment (including the built environment), underscores practices that reflect local cultures and ecology (Western and Wright 1994; Krasny and Tidball 2012), and occurs in diverse ecosystems (eg coastal areas, alpine environments) and in different contexts (eg from rural areas to urban centers). For example, Krasny and Tidball (2012) noted the diversity of initiatives and activities found in cities, including the removal of invasive species and the establishment of community gardens. The two cases we focus on (Panels 1 and 2; Figures 2 and 3) encompass rural, coastal communities.

In a globalized world, CBC efforts are neither strictly local, nor are they isolated from global economic and market influences (Berkes 2007). Community initiatives are, moreover, linked to higher-level organizations that often establish the rules, rights, and institutional conditions for conservation (Agrawal and Gibson 1999; Bixler 2014). Such initiatives must also negotiate access to resources and support, and respond to external drivers of change (eg climate, markets) that influence local livelihoods and ecosystems. Thus, governance contexts for CBC are varied and reflect the uniqueness of different locations. For example, the regulatory frameworks for conservation in Europe, Australia, and North America differ from one another and from the two cases – in Jamaica and Vietnam – that we showcase (Panels 1 and 2). Understanding these differences can be key to identifying barriers and opportunities and navigating the complexities of CBC.

The three waypoints we present below derive from an emerging literature on governance networks in conservation and natural resource management settings. Some important questions discussed in scholarly works include: key actors and their roles in networks (Crona and Bodin 2010; Prell *et al.* 2011), interactions across levels of governance (Ernstson *et al.* 2010; Mills *et al.* 2014), opportunities for network building (Vance-Borland and Holley 2011; Hauck *et al.* 2015), the diffusion of ideas that influence policy objectives (Syme *et al.* 2012; Weiss *et al.* 2012), and how informal social networks

Panel 1. Jamaica: Special Fishery Conservation Areas

To address the potential impacts of climate change, loss of biodiversity, and marine resource exploitation, eight Caribbean nations, including Jamaica, launched the Caribbean Challenge Initiative in 2008. In signing the Challenge, these nations committed to protecting approximately 20% of their nearshore marine areas by 2020. The Jamaican government established 12 Special Fishery Conservation Areas (SFCAs) – marine no-take zones – between 2009 and 2012, with more under consideration. Through Memorandums of Agreement, the Jamaican government has also established co-management arrangements with local NGOs and fisheries cooperatives that delegate roles and responsibilities (eg monitoring) associated with day-to-day SFCA management. Understanding the networks of actors in these new governance arrangements is central to achieving long-term conservation outcomes (Alexander 2015; Alexander *et al.* 2015).

The SFCAs have clear jurisdictional boundaries (ie there are lines drawn on a map). However, these boundaries are not adequate for capturing the relevant actors and actor groups (cf Waypoint 1). For example, focusing exclusively on the relational ties among the fishermen whose landing sites – ie beaches where fishers land and launch their boats – fall within the jurisdictional boundary of the SFCA would have excluded fishermen who traditionally fished in those same waters prior to being designated a no-take area but whose landing sites are outside of the SFCA boundary. Alternatively, redefining the network boundary to capture both groups of fishermen in the network allowed for: (1) the identification of actors who may play a bridging role between landing sites and (2) clarity on how the position of particular actors may influence the diffusion of new norms and behaviors related to sustainable fishing practices and compliance (cf Waypoint 2).

The establishment of the individual SFCAs also resulted in a national network of SFCAs. However, understanding different processes relevant to this governance network (eg collaboration, knowledge exchange) required examining the multiple (ie nested) governance networks characterized by different boundaries and groups of actors. This context characterized by multi-level governance networks highlighted the interconnections of Waypoints 2 and 3. For instance, to understand the diffusion of new norms and compliance needs within individual SFCAs, an examination of community-level interactions among local fishers and conservation area wardens was required. At the same time, understanding collaboration and knowledge exchange among the island-wide network of SFCAs required an examination of relational ties among a different set of actors, including government agencies, NGOs, universities, and community organizations whose interests, information, and knowledge needs are quite different than those of the communities.

The size and scope of the governance networks associated with the SFCAs in Jamaica allowed us to bound part of the network depending upon the question while at the same time examining how different subnetworks interacted (cf Waypoint 1 and 3). For example, some actors, such as SFCA managers and NGOs, are present in both networks (ie individual SFCAs and the national network; cf Waypoint 3). Reflecting on the different boundaries, actors, and their interests helps conservation actors consider how different processes predominate at different temporal and spatial scales (eg diffusion of new norms versus collaboration between managers). Moreover, it helped to identify marginalized actors (or subgroups of actors) that were reflected in fragmented networks of relational ties (cf Waypoint 3).

Figure 2. *Local wardens and marine authorities jointly patrol one of the SFCAs on Jamaica's southern coast.*

support formal governance networks (Bullock *et al.* 2012; Cohen *et al.* 2012). Research on social capital frames our understanding of how relationships for collective action are influenced by community norms, reciprocity, kinship and friendship, and trust (eg Pretty 2003; Scholz *et al.* 2008; Marin *et al.* 2012). Measurements of social interactions and relational processes have drawn from mathematical approaches to networks (eg Wasserman and Faust 1994; Borgatti *et al.* 2009), as well as studies on social power and institutionalized constraints on the participation of diverse actors in decision making (eg Scholz *et al.* 2008; Marin and

Panel 2. Vietnam: fishery co-management networks in the Cau Hai Lagoon

In the Cau Hai Lagoon, located in Thua Thien-Hue province in central Vietnam, strategies to involve fishing households in conservation and management are needed to alleviate the intensive use of resources from capture fishing and aquaculture. One relatively recent strategy has been the allocation of collective property rights to Fishing Associations (FAs) through territorial use rights, and the establishment of co-management agreements between FAs, commune governments, and the district government. Between 2009 and 2012, 16 FAs received territorial use rights to fishing areas, granting them some authority for monitoring and enforcement of fishing activities (Andrachuk and Armitage 2015).

Development of a co-management network in the Cau Hai Lagoon has proven challenging. There are nine local-level government bodies (communes and towns), two district governments, and the provincial government, with overlapping spatial and managerial responsibilities. Other actors include researchers and NGOs that have played formal and informal roles in capacity building or facilitating the process of allocating fishing rights, thus illustrating how diverse actors are important in the network (Waypoint 1). To understand options for conservation and management activities across the lagoon, we considered (1) how different actors (including informal actors) embedded in this network may be influencing co-management processes and (2) the extent that key actor groups (eg fishers) were incorporated into the co-management network.

We solicited information about which people were most *influential* in decision making and the relationships that people have formed when discussing certain fisheries-related topics. This "influence network" simultaneously reflects social relationships and formal channels of decision making, as well as cultural and political norms. Although Vietnam has moved toward more decentralized approaches to conservation and management, the central government still plays a prominent role, and, consequently, the orientation of the Cau Hai Lagoon fisheries co-management network reflects this reality (cf Waypoint 3). Where we might have expected co-management to offer a somewhat decentralized network with subgroups formed around social or livelihood affiliations (eg fishers who live in the same community or who use the same type of gear), we instead found that Vietnam's centralized government has maintained authority and power (see also Ho *et al.* 2015) (cf Waypoint 2). We also found that a lack of cooperation between neighboring FAs was in part due to their limited financial capacity, but more importantly, co-management arrangements were not designed with horizontal coordination in mind and their management training did not encourage communication among FA leaders. Once shown the importance of sharing knowledge about best practices and direct communication for immediate enforcement of illegal fishing activities, FA leaders began to see the benefits of communicating directly with each other rather than only through formal channels involving government agents.

Considering the ways that certain key network actors are linked across different jurisdictional levels revealed other important insights for conservation practitioners. For instance, once the most highly connected actors were identified (Waypoint 1), further examination revealed the positions and roles they occupy within the network. Prominent actors tended to arise from the district government and provincial FA, given that the provincial government actors and FAs tend not to interact directly (Waypoint 3). As part of the research process, these insights were provided to network actors, who were then encouraged to think about how the disconnect between fishers and high-level government actors (who form policy) has consequences for those whose values and interests are – or are not – reflected in official policies. These insights also helped emphasize which subgroups within the network would benefit from improved communications.

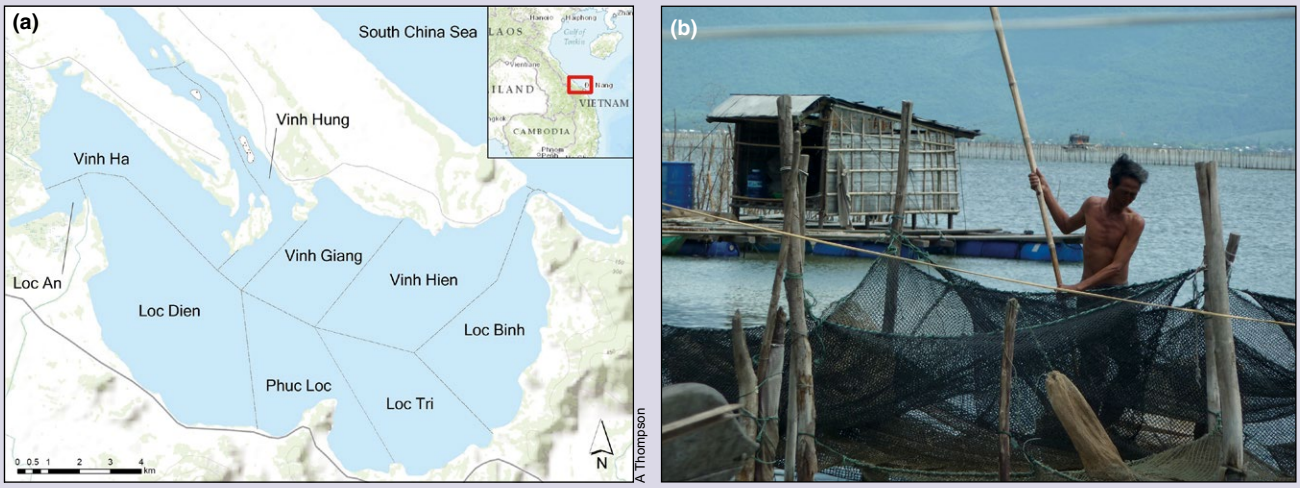

Figure 3. *(a) Fishing Associations in the Cau Hai Lagoon, in Vietnam. (b) A fisherman tending to his fish cages, a type of aquaculture – one of several gears, methods, and livelihoods found in the Cau Hai Lagoon.*

Berkes 2010). Other contributions draw from the social network and resource management literatures to examine relationships that have direct bearing on resource management and conservation outcomes (Bodin and Prell 2011; Henry and Vollan 2014). The waypoints identified below serve as a gateway into this diverse

literature and we use two examples (Panels 1 and 2) from our own research to provide insights for conservation practitioners and researchers.

Waypoint 1: who is in the network?

The actors that are part of a governance network do not operate in isolation and it is important to understand the interactions of actors in the entire network, as well as the interactions within or among subgroups (or subnetworks). For instance, a lack of coordination among conservation actors as a result of conflict about objectives may reflect the existence of subgroups that share certain characteristics (eg geographic location, family ties, occupation). The overall network function may improve when these network subgroups are made explicit (Bodin and Prell 2011). As such, how governance networks are bound together and the types of actors that are included – or excluded – largely determine the insights to be gained about their function and contributions to CBC.

Identifying what actors (ie key individuals and organizations) are in a governance network is an important starting point for those engaged in fostering CBC (Prell *et al.* 2011; Vance-Borland and Holley 2011), but this task may not be as straightforward as it seems. Evidence of hybrid arrangements – for instance, co-management, public–private partnerships, and private–social partnerships (Lemos and Agrawal 2006) – reflects an expanded role for a broader array of conservation actors. Government actors (eg wildlife departments, environmental agencies) are now just one source of decision-making authority in many conservation settings (Lemos and Agrawal 2006; Armitage *et al.* 2012). Contemporary CBC is now likely to involve multiple government agencies interacting with one another, civil-society organizations (eg non-governmental organizations [NGOs], fishermen's cooperatives, watershed councils, neighborhood associations, youth groups), and private businesses, all with diverse interests, values, and capacities (Carlsson and Berkes 2005; Krasny and Tidball 2012). Untangling the interactions among this array of actors that contribute to, interact with, and co-define conservation plans and initiatives underpins Waypoint 1.

Governance networks often reflect connections across multiple organizational, jurisdictional, and political levels. Vertical network ties to higher levels of organization (eg jurisdictional, political) have been noted as an important mechanism to both access and leverage the resources, ideas, and information that are often critical to CBC efforts (Bodin and Crona 2009; Marin *et al.* 2012; Alexander *et al.* 2015). Moreover, functions related to conservation, such as planning and management, can be quite distinct but complementary at different administrative and jurisdictional levels (Bodin and Crona 2009; Guerrero *et al.* 2013). Mills *et al.* (2014) illustrated in their analysis of the Coral Triangle Initiative (a seascape conservation effort focused on protecting marine biodiversity in a 6 million km^2 area spanning Indonesia, Malaysia, the Philippines, Papua New Guinea, Timor Leste, and the Solomon Islands) that "social networks play an important role in facilitating effective and sustained connections between people responsible for conservation plans and those responsible for local conservation actions".

Understanding the constellation of actors in a governance network also draws attention to the different types of networks and boundaries they create. A boundary is more than a physical limit or a simple indicator of the size of a governance network; rather, a network boundary reflects the "glue" that can maintain network continuity and that brings different actors together, often across different jurisdictions. For example, we can identify networks of actors with shared goals or environmental interests, such as a common concern for invasive species (see Ernstson *et al.* 2008; Lejano *et al.* 2013). Some governance networks link actors through formal regulatory requirements (Provan and Kenis 2008), while others may be bound by informal relationships among their actors, such as sharing networks among resource users (eg Collings 2011) or "shadow" networks of grassroots individuals and organizations that coalesce around specific problems (eg Bullock *et al.* 2012).

Recognition of different network boundaries can provide valuable perspectives on the main catalysts or variables that influence network function and CBC outcomes. For example, a network based upon formal agreements will require greater emphasis on strategies to foster organization/agency-based collaboration. In contrast, examining a network of personal relationships can illustrate the value of community-level patterns of trust that may determine buy-in (eg among farmers or fishers) and implementation of conservation initiatives (Pretty 2003). In networks where actors are bounded by customary practices of reciprocity for food and goods, CBC initiatives can build on and support underlying social relations of trust. Similarly, networks based on knowledge exchange can sustain conservation efforts, such as those in Canada's Arctic that bridge scientific and traditional knowledge (Kocho-Schellenberg and Berkes 2014). Regardless of the network function, acknowledging who we consider to be inside or outside a governance network can reveal core values of actors and can be important for delivering positive conservation outcomes.

Waypoint 2: what are the values and interests of actors in the network?

The potential for successful CBC is often dependent on our ability to identify the core values and interests of diverse actors in governance networks. Actors within some networks – even in relatively small communities – may not necessarily have shared interests (Dryzek 1997; Agrawal and Gibson 1999; Forsyth 2013). For instance, Rathwell and Peterson (2012) found that adjacent municipal governments engaged in local water

management in the Montérégie region of Québec, Canada, focused on quite different water conservation issues. Although both municipalities were concerned with water-specific ecosystem services, one focused on services associated with agriculture while the other largely concentrated on services related to tourism. Because of these differing orientations, the two neighboring local governments collaborated with different organizational networks despite their geographical proximity. In another example, Yaffee and Wondolleck (2000) described the formation of a network of farmers, government officials, and environmentalists initially at odds over protection of endangered bird species in the Laguna Atascosa National Wildlife Refuge, located in Texas. In this case, farmers had been resistant to proposed restrictions on their pesticide use. However, as various constituents of these groups met informally, alternative pathways to achieve conservation and livelihood objectives emerged. Ultimately, these groups recognized that different methods of application and quantities of pesticide could be used in ways that would minimize poisoning birds inside and adjacent to the refuge.

These two examples offer several insights about actor interests, values, and interactions in governance networks. First, interests, values, and assumptions are fluid, and as a result, governance networks will likewise be dynamic (see below). Second, governance networks that succeed in achieving generally desirable conservation outcomes can take a considerable amount of time to develop (Pretty 2003), and often depend on key actors (individuals or organizations) that create the space for different values and interests to be deliberated (Schneider *et al.* 2003; Lejano *et al.* 2013). Research that is focused only on formal relationships (eg partnerships "on paper") is far less likely to uncover underlying value differences and conflicts in practice (Prell *et al.* 2011; Ernoul and Wardell-Johnson 2014). Conservation actors navigating governance networks should therefore be aware of the presence or absence not only of relevant actors in the network but also of the shared interests and values that shape collaborative relationships. Trust and opportunities to share power, knowledge exchange and social learning, and prospects for accountability and legitimacy are often linked to the presence of shared interests (Agrawal and Gibson 1999; Lejano *et al.* 2013).

Collaboration within governance networks is considered crucial for conservation efforts that link communities and organizations (government and/or non-government) across regions and large landscapes (Berkes 2004; see also Panel 1 in Scarlett and McKinney 2016). In particular, strong relationships formed through repeated social interactions among various actors are thought to foster the trust and common understanding needed for collective action (Pretty 2003; Folke *et al.* 2005), but evidence from a range of conservation settings suggests that levels of trust, cohesion, and power sharing differ substantially depending on the circumstances that bring different actor groups together (Lejano *et al.* 2013). Indeed, the exercise of power by certain actors in networks has an important effect on conservation and natural resource management outcomes (Raik *et al.* 2008; see WebPanel 1). Asymmetrical relations of power and access to resources among actors are commonly manifested in the form of exclusions, inequalities, and hierarchies (Agrawal and Gibson 1999; Crona and Bodin 2010).

Governance networks are hypothesized to facilitate knowledge exchange and social learning. Such processes are considered necessary to bring together local actors and higher-level authorities involved in CBC (Folke *et al.* 2005; Armitage *et al.* 2009; Newig *et al.* 2010). As Weiss *et al.* (2012) illustrated, however, forms of knowledge exchange can vary considerably within networks and subnetworks. Moreover, some actors "consume" more knowledge than they "produce", resulting in knowledge "hoarding" (Weiss *et al.* 2012). Powerful or more influential actors can determine the types and sources of knowledge that are valued (Dryzek 1997; Forsyth 2013). How knowledge requirements for CBC are framed (eg as a science problem, or as a complex issue in need of different forms of knowledge) will influence how and what information flows through governance networks (Forsyth 2013; Lejano *et al.* 2013). The strategies used to facilitate knowledge exchange and learning (Reed *et al.* 2014) can thus be co-opted in self-serving rather than cooperative ways by those who are able to leverage unequal power relationships. A systematic assessment of social processes and practices (knowledge exchange) in a network can help to reveal whether knowledge is being co-produced in response to local conservation priorities.

As noted above, governance networks are dynamic through time and space. Network boundaries evolve, and the actors inside and outside a network will also shift. The emergence of hybrid governance arrangements and new actors in conservation, and the need to scale-up CBC to support large-landscape conservation initiatives, create challenging conditions (Jedd and Bixler 2015). In particular, uncertainty about the roles and responsibilities of different actors, a lack of clear checks and balances (especially where private-sector actors are involved), and concerns about the transparent flow of information needed for conservation make notions of accountability and legitimacy of networks hard to pin down. Expectations of accountability may vary among actors, especially in cases where no mechanism has been established and where values and interests are not aligned (Koliba *et al.* 2011). Yet in most governance networks in which CBC initiatives are situated, informal accountability mechanisms – manifested through social norms, actions, and shared values – often play an important and complementary role to more formal accountability mechanisms, and ultimately affect network performance (Romzek *et al.* 2012). Explicit consideration of actor values and interests embedded within

governance networks can reveal the social attributes (eg trust, legitimacy) and social processes (eg knowledge exchange, social learning) that determine whose conservation agendas are (or are not) supported.

Waypoint 3: how are actors in the network connected?

The basic analytical units of networks are nodes (ie actors) and ties (ie the interactions between nodes). Nodes may represent individuals (eg resource users, community leaders, policy makers) or organizations (eg civil-society organizations, government agencies). Network ties may represent a variety of social relations (eg kinship, friendship, collaboration) or flows of resources, such as buying and selling goods, or sharing knowledge (Borgatti *et al.* 2009). Different network structures (eg centralized, decentralized, fragmented) reflect different configurations of nodes and ties, and these different configurations have implications for governance, including the potential for participation, the extent of meaningful collaboration of actors across levels, or the flow of information among conservation actors within a network and across network boundaries.

For a conservation practitioner or scientist, it is useful to understand how actors in a governance network are connected through time, and in response to different issues or objectives. What connections are emphasized or examined will, in turn, influence perceptions and empirical understandings about the efficacy of that network. For instance, there is no single governance network structure that is "ideal" for CBC. Some governance networks may be non-hierarchical and lack formal administrative command (Torfing 2005; Hartley 2010) but can still yield desirable outcomes, as with the "harbor gangs" associated with the Maine lobster fishery (Acheson 1988). Other governance network structures may reveal power asymmetries, suggesting a form of structural hierarchy (Carlsson and Sandstrom 2008; Crona and Bodin 2010). Many hierarchies are rooted in informal network relationships. A charismatic actor can wield considerable influence and power in a local governance network because community members regard their knowledge as superior. This may be the case even if those individuals are not members of conservation committees or are not employed by conservation organizations.

A view of governance networks as multi-level (ie nodes and ties that cross jurisdictional or administrative levels) provides additional insight for conservation, including the role of actor or organization nodes that serve to "bridge" otherwise disconnected actors. For example, Ernstson *et al.* (2010) emphasized the role of organizations that link together other organizations across scales or jurisdictions (ie cross-scale broker) in managing and conserving urban biodiversity. In particular, cross-scale brokers can facilitate the sharing of knowledge (eg policy information, local conservation priorities) between actor groups that operate at different spatial scales or who are located across different sites, jurisdictions, or ecosystems (Ernstson *et al.* 2010; Cohen *et al.* 2012). This is the case in the Solomon Islands, where specific member organizations of the Solomon Islands Locally Managed Marine Area Network were identified as the pathways for the exchange of locally and regionally derived knowledge important for the management of coastal ecosystems (Cohen *et al.* 2012).

As previously noted, the actors involved in networks, and the nature of linkages between actors, are continually changing (Kocho-Schellenberg and Berkes 2014; Imperial *et al.* 2016). The web of social relationships that connect CBC actors can be self-organizing, as in southern Sweden with the emergence and sustained influence of the Ecomuseum Kristianstads Vattenrike to coordinate the management of a wetland landscape of considerable cultural and ecological value (Olsson *et al.* 2004). In such circumstances, the necessary preconditions that lead to positive conservation outcomes may be difficult to identify (eg Hartley 2010; Hahn 2011). Alternatively, the web of social relationships in a governance network may require strategies to facilitate (or steer) social interactions to support conservation (eg Schneider *et al.* 2003; Newig *et al.* 2010). One such strategy to foster network change is through the participatory process of "network weaving" (Vance-Borland and Holley 2011). For example, after assessing the structural characteristics of a conservation governance network in Lincoln County, Oregon, Vance-Borland and Holley (2011) communicated the results and shared network maps with the stakeholders to encourage the establishment of new ties between actors, and to address specific collaboration gaps. Maps of governance network structure can reveal subgroups of actors that are separated from other actors, or they can be used to identify key actors that help to facilitate (directly or indirectly) the flow of information or resources from one set of actors to another. This may occur vertically across jurisdictional levels, or horizontally: for instance, among several local conservation committees within a particular region (eg a biosphere reserve) or jurisdiction. The utility of Waypoint 3 to identify how actors in the network are connected provides insight into the social processes (eg participation, collaboration), social attributes (eg trust), and actor roles (eg bridging organizations) that connect conservation actors and initiatives across scales (Figure 4; sensu Alexander and Armitage 2015).

Conclusion

There is no blueprint to guide how network governance concepts should be applied to CBC challenges. The physical context of particular conservation challenges is often unique, the institutions and rules governing human interaction with ecosystems are context specific, and the questions of interest to practitioners will encourage different applications of network thinking. To conclude, we offer two case studies to illustrate the waypoints: an evolving network of co-managed marine reserves in Jamaica (Panel 1

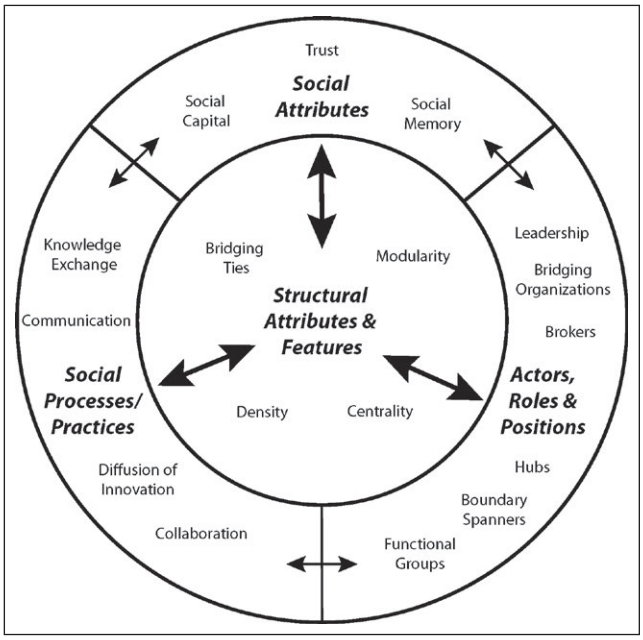

Figure 4. *Features, attributes, and processes associated with community-based and large-landscape conservation. The primary arrows represent the possible analytical relationships examined between specific network structures/features and the various attributes. The secondary arrows represent the possible analytical relationships between the different categories of features and attributes. Reproduced with permission from Alexander and Armitage (2015).*

and Figure 2) and a newly established co-management network for a small-scale fishery in the Cau Hai Lagoon of central Vietnam (Panel 2 and Figure 3).

In Jamaica, network thinking was used to examine both local-level networks and the interactions between fishers and wardens, as well as a management-level network to evaluate interactions among government agencies and other organizations (eg community-based organizations, NGOs, universities). Examining multiple governance networks characterized by different boundaries and groups of actors (see Waypoint 1) proved essential for: (1) understanding different processes relevant to governance (eg collaboration), (2) capturing a more representative and diverse set of values and interests (Waypoint 2), and (3) revealing how different patterns and strengths of connections among governance actors – including fishers and wardens – have been enhancing and inhibiting the establishment of co-managed marine reserves (Waypoint 3). The Vietnam case examined the shift from top-down government control to more decentralized co-management of aquatic resources. Network boundaries (see Waypoint 1) were established by identifying the actors who are directly involved in management activities (eg Fishing Association leaders) and those who indirectly influence management processes (eg university researchers who provide training and capacity building). Identification of a broad range of actors (formal and informal) also highlighted the potential for interconnections horizontally among fishers and vertically with government agencies (see Waypoint 3). Application of network thinking helped devise an approach to assess the decentralization process in terms of the relative influence of various actors in the network (Waypoint 2).

The two cases share many similarities (eg rural, coastal communities in developing countries). However, there are also major differences with regard to their respective governance contexts (eg culture, history of resource use, rules, rights, norms). The waypoints we outlined offer one starting point to uncover conservation challenges related to multi-level interactions among conservation actors in governance networks, unequal power relationships, and sometimes conflicting sets of social norms and environmental values. The application of the waypoints and selected implications for CBC are summarized in WebTable 1.

A network perspective reflects the complexity and connectivity of actors that play direct and indirect roles in CBC. Efforts to understand governance networks can help to identify and analyze challenges facing CBC initiatives, and to integrate local efforts with landscape-scale conservation initiatives more effectively. However, evidence of the causal influence that network structures and dynamics have on specific conservation outcomes is not yet well understood (Bodin *et al.* 2014; Henry and Vollan 2014). A lack of evidence, or consensus on the evidence base that does exist, highlights an important challenge for this emerging field. Ongoing monitoring and evaluation is thus critical to understand how particular conservation initiatives and networks contribute (or not) to improved conservation outcomes (Thomas and Koontz 2011; Bixler *et al.* 2016).

The waypoints we have identified here can support efforts of conservation actors to "know their networks" and to consider in a more systematic way the social relationships and network structures that influence conservation outcomes. These waypoints are meant to encourage: (1) further reflection about the social, institutional, and relational context in which conservation initiatives occur, and to consider how actors at multiple levels influence conservation practice; (2) greater awareness about the potential contributions of network theory to governance and community conservation challenges; and (3) the integration of CBC within large-landscape conservation initiatives. Ultimately, a focus on governance networks can help conservation actors navigate the challenges of CBC in a multi-level world.

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