Received: 7 November 2017 | Revised: 6 June 2018 | Accepted: 1 July 2018

DOI: 10.1111/conl.12600

REVIEW

WILEY Conservation Letters
A journal of the Society for Conservation Biology
Open Access

Environmental governance: A practical framework to guide design, evaluation, and analysis

Nathan J. Bennett[1,2,3] | Terre Satterfield[1]

[1]Institute for Resources, Environment, and Sustainability, University of British Columbia, Vancouver, BC, Canada, V6T 1Z4

[2]Institute for the Oceans and Fisheries, University of British Columbia, Canada, Vancouver, BC, Canada, V6T 1Z4

[3]Center for Ocean Solutions, Stanford University, Stanford, CA, USA

Correspondence
Nathan Bennett, University of British Columbia, AERL Building, 429–2202 Main Mall, Vancouver, BC Canada V6T 1Z4.
Email: nathan.bennett@ubc.ca

Funding information
Liber Ero Fellowship Program; OceanCanada Partnership; Social Sciences and Humanities Research Council of Canada, Grant/Award Numbers: SSHRC IDG #430-2014-00569, SSHRC IG #F12-04439

Editor
Andrew Knight

Abstract

Governance is one of the most important factors for ensuring effective environmental management and conservation actions. Yet, there is still a relative paucity of comprehensive and practicable guidance that can be used to frame the evaluation, design, and analysis of systems of environmental governance. This conceptual review and synthesis article seeks to addresses this problem through resituating the broad body of governance literature into a practical framework for environmental governance. Our framework builds on a rich history of governance scholarship to propose that environmental governance has four general aims or objectives – to be effective, to be equitable, to be responsive, and to be robust. Each of these four objectives need to be considered simultaneously across the institutional, structural, and procedural elements of environmental governance. Through a review of the literature, we developed a set of attributes for each of these objectives and relate these to the overall capacity, functioning, and performance of environmental governance. Our aim is to provide a practical and adaptable framework that can be applied to the design, evaluation, and analysis of environmental governance in different social and political contexts, to diverse environmental problems and modes of governance, and at a range of scales.

KEYWORDS

conservation, effective governance, environmental governance, environmental management, equitable governance, responsive governance, robust governance

1 | INTRODUCTION

While environmental problems are often viewed as having technical, managerial, or behavioral dimensions, increasing attention has been paid to environmental governance as an overarching means to address these complexities. Indeed, interest in environmental governance has led to research at all scales from the local to the global and focused on issues such as resource scarcity and conflicts, allocation and access, and biodiversity conservation in forest, agricultural, freshwater, marine, and even atmospheric systems. One broad and enduring insight from this research is that governance is one of the most important factors in enabling or undermining the effectiveness of conservation and environmental management (Armitage, de Loë, & Plummer, 2012; Lockwood, Davidson, Curtis, Stratford, & Griffith, 2010; Ostrom, 1999). Yet, we argue that there is still a relative paucity of comprehensive and practicable guidance that can be used to frame the evaluation, design, and analysis of systems of environmental governance.

This is a bold claim to make regarding a field that is as broad as it is deep. This is especially so as the academic literature on environmental governance has produced a plethora of governance theories and analytical frameworks. For example, environmental governance scholars have developed theory in the

areas of common-pool resource governance (Agrawal, 2003; Ostrom, 1999), adaptive governance (Armitage, Berkes, & Doubleday, 2010; Brunner, 2005; Folke et al., 2005), anticipatory governance (Boyd, Nykvist, Borgström, & Stacewicz, 2015), institutional governance (Adger, Brown, & Tompkins, 2005; Paavola, 2007), good governance (Graham, Amos, & Plumtree, 2003; Lockwood et al., 2010), and global environmental governance (O'Neill, 2009; Young, 1997) to name but a few subfields. A prevailing sentiment across these literatures is that of "good" governance – or that the evaluation of environmental governance is inherently normative. Our particular aim then is to garner from these diverse areas of theory to characterize key features of governance (i.e., objectives and attributes) that can be applied to the design, evaluation, and analysis of environmental governance. We do so while accepting that it is beyond the scope of this article to provide a detailed review of this extensive theoretical literature.

Several notable challenges to the uptake and application of insights from governance scholarship are evident and need to be addressed if this body of work is to improve conservation and environmental management. First, the field as a whole can be quite theoretical, and thus seem overwhelming and inaccessible to many policymakers, managers, practitioners, and scientists from other fields who might wish to apply governance concepts, theories, or frameworks to help ameliorate real-world environmental problems. Second, there is often a lack of conceptual and analytical clarity about the difference between governance and management in much of the recent applied research on the topic (Lockwood, 2010). Third, many of the past studies that focus on evaluating or analyzing environmental governance often focus on a limited set of features rather than considering the wider array of governance objectives and related attributes (Table 1). This may be due to the adherence by different researchers to different governance theories (e.g., adaptive governance, good governance) or frameworks (e.g., the social-ecological systems framework) and the application of the specific factors or particular indicators that they propose. While there is significant overlap, lack of integration across governance theories has meant that a more comprehensive analytical framework is still needed. Finally, past research has often focused on normative or procedural considerations (e.g., participation, recognition, access to justice) rather than substantive concerns (e.g., ecological and social outcomes) related to different governance regimes. This has meant that the links between governance capacity, functioning, and performance are often not clear – though some recent empirical research has emerged to examine and clarify the links between governance inputs and processes and social and ecological outcomes (Bodin, 2017; Cohen, Evans, & Mills, 2012; Plummer, Baird et al., 2017).

This conceptual review and synthesis article seeks to address these problems through resituating the broad body of governance literature – including the languages, terms, methods, and metrics – to provide a much needed comprehensive and practical framework and a common lexicon for future engagements. Our aim is to provide a framework that can be adapted and applied to the design, evaluation, and analysis of the capacity, functioning, and performance of environmental governance in diverse contexts and at a range of scales.

2 | TOWARD A COMPREHENSIVE AND PRACTICAL FRAMEWORK FOR ENVIRONMENTAL GOVERNANCE

2.1 | Methods

Our first step was to reduce the complexity of the main analytical elements, objectives, and related attributes that pertain to environmental governance while still being comprehensive (Figure 1). When developing the framework, we first reviewed the literature to ascertain clear definitions and conceptualizations of the analytical elements (i.e., institutions, structures, and processes) of governance (see below). We then reviewed the academic literature on environmental governance to develop a comprehensive list of considerations (alternately termed principles, attributes, or indicators of governance by different authors) associated with the capacity, functioning, and performance of governance. As our aim was to be comprehensive, we reviewed the literature until thematic saturation was achieved – that is, no new themes were emerging. To develop a summary list of attributes and objectives from this long list, we combined commensurate terms into a set of 19 attributes, which we checked against the literature to ensure comprehensive thematic coverage. Finally, we assigned these attributes to four overarching categories that encompass the general aims or objectives of environmental governance. In so doing, we sought to evaluate and construct each category according to guidance on designing clear and appropriate attributes and objectives. That is, we ensured they were: distinct, comprehensive, direct, operational, understandable and unambiguous (Keeney, 2007; Keeney & Gregory, 2005). A summary of this review of the literature is in Table 1 with supporting references provided throughout the text, whereas a more succinct representation of the primary objectives and attributes as they relate to the elements of governance is in the framework in Figure 1.

2.2 | Definition and conceptual elements of environmental governance

Governance is generally defined as the *institutions, structures, and processes* that determine who makes decisions, how and for whom decisions are made, whether, how and what actions are taken and by whom and to what effect (Graham et al., 2003; Lockwood et al., 2010). An important conceptual

TABLE 1 Objectives, attributes, characteristics, outputs and outcomes of environmental governance

Objectives	Attributes (Qualities or Capacities)	General Characteristics or Inputs (Capacity)	Idealized Outputs (Functioning)	Idealized Outcomes (Performance)
Effective Supports maintenance of system integrity and functioning.	Direction	Scope, goals and aims are comprehensive, clearly articulated and communicated to stakeholders. Clear boundaries on action and scope exist.	Defines what effective action encompasses and sets milestones for achieving success.	• Improvement in ecosystem functioning. • Greater biodiversity or species. • Increases in productivity of system or provisioning of ecosystem services. • Better environmental health.
	Coordination	The roles, functions, and mandates of different governments, agencies and organizations are coordinated. A coordinating body or unit is present.	Produces system of rules for use, mechanisms for exclusion, management actions and spatial coverage that are complementary and adequate to achieve objectives. Provides a forum for discussion, debate, negotiating and resolving trade-offs.	
	Capacity	Capacity, skills and resources are sufficient and are being actively developed. Capable and visionary leadership is present. Mechanisms are present to resolve conflicts between groups.	Enables successful decision-making and the initiation, organization, implementation and evaluation of actions.	
	Informed	Planning and management decisions and actions are informed by best available information and integration of a diversity of knowledge types and systems.	Increases the likelihood that management actions will lead to effective outcomes.	
	Accountable	Procedures are present to hold governors accountable for performance of system. Mechanisms are in place to ensure that means and rationales for making decisions are transparent.	Ensures that governors act on mandated decisions and that effective actions are being taken.	
	Efficient	Efficacy guides decisions regarding management actions and deployment of resources. Time requirements of actors are reasonable. Economic costs and actions taken are commensurate with productivity of system.	Maximizes the productivity of management actions while minimizing the wasteful use of available resources.	

continued

TABLE 1 Continued

Objectives	Attributes (qualities or capacities)	General characteristics or inputs (capacity)	Idealized outputs (functioning)	Idealized Outcomes (performance)
Equitable Employs inclusive processes and produces fair outcomes.	Recognition	Policies and processes ensure acknowledgement of, respect for and incorporation of diverse perspectives, values, cultures and rights. Views of marginalized and vulnerable groups are considered.	Facilitates socially acceptable governance and perceptions of legitimacy. Aids in the design of management actions that are appropriate to the social context.	• Inclusion in decision-making processes. • Improved socio-economic outcomes. • Increases in quality of life or wellbeing. • More fair distribution of wealth. • Better access to justice and protection of rights.
	Participation	Spaces and processes to enable participation and collective choice are present. Structures that ensure the representation and engagement of different stakeholder groups are in place.	Contributes to just power relations and decision-making processes. Leads to plans and actions that represent the interests of different groups. Allows parties to democratically debate decisions and maintain dignity.	
	Fair	Mechanisms are in place to ensure socio-economic costs and benefits are just and fairly distributed. Rights and responsibilities are shared and assigned fairly. Unequal circumstances are considered.	Ensures a fair balance of costs and benefits accrue to different groups.	
	Just	Laws and policies are present to protect local rights and mechanisms ensure that groups have access to justice.	Ensures rights (e.g., title, historical tenure, access, use, management) are not undermined and that reparations or compensation are made for past damages.	
Responsive Enables adaptation to diverse contexts and changing conditions.	Learning	Monitoring, evaluation, reflections and communication of performance is institutionalized. Processes and platforms are in place to co-produce knowledge and enhance social and institutional memory.	Ensures that information is produced, documented, shared and informs decision-making.	• Enables the resilience of resource. • Enables the resilience of local communities. • More adaptable institutions to changing conditions. • More flexible institutions that can be altered to work in different contexts.
	Anticipatory	Long-term planning and foresight thinking are institutionalized. Known and unknown risks and opportunities are considered, analyzed and planned for.	Produces plans and steps to prepare and prevent consequences of unexpected risks. Enhances knowledge, capacity and flexibility for disturbance.	

Continued

TABLE 1 Continued

Objectives	Attributes (qualities or capacities)	General characteristics or inputs (capacity)	Idealized outputs (functioning)	Idealized Outcomes (performance)
	Adaptive	Spaces for reflection and deliberation are institutionalized. Processes exist to revisit and evolve policies, institutions and adapt actions.	Ensures that management plans and actions are being actively adapted to reflect changing social-ecological contexts and new knowledge.	
	Innovative	Innovation and experimentation is encouraged and success and failures are monitored. A higher risk tolerance is embodied.	Allows change to be seen as an opportunity. Enables new and more effective ideas and actions to emerge.	
	Flexible	Policies exist that recognize the need to downscale environmental management and conservation models to fit local realities. Efforts are taken to understand and document about the diverse contexts where policies are applied and to deliberate on necessary adjustments.	Enables governance systems and management models to be adjusted to better fit with local social, cultural, political, economic and environmental contexts.	
Robust Ensures functioning institutions persist, maintain performance and cope with perturbations and crises.	Legitimate	A collective vision shapes policies and guides actions at all scales. Institutional legitimacy is conferred (e.g., in policy) and perceived (e.g., by constituents). Governors act with integrity and consistency. Institutions are transparent.	Ascertains that there is support from above and that there is a supportive constituency.	• Institutions are strengthened and well supported. • Institutional performance and functioning is more or less consistent. • Institutions persist over time.
	Connected	Networks of organizations and actors are strongly linked vertically and horizontally. Bridging organizations are present. Processes are in place to support network development, to develop social relations and to support mutual learning.	Helps to bridge between and across scales. Creates supportive community, produces social capital, fosters respect and trust and builds social memory. Encourages communication, information exchange, enables diffusion of innovations, and facilitates collaboration.	
	Nested	Tasks are assigned to appropriate levels. Decision-making authority and responsibility are conferred to the lowest level possible. Self-organization is encouraged and supported. Authority and responsibility is supported by adequate state or other outside support (legal recognition, political will, time commitment) and oversight.	Empowers appropriate entity to take necessary action. Allows also for shaping and adapting institutions and decision-making processes to different local sub-contexts (social circumstances, governance, ecologies) within larger system.	

Continued

TABLE 1 Continued

Objectives	Attributes (qualities or capacities)	General characteristics or inputs (capacity)	Idealized outputs (functioning)	Idealized Outcomes (performance)
	Polycentric	Decision-making and action taking centers in multiple places, across jurisdictions and at multiple scales interact and cohere towards a common goal. Institutions are present that are diverse and redundant - that serve similar purposes and have overlapping jurisdictions and functions.	Helps to buffer against change in one location. Ensures that the governance system does not collapse when faced with adversity or crises.	

distinction needs to be made between governance and management: the latter refers to the *resources, plans, and actions* that result from the functioning of governance (Lockwood, 2010). The aim of environmental governance, in particular, is to manage individual behaviors or collective actions in pursuance of public environmental goods and related societal outcomes (Armitage et al., 2012; Termeer, Dewulf, & Van Lieshout, 2010). To comprehend environmental governance is to understand how decisions related to the environment are made and whether resultant policies and processes lead to environmentally and socially sustainable outcomes. The analysis of environmental governance focuses on the capacity, functioning, and/or performance of the institutional, structural, and procedural elements of governance (Figure 1)

Drawing first on early work by North (1990), we further define *institutions* as both the formal (e.g., constitutions, laws, policies, tenure systems) and informal rules (e.g., cultural context, social norms, prevailing power structures) that shape human interactions (e.g., in the form of decision-making structures and processes) and that guide, support, or constrain human or management actions. The term *structures* refers to the formalized bodies or entities (e.g., decision-making arrangements, comanagement bodies) and organizations (e.g., levels of government, private sector organizations, civil society organizations) as well as informal networks of actors and organizations that embody governance capacities (e.g., efficiency, participation) and perform different functions (e.g., producing rules and decisions, enabling management actions). Governance *processes*, which are the means for realizing the functions and the performance of governance, include articulation of institutional mandates, negotiation of values, conflict resolution, law making, policy formation, diffusion of information, and application of policy. These processes, then, play an important role in both decision-making and the implementation of those decisions. Environmental governance structures and processes can come together in different ways – for example, governance can be driven from the top by governments or private individuals or actors, from the bottom by local communities, or via shared decision-making and authority through formal comanagement arrangements or informal networks of actors and organizations. Moreover, the institutional, structural, and procedural elements of governance are understood to occur at various scales from local to global, to interact across scales, and to have an effect on the capacity, performance, and outcomes of environmental governance (North, 1990; Young, 1997).

2.3 | Objectives and attributes for environmental governance

Previous governance scholarship and frameworks tend to prioritize or even neglect certain fundamental objectives of environmental governance. It is not surprising, for example, that the literatures on adaptive and anticipatory governance emphasize features that enable *responsive*-ness, such as learning, innovation, foresight, and adaptation (Armitage et al., 2010; Boyd et al., 2015). Good governance frameworks, on the other hand, focus heavily on normative concerns related to *equity*, such as participation, fairness and justice, as well as transparency and legitimacy, but tend to give less attention to effectiveness (Graham et al., 2003; Lockwood, 2010). The research applying institutional and network governance theories have tended to concentrate on institutional *robustness* (Cudney-Bueno & Basurto, 2009; Morrison, 2017) and the functional *effectiveness* of governance at practices and processes such as knowledge sharing or collaboration (Cárcamo, Garay-Flühmann, & Gaymer, 2014; Wyborn, 2015a). Problematically, across much the environmental governance literature, effectiveness at achieving ecological outcomes is often assumed or relegated to discussions of management.

Some authors have put forward various proposals for more integrative sets of governance objectives. For example, Adger et al. (2002) proposed that four broad integrated and indivisible criteria be taken into account in environmental

governance and decision-making: efficiency, effectiveness, equity, and legitimacy. Recent literature on protected areas governance use evaluative indicators under the broad but vague categories of quality, diversity, and vitality (Borrini-Feyerabend & Hill, 2015). Alternately, while not focused on the environment, North (2010) suggests that economic change depends on having societal institutions that are productive, stable, fair, broadly accepted, and flexible. There are numerous other proposals. Yet, we felt there was no framework or set of objectives that adequately captured the entirety of potential aims and attributes of governance, nor that was easily applied to diverse contexts, problems, scales, and types of governance.

Thus, our framework builds on a rich history of governance scholarship but proposes a different set of overarching objectives supported by a more comprehensive set of attributes. Our literature review and categorization suggests that environmental governance has four generalizable and distinct objectives – to be effective, to be equitable, to be responsive, and to be robust – that ought to be considered simultaneously across institutional, structural, and procedural elements (Figure 1). We define the four objectives as follows: (1) effective governance supports the maintenance of system integrity and functioning; (2) equitable governance employs inclusive processes and produces fair outcomes; (3) responsive governance enables adaptation to diverse contexts and changing conditions; and (4) robust governance ensures that functioning institutions persist, maintain performance, and cope with perturbations and crises. Below, we briefly review the attributes that correspond with each objective (see Table 1 for a summary).

2.3.1 | Effective environmental governance

A central objective of environmental governance is maintaining or improving the ability of environmental systems to function and to produce ecosystem services through the persistence of species, habitats or biodiversity (see Figure 1). Attributes of the first objective – *effective environmental governance* – include: direction, coordination, capacity, informed, accountable, and efficient. Clear *direction* is provided through precision in the articulation of vision, goals, aims, and the establishment of clear boundaries on action and scope (Graham et al., 2003; Lockwood et al., 2010; Wyborn, 2015b). This establishes what effective action encompasses and sets milestones for achieving success. *Coordination* of the roles, functions, and mandates of different governments and organizations, perhaps through a coordinating body or comanagement unit, helps instead to establish systems of rules, ensure the adequacy of management actions, and resolve trade-offs (Abe, Brown, Ajao, & Donkor, 2016; Wyborn, 2015a). The presence and active development of *capacity*, including skills (e.g., leadership, conflict resolution) and resources (e.g., financial, infrastructure), enables the initiation of planning processes and implementation of management actions (Armitage et al., 2010; Lockwood et al., 2010; Wyborn, 2015b). When planning and management decisions are *informed* by the best available knowledge – which includes diverse and integrated knowledge types (natural and social) and of systems (scientific, local, and indigenous) – this can increase the likelihood of effective outcomes (Charnley et al., 2017; Tengö, Brondizio, Elmqvist, Malmer, & Spierenburg, 2014). Clear mechanisms to hold governors *accountable* can help to ensure that mandated decisions are followed and effective actions are being taken (Lockwood, 2010; Lockwood et al., 2010; Secco, Da Re, Pettenella, & Gatto, 2014). Transparency, in communicating the means and rationales for decisions and the outcomes of potential future or past actions, makes accountability possible. *Efficient* governance requires that time requirements of actors are reasonable, that efficacy guides the choice of management actions and deployment of public resources, and that costs and actions are commensurate with system productivity (Ostrom, 1990; Secco et al., 2014).

2.3.2 | Equitable environmental governance

Second, to achieve the objective of being socially equitable, environmental governance should engage decision-making processes and produce socioeconomic outcomes that might be characterized as: inclusive, participatory, fair, and just. Equitable environmental governance begins with policies and processes that recognize, respect, and are *inclusive* of the perspectives, knowledge systems, values, cultures, and rights of diverse stakeholders (Borrini-Feyerabend et al., 2015; Lockwood et al., 2010; McDermott, Mahanty, & Schreckenberg, 2013), including the views of groups who are often marginalized (e.g., women, indigenous peoples, or minority groups) or vulnerable (e.g., impoverished communities). Effective *participation* requires context and scale-specific spaces, processes, and structures to enable inclusion, representation, and engagement of stakeholder groups in collective decision-making processes (Lockwood, 2010; Reed, 2008). This facilitates the sharing of power, democratically debated decisions, maintenance of dignity, and the creation of representative plans and actions. Power- and benefit-sharing mechanisms can help ensure that the socioeconomic benefits and burdens of conservation and environmental management are distributed in a *fair* manner, and that rights and responsibilities are shared and assigned commensurate to circumstances (Bennett, Teh et al., 2017; Pascual et al., 2014; Zafra-Calvo et al., 2017). Finally, equitable governance is safeguarded when laws and policies are present to protect local rights and tenure, ensure that consent is freely given, and groups have access to *justice* to defend against incursions

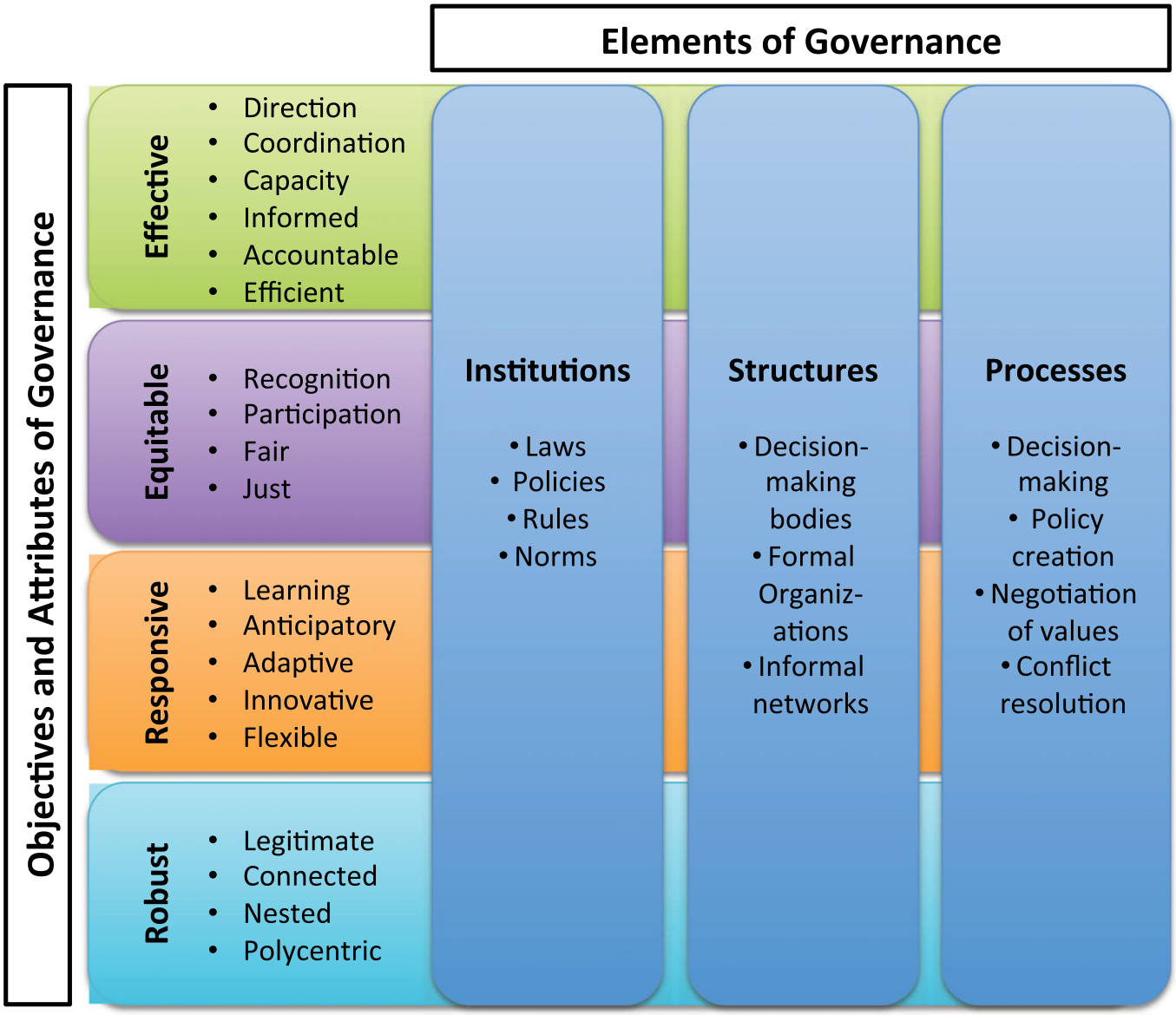

FIGURE 1 A practical framework for understanding the objectives, attributes, and elements of environmental governance

or facilitate reparations and/or compensation for past wrongs (Bennett, Teh et al., 2017; FAO, 2012).

2.3.3 | Responsive environmental governance

Third, the objective of being *responsive* ensures that environmental governance is adaptable both to changing environmental and social conditions and to diverse contexts. Responsive environmental governance arrangements exemplify: learning, anticipation, adaptability, innovation, and flexibility. Institutional and social *learning* is realized through ongoing monitoring and evaluation, communication, and reflection on the social and ecological performance of environmental governance (Armitage & Plummer, 2011). Collective memory, and consequently the ability to effectively manage and adapt to change, is enhanced through practices such as documentation and sharing of lessons learned, knowledge coproduction, and developing communities of practice (Berkes & Turner, 2006; Maida & Beck, 2016). The knowledge and capacity to address disturbances can also be improved through the institutionalization of *anticipation* or foresight, including consideration, analysis, and planning for the consequences of both chronic and acute risks (Boyd et al., 2015; Tschakert & Dietrich, 2010). *Adaptive* environmental governance is enabled by institutionalized spaces for dialogue, reflection and deliberation, and clear processes and steps to ensure that policies, institutions, and management actions are periodically revisited and actively updated or changed when required (Armitage et al., 2010; Dietz, Ostrom, & Stern, 2003). A culture of *innovation*, coupled with a higher risk tolerance, encourages experimentation with new ideas and the monitoring and documentation

of successes and failures to enable effective management actions to emerge (Chaffin et al., 2016; Dietz et al., 2003). Rather than promoting one-size-fits-all approaches, *flexibility* in institutions and policies allows for the calibrating of environmental management and conservation models to diverse local realities (Epstein et al., 2015; Gaymer et al., 2014). This requires that efforts are made to understand and document the social, cultural, political, economic. and environmental contexts where interventions are being implemented and to deliberate on necessary adjustments to idealized models.

2.3.4 | Robust environmental governance

The final objective of environmental governance is to be robust – that is, functioning institutions – persist over time, maintain performance, and cope with perturbations and crises. Robust environmental governance institutions are legitimate, connected, nested, and polycentric. *Legitimate* institutions are guided by a collective vision, conferred with formal legitimacy (e.g., through law or policy) and perceived to be legitimate by constituents and stakeholders (Lockwood, 2010; Lockwood et al., 2010). This ensures both strong political justification and local support. Robust networks of institutions and actors are structurally *connected* horizontally and vertically, often enabled by bridging organizations, and characterized by positive social relations (e.g., trust and social capital; Bodin, 2017; Bodin & Crona, 2009; Folke, Hahn, Olsson, & Norberg, 2005). Functional networks facilitate collaboration, knowledge and information exchange. and diffusion of innovations (Barnes, Lynham, Kalberg, & Leung, 2016; Blythe et al., 2017; Cohen et al., 2012). In *nested* governance, decision-making authority, responsibility, and tasks are devolved to the lowest-possible and most administratively appropriate level, which enables the proper entity to self-organize, make decisions, and take actions (Lebel et al., 2006; Marshall, 2007; Ostrom, 1990). Responsibility and authority at lower scales need to be matched with adequate support and oversight from higher levels. *Polycentric* systems of governance have semiautonomous decision-making and action-taking centers in multiple locations, across jurisdictions, and at multiple scales that interact and cohere toward a common goal (Carlisle & Gruby, 2017; Ostrom, 2010). Polycentricity, through providing institutional diversity and redundancy in purpose and function, helps to buffer against change and avoid institutional collapse when faced with adversity (Morrison, 2017).

3 | DISCUSSION

3.1 | Summary

In this article, we present a framework that aims to be both practical and comprehensive for environmental governance that might be applied to diverse contexts, problems, and scales. For example, it might be adapted and applied to examine or evaluate the governance of a locally managed community forest, a national system of marine protected areas, a transboundary fishery or efforts to conserve biodiversity and ecosystem services at regional or global scales (Díaz et al., 2015). However, we are neither naïve to the challenges of environmental governance nor the potential limitations of this framework. First, the ability of the governance system (structures, institutions, and processes) to achieve desired objectives – whether this is in a fishery, a marine protected area, a watershed, a forest, an agricultural landscape, or other system – is also determined by the complexity of the context and the problem being addressed (Bavinck, Chuenpagdee, Jentoft, Kooiman, 2013). Governance systems that are more responsive – that emphasize learning, anticipation, adaptation, innovation, and fit – may be better able to address this complexity (Armitage et al., 2010; Epstein et al., 2015). Second, issues related to power and politics can challenge or undermine the functioning and performance of any system of environmental governance. For example, some actors or groups might have greater access to or influence over decision-making or policy creation processes with repercussions for both social and environmental performance (Boonstra, 2016). The ability of environmental governance to handle power rests, in part, in how well governance structures, institutions, and processes fulfill the objective of equity, which can facilitate recognition of diverse groups and worldviews, inclusion of stakeholders in decision-making, fairness in the allocation of costs and benefits, and access to justice when principles are violated. Third, as all ecological systems and social contexts are unique, systems of environmental governance need to be locally grounded. Indeed, the framework that we offer is not intended as a "one-size-fits-all" approach, but rather a guide to be adapted to fit diverse realities and governance challenges. Finally, we recognize that the depth of treatment given to each attribute is somewhat limited by the scope and length of the article. There are certainly more sophisticated treatments of each of these considerations in the literature, to which those engaging with these ideas should turn if they desire more information. Local perspectives on these considerations may be different yet. We definitely encourage building on and from the foundation of objectives and attributes provided by the framework.

Our particular goal is a framework that advances governance in several ways. First, our aim is to provide clarity on the elements of governance and so a useful reference for future research that seeks to characterize systems of environmental governance. Second, we provide a broader and more comprehensive set of attributes than has any particular theory or framework alone – which will provide a useful reference for the design of indicators for evaluation of environmental governance. Third, we suggest that future evaluations of

environmental governance need to better address the four general objectives that we propose here – (1) to be effective, (2) to be equitable, (3) to be responsive, and (4) to be robust – across the institutional, structural, and procedural elements of governance. We suggest that it is important to engage with all four objectives simultaneously as there can be interactions – both synergies and trade-offs – between them. For example, *equity* (in decision-making processes or outcomes) can support perceptions of legitimacy and thus the *robustness* of institutions (Bennett, 2016; Ostrom, 1999; Turner et al., 2016). Similarly, *effectiveness* relies on the *responsiveness* of institutions to changing environmental and social conditions (Weeks & Jupiter, 2013) and the flexibility of environmental governance models to fit or match diverse contexts (Epstein et al., 2015; Sarkki, Rantala, & Karjalainen, 2015). On the other hand, when too much emphasis is placed on one objective over others in systems of environmental governance, unintentional trade-offs and negative consequences can follow. For example, when primary importance is placed on environmental effectiveness over equity, this might have unintended social consequences and negative feedbacks for ecosystems (Larrosa, Carrasco, & Milner-Gulland, 2016). Institutions that are ineffective or inequitable might also persist when robustness is not balanced with features that enable responsive, equitable, and effective environmental governance. Thus, research on and the practice of environmental governance needs to address the four objectives simultaneously – while also seeking to better understand the relationships between and how to achieve balance across objectives. From a practical standpoint, the common lexicon that we offer will be helpful for those seeking to develop guidance on all dimensions of governance, and also assist in the design of indicators for evaluating that governance.

3.2 | Application of the framework for design, evaluation, or analysis

In sum, the novelty of this framework is in the merging of the diversity of governance frameworks and recommended features into a more comprehensive offering to guide: (1) design, (2) evaluation, and (3) analysis of environmental governance.

First, many studies often treat governance as the context within which environmental management occurs or as something that emerges from sociopolitical contexts rather than as something that can be produced, shaped or designed. We propose that this framework can be a useful reference for the development of guiding principles or recommendations for different environmental issues (e.g., marine conservation, fisheries management, terrestrial protected areas, water governance, wildlife management, and forestry). For example, the lead author of this article used the general framework proposed here as the basis for a collaboration with several NGOs and government agencies to design governance objectives and principles for a system of marine reserves in the Gulf of California of Mexico (Bennett, Lasch-Thaler et al., 2017). While this process is still underway, one important lesson learned to date was that this is not meant to be a blueprint per se, but the framework can be usefully adapted and applied to the design of governance in different social and political contexts.

Second, since all policies should be seen as experiments that require continual monitoring and adaptation (Armitage et al., 2008), indicators have become an important part of learning and reflection. In this article, we stopped short of developing indicators for the different objectives and attributes. This is because the application of the framework for monitoring and evaluation of environmental governance will require adaptation to fit the objectives of different initiatives, calibration to the normative expectations of the setting, and the development of problem and scale-specific indicators. It is also important to ensure that the indicators developed address, as relevant, both: (1) the institutional, structural, and procedural elements of environmental governance and (2) the capacity (inputs), functioning (outputs), and performance (outcomes) associated with each governance attribute and objective (Hockings, Stolton, Leverington, Dudley, & Courrau, 2006; Lockwood, 2010). We recommend that indicators for evaluating environmental governance be developed in collaboration with stakeholders to ensure that they correspond with local norms and increase their legitimacy and salience (Hicks et al., 2016; Keeney & Gregory, 2005).

Third, there has been increasing attention to analyzing the impact of different attributes and elements of governance on social and ecological outcomes to develop generalizable lessons aimed at improving conservation in a variety of contexts (Ban et al., 2017; Cinner et al., 2016; Mascia et al., 2017). Additional efforts are needed to better understand these cause-effect relationships between governance and social and ecological performance (Biesbroek, Dupuis, & Wellstead, 2017; Plummer, Dzyundzyak et al., 2017). To move this body of research forward, there is a need to engage: (1) clearer conceptualizations of the difference between governance and management and (2) more comprehensive sets of features and indicators than might be drawn from a single area of governance theory. We hope that the framework we present here provides one such comprehensive reference set of objectives and attributes from which to draw in future research.

4 | CONCLUSION

To conclude, we recognize the importance of governance in environmental management and conservation and reiterate the need for greater attention to understanding the myriad systems of environmental governance. The framework that we provide here might be applied to better understand environmental governance in different social contexts, for

diverse ecological issues and at a range of scales. Evaluations and deliberations guided by the framework might also support efforts to design and improve the capacity, functioning, and performance of environmental governance systems. However, we emphasize that there are no panaceas and there will inevitably be a continual process of learning and regeneration for any particular system of environmental governance. In presenting this framework, we hope to support such efforts – be that by governments, NGOs, private actors, local communities, researchers, or collaborative networks – to analyze, evaluate, and create more effective, equitable, responsive, and robust environmental governance.

ACKNOWLEDGMENTS

This research was supported in part by funding from the Social Sciences and Humanities Research Council of Canada (SSHRC IDG Grant No. 430-2014-00569 and SSHRC Insight Grant No. F12-04439). NJB acknowledges the support of the Liber Ero and Banting Postdoctoral Fellowship Programs, the Ocean Canada Partnership, and the Community Conservation Research Network. The authors would also like to acknowledge the substantial improvements that were made to the manuscript as a result of the thorough and professional comments provided by several anonymous reviewers.

ORCID

Nathan J. Bennett http://orcid.org/0000-0003-4852-3401

REFERENCES

Abe, J., Brown, B., Ajao, E. A., & Donkor, S. (2016). Local to regional polycentric levels of governance of the Guinea current large marine ecosystem. *Environmental Development*, *17*, 287–295.

Adger, W. N., Brown, K., Fairbrass, J., Jordan, A., Paavola, J., & Rosendo, S. (2002). *Governance for sustainability: Towards a "thick" understanding of environmental decision making* (No. 02–04). CSERGE Working Paper EDM.

Adger, W. N., Brown, K., & Tompkins, E. L. (2005). The political economy of cross-scale networks in resource co-management. *Ecology and Society*, *10*, online.

Agrawal, A. (2003). Sustainable governance of common-pool resources: Context, methods, and politics. *Annual Review of Anthropology*, *32*, 243–262. https://www.annualreviews.org/doi/abs/10.1146/annurev.anthro.32.061002.093112

Armitage, D., & Plummer, R. (2011). Adapting and transforming: Governance for navigating change. In D. Armitage & R. Plummer (Eds.), *Adaptive capacity and environmental governance* (pp. 287–302). Springer Series on Environmental Management. Berlin, Heidelberg: Springer.

Armitage, D., Plummer, R., Berkes, F., Arthur, R. I., Charles, A., Davidson-Hunt, I. J., … Wollenberg, E. K. (2008). Adaptive co-management for social–ecological complexity. *Frontiers in Ecology and the Environment*, *7*, 95–102.

Armitage, D., Berkes, F., & Doubleday, N. (2010). *Adaptive co-management: Collaboration, learning, and multi-level governance*. Vancouver, BC: UBC Press.

Armitage, D., de Loë, R., & Plummer, R. (2012). Environmental governance and its implications for conservation practice. *Conservation Letters*, *5*, 245–255.

Ban, N. C., Davies, T. E., Aguilera, S. E., Brooks, C., Cox, M., Epstein, G., … Nenadovic, M. (2017). Social and ecological effectiveness of large marine protected areas. *Global Environmental Change*, *43*, 82–91.

Barnes, M. L., Lynham, J., Kalberg, K., & Leung, P. (2016). Social networks and environmental outcomes. *Proceedings of the National Academy of Sciences*, *113*, 6466–6471.

Bavinck, M., Chuenpagdee, R., Jentoft, S., Kooiman, J. (Eds.). (2013). *Governability of fisheries and aquaculture*. Dordrecht: MARE Publication Series. Springer Netherlands.

Bennett, N. J. (2016). Using perceptions as evidence to improve conservation and environmental management. *Conservation Biology*, *30*, 582–592.

Bennett, N. J., Lasch-Thaler, C., Mancha-Cisneros, M. M., Suárez-Castillo, A. N., Walther-Mendoza, M., Vázquez-Vera, L., & Espinosa-Romero, M. J. (2017). *Integración de consideraciones socio-económicas y de gobernanza en el diseño y manejo de las zonas de recuperación en el Golfo de California, México*. La Paz, Mexico: The Nature Conservancy/Comunidad y Biodiversidad A.C.

Bennett, N. J., Teh, L., Ota, Y., Christie, P., Ayers, A., Day, J. C., … Satterfield, T. (2017). An appeal for a code of conduct for marine conservation. *Marine Policy*, *81*, 411–418.

Berkes, F., & Turner, N. (2006). Knowledge, learning and the evolution of conservation practice for social-ecological system resilience. *Human Ecology*, *34*, 479–494.

Biesbroek, R., Dupuis, J., & Wellstead, A. (2017). Explaining through causal mechanisms: Resilience and governance of social–ecological systems. *Current Opinion in Environmental Sustainability*, *28*, 64–70.

Blythe, J., Sulu, R., Harohau, D., Weeks, R., Schwarz, A. -M., Mills, D., & Phillips, M. (2017). Social dynamics shaping the diffusion of sustainable aquaculture innovations in the Solomon Islands. *Sustainability*, *9*, 126.

Bodin, Ö. (2017). Collaborative environmental governance: Achieving collective action in social-ecological systems. *Science*, *357*, eaan1114.

Bodin, Ö., & Crona, B. I. (2009). The role of social networks in natural resource governance: What relational patterns make a difference? *Global Environmental Change*, *19*, 366–374.

Boonstra, W. J. (2016). Conceptualizing power to study social-ecological interactions. *Ecology and Society*, *21*(1), 21. https://doi.org/10.5751/ES-07966-210121

Borrini-Feyerabend, G. & Hill, R. (2015). Governance for the conservation of nature. In: Worboys, G.L., Lockwood, M., Kothari, A., Feary, S. & Pulsford, I. eds. *Protected Area Governance and Management*. (pp. 169–206). ANU Press, Canberra, Australia.

Borrini-Feyerabend, G., & Hill, R. (2015). Governance for the conservation of nature. *Prot. Area Gov. Manag.*, 169–206.

Boyd, E., Nykvist, B., Borgström, S., & Stacewicz, I. A. (2015). Anticipatory governance for social-ecological resilience. *Ambio*, *44*, 149–161.

Brunner, R. D. (2005). *Adaptive governance: Integrating science, policy, and decision making*. New York: Columbia University Press.

Cárcamo, P. F., Garay-Flühmann, R., & Gaymer, C. F. (2014). Collaboration and knowledge networks in coastal resources management: How critical stakeholders interact for multiple-use marine protected area implementation. *Ocean & Coastal Management*, *91*, 5–16.

Carlisle, K., & Gruby, R. L. (2017). Polycentric systems of governance: A theoretical model for the commons. *Policy Study Journal*, in press. http://onlinelibrary.wiley.com/doi/10.1111/psj.12212/abstract.

Chaffin, B. C., Garmestani, A. S., Gunderson, L. H., Benson, M. H., Angeler, D. G., Arnold, C. A. (Tony), … Allen, C. R. (2016). Transformative environmental governance. *Annual Review of Environment and Resources*, *41*, 399–423.

Charnley, S., Carothers, C., Satterfield, T., Levine, A., Poe, M. R., Norman, K., … St. Martin, K. (2017). Evaluating the best available social science for natural resource management decision-making. *Environmental Science & Policy*, *73*, 80–88.

Cinner, J. E., Huchery, C., MacNeil, M. A., Graham, N. A. J., McClanahan, T. R., Maina, J., … Mouillot, D. (2016). Bright spots among the world's coral reefs. *Nature*, advance online publication.

Cohen, P. J., Evans, L. S., & Mills, M. (2012). Social networks supporting governance of coastal ecosystems in Solomon Islands. *Conservation Letters*, *5*, 376–386.

Cudney-Bueno, R., & Basurto, X. (2009). Lack of cross-scale linkages reduces robustness of community-based fisheries management. *Plos One*, *4*, e6253.

Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N., Larigauderie, A. Adhikari … Zlatanova, D. (2015). The IPBES conceptual framework — connecting nature and people. *Current Opinion in Environmental Sustainability*, Open Issue, *14*, 1–16.

Dietz, T., Ostrom, E., & Stern, P. C. (2003). The struggle to govern the commons. *Science*, *302*, 1907–1912.

Epstein, G., Pittman, J., Alexander, S. M., Berdej, S., Dyck, T., Kreitmair, U., … Armitage, D. (2015). Institutional fit and the sustainability of social–ecological systems. *Current Opinion in Environmental Sustainability*, *14*, 34–40.

FAO. (2012). *Voluntary guidelines on the responsible governance of tenure of land, fisheries and forests in the context of national food security*. Rome: Food and Agriculture Organization of the United Nations.

Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources*, *30*, 441–473.

Gaymer, C. F., Stadel, A. V., Ban, N. C., Cárcamo, P. F., Ierna, J., & Lieberknecht, L. M. (2014). Merging top-down and bottom-up approaches in marine protected areas planning: Experiences from around the globe. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *24*, 128–144.

Graham, J., Amos, B., & Plumtree, T. (2003). *Governance principles for protected areas in the 21st century*. Ottawa, ON: Institute on Governance, Parks Canada, and CIDA.

Hicks, C. C., Levine, A., Agrawal, A., Basurto, X., Breslow, S. J., Carothers, C., … Levin, P. S. (2016). Engage key social concepts for sustainability. *Science*, *352*, 38–40.

Hockings, M., Stolton, S., Leverington, F., Dudley, N., & Courrau, J. (2006). *Evaluating effectiveness: A framework for assessing the management effectiveness of protected areas* (2nd ed.). Gland, Switzerland: IUCN.

Keeney, R. L. (2007). Developing objectives and attributes. In: Edwards, W., Jr, R.F.M. & Winterfeldt, D. von. eds. *Advances in Decision Analysis: From Foundations to Applications*. Cambridge University Press, Cambridge, UK, pp. 104-128.

Keeney, R. L., & Gregory, R. S. (2005). Selecting attributes to measure the achievement of objectives. *Operations Research*, *53*, 1–11.

Larrosa, C., Carrasco, L. R., & Milner-Gulland, E. J. (2016). Unintended feedbacks: Challenges and opportunities for improving conservation effectiveness. *Conservation Letters*, *9*, 316–326.

Lebel, L., Anderies, J. M., Campbell, B., Folke, C., Hatfield-Dodds, S., Hughes, T. P., & Wilson, J. (2006). Governance and the capacity to manage resilience in regional social-ecological systems. *Ecology and Society*, *11*, online.

Lockwood, M. (2010). Good governance for terrestrial protected areas: A framework, principles and performance outcomes. *Journal of Environmental Management*, *91*, 754–766.

Lockwood, M., Davidson, J., Curtis, A., Stratford, E., & Griffith, R. (2010). Governance principles for natural resource management. *Society and Natural Resources*, *23*, 986–1001.

Maida, C. A., & Beck, S. (2016). Towards communities of practice in global sustainability. *Anthropology in Action*, *23*, 1–5.

Marshall, G. (2007). Nesting, subsidiarity, and community-based environmental governance beyond the local scale. *International Journal of the Commons*, *2*, 75–97.

Mascia, M. B., Fox, H. E., Glew, L., Ahmadia, G. N., Agrawal, A., Barnes, M., … White, A. T. (2017). A novel framework for analyzing conservation impacts: Evaluation, theory, and marine protected areas. *Annals of the New York Academy of Sciences*, *1399*, 93–115.

McDermott, M., Mahanty, S., & Schreckenberg, K. (2013). Examining equity: A multidimensional framework for assessing equity in payments for ecosystem services. *Environmental Science & Policy*, *33*, 416–427.

Morrison, T. H. (2017). Evolving polycentric governance of the Great Barrier Reef. *Proceedings of the National Academy of Sciences*, *114*, E3013–E3021.

North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge; New York: Cambridge University Press.

North, D. C. (2010). *Understanding the process of economic change*. Princeton University Press, Princeton, New Jersey.

O'Neill, K. (2009). *The Environment and international relations*. Cambridge University Press, New York, NY.

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

Ostrom, E. (1999). Coping with tragedies of the commons. *Annual Review of Political Science*, *2*, 493–535.

Ostrom, E. (2010). Polycentric systems for coping with collective action and global environmental change. *Global Environmental Change*, 20th Anniversary Special Issue, *20*, 550–557.

Paavola, J. (2007). Institutions and environmental governance: A reconceptualization. *Ecological Economics*, *63*, 93–103.

Pascual, U., Phelps, J., Garmendia, E., Brown, K., Corbera, E., Martin, A., … Muradian, R. (2014). Social equity matters in payments for ecosystem services. *Bioscience*, *64*, 1027–1036.

Plummer, R., Baird, J., Dzyundzyak, A., Armitage, D., Bodin, Ö., & Schultz, L. (2017). Is adaptive co-management delivering? Examining relationships between collaboration, learning and outcomes in UNESCO biosphere reserves. *Ecological Economics*, *140*, 79–88.

Plummer, R., Dzyundzyak, A., Baird, J., Bodin, Ö., Armitage, D., & Schultz, L. (2017). How do environmental governance processes shape evaluation of outcomes by stakeholders? A causal pathways approach. *Plos One*, *12*, e0185375.

Reed, M. S. (2008). Stakeholder participation for environmental management: A literature review. *Biological Conservation*, *141*, 2417–2431.

Sarkki, S., Rantala, L., & Karjalainen, T. P. (2015). Fit between conservation instruments and local social systems: Cases of co-management and payments for ecosystem services. *Change and Adaptation in Socio-Ecological Systems*, *2*, 59-78.

Secco, L., Da Re, R., Pettenella, D. M., & Gatto, P. (2014). Why and how to measure forest governance at local level: A set of indicators. *Forest Policy and Economics*, Assessing forest governance - analytical concepts and their application, *49*, 57–71.

Tengö, M., Brondizio, E. S., Elmqvist, T., Malmer, P., & Spierenburg, M. (2014). Connecting Diverse Knowledge Systems for Enhanced Ecosystem Governance: The Multiple Evidence Base Approach. *Ambio*, *43*, 579–591.

Termeer, C., Dewulf, A., & Van Lieshout, M. (2010). Disentangling scale approaches in governance research: Comparing monocentric, multilevel, and adaptive governance. *Ecology and Society*, *15*, 29.

Tschakert, P., & Dietrich, K. A. (2010). Anticipatory learning for climate change adaptation and resilience. *Ecology and Society*, *15*, 11.

Turner, R. A., Addison, J., Arias, A., Bergseth, B. J., Marshall, N. A., Morrison, T. H., & Tobin, R. C. (2016). Trust, confidence, and equity affect the legitimacy of natural resource governance. *Ecology and Society*, *21*(3), 18. https://doi.org/10.5751/ES-08542-210318

Weeks, R., & Jupiter, S. D. (2013). Adaptive comanagement of a marine protected area network in Fiji. *Conservation Biology*, *27*, 1234–1244.

Wyborn, C. (2015a). Cross-scale linkages in connectivity conservation: Adaptive governance challenges in spatially distributed networks. *Environmental Policy and Governance*, *25*, 1–15.

Wyborn, C. A. (2015b). Connecting knowledge with action through coproductive capacities: Adaptive governance and connectivity conservation. *Ecology and Society*, *20*(1), 11. https://doi.org/10.5751/ES-06510-200111

Young, O. R. (1997). *Global governance: Drawing insights from the environmental experience*. MIT Press, Cambridge, MA.

Zafra-Calvo, N., Pascual, U., Brockington, D., Coolsaet, B., Cortes-Vazquez, J. A., Gross-Camp, N., … Burgess, N. D. (2017). Towards an indicator system to assess equitable management in protected areas. *Biological Conservation*, *211*, 134–141.

How to cite this article: Bennett NJ, Satterfield T. Environmental governance: A practical framework to guide design, evaluation and analysis. *Conservation Letters*. 2018;e12600. https://doi.org/10.1111/conl.12600