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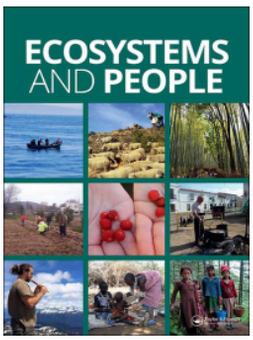

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On the frontiers of collaboration and conflict: how context influences the success of collaboration

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ABSTRACT

The increasing scale and interconnection of many environmental challenges – from climate change to land use – has resulted in the need to collaborate across borders and boundaries of all types. Traditional centralized, top-down and sectoral approaches to governance of single-issue areas or species within social-ecological systems often have limited potential to alleviate issues that go beyond their jurisdiction. As a result, collaborative governance approaches have come to the forefront. A great deal of past research has examined the conditions under which collaborative efforts are likely to achieve desired outcomes. However, few studies have analyzed how the means to achieve successful collaborative outcomes differ based on context when examined across multiple studies. In this research, we begin to chart a means for doing this. Building onto a Context-Mechanism-Outcome (CMO) Framework, we provide a coding manual to analyse how contextual variables mediate the effects of mechanism variables on outcomes of the collaborative governance of social-ecological systems. Through the examination of four cases, we provide a proof-of-concept assessment and show the utility of the CMO framework and coding manual to draw comparisons across cases for understanding how collaborative outcomes are contingent on the social-ecological context in which they occur.

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Introduction

Over the past two decades, much research has emphasized the need to craft institutions to the scale of the environmental challenge addressed (Epstein et al. 2015; Leventon et al. 2019). Young (2002), approaching this from the scale of international regimes, describes this as improving institutional fit. Ostrom (1990) similarly discusses the importance of polycentric governance and congruence between institutions and the ecological system, focusing on cases at the local level. Increasing fragmentation of ecosystems due to land-use change, telecoupling and interconnection of our social, economic, and ecological subsystems across space, the threats of climate change, and the globalized scale of human activities, have exacerbated the challenge of achieving institutional fit with many social-ecological challenges crossing jurisdictional boundaries (Newig et al. 2019). These boundaries arise between private landowners, between public and private land managers, between local and national agencies, between resource sectors, and across international frontiers. As a result, since the early 2000s, governance scholars have seen an increased role for collaboration as a mechanism for governing across borders and boundaries to improve fit at the scale of the challenge (Wondolleck and Yaffee 2000; Ansell and Gash 2008). In the literature review of this article, we highlight past research that studied mechanisms for improving collaborative outcomes. Building on this, we present an approach facilitating cross-case comparison of how context moderates such mechanisms to improve outcomes and then demonstrates efficacy

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across four diverse cases. In this way, we contribute to the field by initiating and testing an approach to identify generalizable findings on the effects of contextual factors on the success of collaborative processes.

The aim of this paper is to draw on different cases to highlight some common insights on why and how context matters for successful collaboration. We undertake two tasks to achieve this aim. In our first task, we produce a Context-Mechanism-Outcome (CMO) analytical framework, and an associated coding manual, to link context to case – a methodological advancement. A mainstay of case study research, scholars often refer to contextual factors – the idiosyncratic aspects of a particular study – as those traits which indicate the specifics of one's research that makes generalizability problematic. It is here that we believe we can make some progress. This paper is an early step in a broader research program that builds on earlier research on key collaborative mechanism variables and 'thick description' of qualitative, ethnographic data that emerges from case studies (Geertz 1973). We pursue generalizable findings through meta-analysis and the assessment of potential common pathways that unfold in collaborations at different scales. Here, meta-analysis refers to a method of collecting data across multiple cases (as in Ostrom 1990) in contrast to medical trial data aggregation (Cox 2014). The data that is generated through thick description can be thought of as the counterpoint to quantitative, big data. This research program to understand collaborative governance of social-ecological systems arises out of an international working group on collaborative governance and management under the auspices of the Programme on Ecosystem Change and Society or PECS (Carpenter et al. 2012). Our second task is to put the framework into practice and learn from an initial coding of cases – an advancement of insight into collaborations. In what follows, we shed light on the contextual factors, mechanisms, and their combined effect on outcomes in collaborative governance applying the CMO framework to four case studies from different parts of the world. The resulting analysis helps elucidate the interaction of contextual and mechanism variables on collaborative outcomes. The purpose is to provide a proof-of-concept assessment of the CMO framework and coding manual for cross-case comparisons and exploring the mediating influence of contextual factors on how mechanism variables lead to case-specific outcomes. We conclude with a discussion of the benefits and limitations and consider how to further develop the approach.

Literature review of collaboration and 'success factors'

In previous work (Cockburn et al. 2020), the authors examine the subject of collaborative governance and management of natural resources by reviewing key literature on the topic in various disciplines and subdisciplines with an aim to gather and distill a core set of criteria for successful collaboration. This approach has been used to assess mechanisms behind the success of common-pool resource governance systems across different resource types (Baggio et al. 2016; Barnett et al. 2016). Here, we reiterate that, in order to assess pathways in the achievement of a variety of outcomes set forth in diverse collaborations, two steps require specific attention. First, a holistic comparative analysis of a collaborative governance process needs to include thoughtful attention to the mediating effects of context on the well-studied path connecting mechanisms and outcomes. Second, performing meta-studies of the governance of social-ecological systems has been hampered by a lack of alignment between fields of research, such as common pool resources (CPR), adaptive collaborative management (ACM), resilient Social-Ecological Systems (SESs), and community-based natural resource management (CBNRM).

In the past two decades, the literature on collaboration in social-ecological systems has developed across multiple overlapping research arenas – collaborative governance (Ansell and Gash 2008; Emerson et al. 2012), collaborative management (Borrini-Feyerabend 1996; Koontz and Thomas 2006), adaptive co-management (Plummer and Armitage 2007; Armitage et al. 2009), and adaptive governance (Folke et al. 2005; Olsson et al. 2006). Without getting immersed in details which have been elaborated elsewhere (Margerum and Robinson 2016; Schoon et al. 2017; Schoon and Cox 2018), these literatures share common characteristics related to decision-making under uncertainty and to governing social-ecological systems at the scale of the dilemma, providing material for the necessary comparative analyses (Step 1 above). However, the differences in labeling that have taken hold in the literature within subdisciplines has caused fragmentation across related literatures, thereby, undermining meta-analyses and the alignment and sharing of theories and ontologies, impeding the necessary meta-studies (Step 2 above). Previously, we identified 20 core criteria (implemented in Schoon et al. 2020) that the subdisciplines considered crucial to successful collaborations. We find these criteria offer a good foundation from which to begin our analysis of collaborative governance and management across a variety of resource systems. In the cases studied here, we refer to mechanism variables,

as described below, as factors that others have identified as design principles (Ostrom 1990) or success factors (Armitage et al., 2009).

Methods

Contextual analysis through the Context-Mechanism-Outcome framework

While the literature on collaboration in social-ecological systems recognizes the importance of context, the moderating influence of context on the pathways of how mechanism variables lead to outcomes – whether successful or unsuccessful – is not well understood (Cockburn et al. 2020). Understanding this moderating influence of context is a key challenge that has been faced and addressed by evaluators of programs and interventions, including collaboration as an intervention, in particular in the field of realist evaluation (Pawson and Tilley 1997). Such evaluation recognizes that interventions are embedded in open, complex systems characterized by dynamic, non-linear interactions and uncertainties (Douthwaite et al., 2017). This approach is well suited to research on collaboration in social-ecological systems as in the case studies we present here.

As generally acknowledged in most social sciences, particularly with qualitative studies, the outcomes of an intervention cannot be isolated from the context in which it unfolds, and various mechanisms interact with one another and with the context to produce particular outcomes. By this, we mean that contextual variables moderate how mechanism variables generate outcomes. In our understanding of the notion of 'mechanisms', we bring together Chen (2005, cited in Dalkin et al., 2015) and Pawson and Tilley (1997) notions of mechanism, seeing them as factors of collaborative initiatives which are a combination of specific resources or activities, and stakeholders' responses to these. Furthermore, we agree with Pawson and Tilley that these mechanisms will only be activated under certain conditions, i.e. that contextual variables influence the ways in which the mechanisms operate to produce outcomes. Therefore, context mediates or links the mechanism and outcome variables. While mechanisms are often construed as sets of variables, to operationalize the idea of mechanisms in our analytical framework, we have chosen to treat mechanisms as individual variables. This mechanism-based approach in realist evaluation has led to the development of the context-mechanism-outcome (CMO) schema to guide such studies. To help us to understand collaborative interventions in social-ecological systems, we have therefore adopted this CMO schema and developed an analytical coding approach to evaluate cases. This approach allows for learning about the nature of collaboration and the influence of contextual features and other systemic mechanisms on the outcomes of collaborations (Cockburn et al. 2020).

Producing the CMO coding manual

The coding manual is based on the CMO framework presented in Cockburn et al. (2020). The contextual variables were identified through a workshop of 25 scholars and practitioners of collaboration in social-ecological systems actively working within or researching collaborations. We identified the mechanism variables through the process described in the literature review – comparing meta-studies of success factors in collaboration (Carr Kelman et al. 2018; Carr Kelman et al. 2019). We defined the outcome variables in four parts based on broad-based social and ecological outcomes as well as outcomes regarding the collaborative process. The coding manual draws on the seminal literature and provides definitions, examples and references for each variable. The coding manual can be accessed online and in the appendix. We used this coding manual to analyze four case studies on collaborative natural resource governance as a proof-of-concept.

Case study selection and analysis

The case studies in this proof-of-concept paper were selected by the authors from collaborative projects they were familiar with from previous research projects. The cases represent a diversity of geographies, resource types, and size of collaboration. These four cases and 20 others, not included in this paper, were discussed in workshops and lab meetings in 2019 and 2020. All case authors are experts on their cases with years of on-the-ground research including semi-structured interviews and archival records review. Each of the case authors used the coding manual to code each context, mechanism, and outcome variables. Using their expertise on the relevant variables from the coding for their individual case, the authors wrote a narrative about how the contextual variables mediated the effects of the mechanism variables on system-level outcomes. For comparison purposes, case authors bolded the context variables described in their narratives. Each case provides an introduction, a description of important contextual and mechanism variables seen as influencing outcomes, and a table describing how environmental, social, and process outcomes were enhanced or degraded through the collaboration. The cases included are shown in Table 1. Future analyses will build on this qualitative study to work towards more quantitative analyses across a large number of case studies.

Table 1. Overview of the case studies.

Case Study	Location	Resource Type	Scale	Size of Collaboration
CBNRM in North Luangwa National Park & surrounding GMAs	Zambia, Southern Africa	Biodiversity	Local to regional	Various; generally involving tribal, government, and NGOs
Pacific NW Salmon Habitat	Pacific NW North America	Salmon and Riparian habitat; farmland	Local to regional	Various; generally involving tribal, government, and agricultural representation
White Mountains Stewardship Project	Arizona, USA	Forestry	Local	~25 people representing organizations from local to national scale
Laikipia region Kenya, Community Based Water Resources Management	Laikipia, Kenya	Water resources	Local to regional	>5000 people at different levels across the region

Results: the case analyses

Case 1 – Zambian Community-Based Natural Resource Management

Introduction to the case and context (with coded contextual variables in bold)

In order to improve environmental management effectiveness **(collaboration goal)** and to enhance justice for communities of protected areas (Ribot 2002), Zambia adopted community-based natural resource management (CBNRM) in 1998 (Zambia National Parks and Wildlife Act 1998), which, in revised formats, has been ongoing **(collaboration status)** since then and represents collaboration in nature conservation and resource use. The claim of CBNRM is to recognize local people's role in conservation and to create partnerships with communities for resource protection (Nyirenda 2012). CBNRM strives to facilitate active participation in decision-making over the management, utilisation, and conservation, hence deriving economic benefits from natural resources (Shackleton et al. 2002; Mbaiwa 2004).

Wildlife **(resource type)** is one of the most renowned resource in Zambia, and of specific interest in this context is the North Luangwa National Park (NLNP), which hosts reintroduced Black Rhinos (Van Der Westhuizen et al. 2010) and whose surrounding Game Management Areas, are among the world's most famous hunting places (Marks and Fuller 2008). Together, this complex, multifunctional landscape **(complexity)** covers approximately 37,500 km^2 **(ecosystem scale)**. The four Game Management Areas (GMAs) surrounding the NLNP serve as buffer zones but also strive to allow for co-existence between wildlife and people (Chomba et al. 2011). However, direct resource use remains largely forbidden for locals without hunting permits, even though a high **resource dependence** on bushmeat due to food insecurity appears to be the case (King 2014). To foster this co-existence, CBNRM seeks to enable sustainable livelihoods through an elaborated scheme of sharing benefits both from consumptive and non-consumptive tourism in the communities that act as custodians of the wildlife without any **property rights** (Fabricius et al. 2013). Empowering these custodians towards collaborative governance of natural resources happens through Community Resource Boards (CRBs) and Village Action Groups (VAGs) which form at the local sub-district level (**governance of the collaboration**). CBNRM activities are supported by conservation and development organizations, such as USAID, GIZ and Frankfurt Zoological Society (**facilitation**).

Legally recognized decision-making over the use of revenues especially from hunting happens through joint collective choice decisions at regular meetings by representatives of the community **(collaboration formality)**, which are formed by a 'democratically elected committee' of 10–15 people at the VAG level **(group size)**. In turn, one representative from each VAG constitutes the CRB at chiefdom level, consisting of 10 CRB members, one local council representative, CRB staff, and the chief. While the traditional leader of the chiefdom, the chief, is the patron of the CRB **(culture)**, the chief has no direct control over the revenues, since in the past the likelihood of financial misappropriation was higher under direct control (Child and Dalal-Clayton 2004). Reformed bottom-up accountabilities since 1996 that enabled better transparency and participation led to increased efficiencies of CBNRM projects in the past **(history of collaboration/conflict)** (Child and Dalal-Clayton 2004; Nyirenda 2012). The Department of National Parks and Wildlife **(decision-making level)**, as a governmental institution under the Zambian Ministry of Tourism and Arts thereby collects 100% of all hunting revenues and redistributes 50% to the CRBs and 5% to the chiefs (**funding level**). The CRBs decide over the allocation of their share of the revenues to development projects in the VAGs according to the current needs of the community.

While many people in the community are aware of the benefits from the resulting development projects, such as the creation of schools or dispensaries or the improvement of roads, many villagers also criticize this scheme as there are still power imbalances (**power asymmetry**) as well as misappropriations (Mwale 2019). The realization of CBNRM on the ground has repeatedly been criticized for its failures and its hierarchical reality and the persistence of elite capture (Simasiku et al. 2008; Mwale 2019), including nepotism. One of the weakest points in this system is that large parts of revenues have to support those public infrastructures for which the state carries

responsibility (Gujadhur 2000). However, irregular and fragmented payments impede some of the development projects that are crucial to increase basic public services. Thus, the scheme is considered to place unfair demands of scarce resources onto the poor while failing to halt biodiversity at the same time.

Mechanism (process) variables this case highlights

Level of trust among stakeholders: In line with the many other investigations on CBNRM effectiveness, transparency, mutual trust, and the recognition of local communities both as partners and as a group with sometimes diverging interests seems to play an important role for the outcomes of the collaboration in this case. Any such participatory and democratic system relies upon interlocking networks of communication between stakeholders and good coordination.

Collaborative and Resource Boundary: The creation of CBNRM in Zambia has benefitted from assistance in the integrated development by external facilitators, which helped to open up democratic participation and continue monitoring at the VAG and the chiefdom level, with partially clear resource and user boundaries. Nonetheless, conflicts remain as wildlife moves between the park and the GMAs, and their movement may increase human-wildlife conflicts and limit the benefits derived from hunting quotas. Notwithstanding, its sustenance requires ongoing adaptations and capacities that not all stakeholders necessarily have capacity. CBNRM may have helped natural resource management by reducing the costs related to wildlife management, which is beneficial for the responsible authorities in the system. However, it is questionable whether this 'inclusion' of locals has helped to create a sense of dignity and worth at the individual, household, and community levels, especially since use of natural resources is restricted to locals and noncompliance is linked to sanctions (**graduated sanctions**).

Minimal recognition of rights to organize: While strong in its rhetoric for participation (Child and Dalal-Clayton 2004), CBNRM projects often fail to facilitate active participation and to include locals in participatory land use planning (Nyirenda 2012), although the communities are often highly dependent on the capital that the natural resources deliver.

Congruence with local ecological conditions: As an example, the exclusion of local ecological evidence and local ecological knowledge in quota setting might be seen as a missed opportunity to create a sense of control and a misrecognition of locals' abilities, as local scouts or hunters may have insightful knowledge about the status of populations (de Georges and Reilly, 2009).

Collective choice arrangements: Despite many efforts to create a more democratic and accountable system of governance, elite control and capture are still troublesome realities that may disempower locals in the decision-making process.

Monitoring the resource users and the resource: In order to reach these high demands, the monitoring of financing and biodiversity and infrastructure performance is necessary to control and adapt the CBNRM process.

Congruence between benefits and costs: Despite many local peoples' awareness of the indirect benefits brought about by community projects, CBNRM has not yet achieved, and probably does not strive for, a full devolution of resource ownership to the community (DeGeorges and Reilly 2009). Consequently, CBNRM in Zambia appears limited in its ability to provide direct material and immaterial benefits.

Leadership: These missing participatory mechanisms may express a lack of political will to allow the community to create more income from natural resources and undermine their rights as key stakeholders to decide on their roles and responsibilities.

Congruence of the rules with local culture, Institutional adaptability: However, the changes in the CBNRM programs in the presented case study area exemplifies an adaptation of translating traditional leadership into tangible outcomes (Nyirenda et al. 2010). Nonetheless, power imbalances in this system are issues that continue to influence the success of such a participatory program (Mwale 2019). For outcome of the case study, please see Table 2.

Case 2 – Pacific NW America salmon habitat

Introduction to the case and context

In Western Washington State (USA) controversy erupted in 2011 over demands by treaty-holding Native American tribes for stricter regulation and enforcement to protect salmon habitat. There is widespread agreement in the region on the importance of salmon **(resource type)**, which are a cultural keystone species for Native American tribes (Garibaldi and Turner 2004), regional icon, and important commercial and recreational fishing resource **(resource dependence)** for all Washingtonians. Yet decades of debate surround the questions of what actions and sacrifices should be taken (and by whom) to address salmon declines (Breslow 2014).

This case draws on research described in Chapman et al. (2019) and Chapman et al. (2020), which together involved analysis and coding of 19 documents and over 30 interviews with farmers and representatives of tribal organizations and US federal and state agencies and local/regional government. Access to both interviewees and materials was facilitated by close work with two local organizations: the Snohomish Conservation District and the Puget Sound Partnership.

Table 2. Outcomes of the Zambian CBNRM case study.

	Environmental Outcomes	Social Outcomes	Process Outcomes (internal to the collaboration)
Positive/ Improved	• Decrease of poaching • Successful reintroduction of flagship species	• Awareness raising of resource conservation • Employment for some people • Additional infrastructure	• Translating traditional leadership into tangible outcomes • Some increased cohesion and participation
Negative/ Degraded	• Selective logging of rare species • Quality loss of forests	• Decreased access to resources without alternative livelihoods	• Elite capture & control, nepotism and mistrust • Dysfunctional and non-transparent decision-making processes • Lack of recognition of community diversity

When tribes signed a series of treaties between 1854–1855, they relinquished millions of hectares of their traditional lands they had inhabited since time immemorial **(resource dependence, history of collaboration/conflict, history of colonialism)**. In return, they were assured of their right to fish salmon in their usual and accustomed areas, recognizing the centrality of this resource to their culture and well-being. In practice, assuring this right to fish at traditional grounds **(user rights)** took over 100 years and decades of struggles (exacerbated by **power asymmetry** between settlers and tribes). Yet as salmon runs declined, this treaty-guaranteed de jure right became threatened de facto **(user rights)**. In 1980 a court ruling confirmed the responsibilities of federal and state agencies to protect salmon in order to assure tribal-treaty rights were upheld. Despite this ruling, four of eight anadromous salmonid species native to the region are threatened under the Endangered Species Act (Washington 2019). As late environmental leader and Nisqually tribal member Billy Frank Jr. explained: '*As the salmon disappear, so do our cultures and treaty rights. We are at a crossroads and we are running out of time*'.

A key challenge for collaborative efforts is the mismatch between the many ecological and jurisdictional layers involved in managing salmon. Tribal treaties were signed with the US government (nation-to-nation scale) where the legal obligations sit at the federal level. Yet actions are needed on many jurisdictional scales to address salmon declines: from local land use planning and state level regulations to global-scale fisheries management and impacts from climate change **(complexity). Decision-making authority** is at times contradictory and contested across jurisdictions and scales.

Addressing salmon declines involves much more than managing the salmon fishery. Impacts from dams, development, roads, runoff, and especially a lack of habitat all contribute to salmon declines. It's also becoming increasingly clear that changing ocean conditions – driven by climate change – play a major role in declining salmon populations **(complexity, ecosystem scale)**. Good habitat for salmon is lacking or threatened throughout the Puget Sound. While salmon face multiple threats, lack of habitat and habitat quality is considered to be a limiting factor and current efforts focus on increasing riparian habitat on farmland. Thus, even when considering only one species, many resources are involved.

An important part of the context that makes collaboration between treaty tribes and the agricultural sector challenging is the centrality of the resources to each **(resources dependence, diversity of objectives)**. Most of the productive farmland in Puget Sound was once the deltas, estuary, and floodplains that represent critical habitat for populations of endangered Chinook salmon, which are the main food for endangered Southern Resident orcas (a second key species in the debate). Protecting salmon likely requires conversion of some farmland into riparian habitat. Farmers feel threatened and worry about the loss of their livelihoods and identities. They have watched farmland disappear from their communities and see strict rules for riparian buffers as one more threat. Without salmon, members of the Tulalip, Swinomish, Stillaguamish, and other tribes would lose an essential part of their identity and cultural heritage **(resource dependence)**. Without viable farming landscapes, farmers will lose an essential part of their identities and the Puget Sound community would risk losing important local food systems. Yet both farms and fish face the common threat of increasing population and development pressure.

Mechanism (process) variables this case highlights:

Congruence between benefits and costs (a): In 1987, a collaborative process involving the forestry sector led to agreements on wildlife protection, including rules for protecting riparian buffers – essential for salmon habitat. Inspired in part by this success, a similar forum was convened from 1999 to 2003 to develop an agreement for the agricultural sector. Yet agreement on rules for riparian buffers could not be reached. Here, a similar mechanism (a collaborative process among treaty tribes, government agencies and a resource sector) led to a very different outcome because of the different contexts. The forestry context involved fewer, larger landowners and protection of existing riparian buffers. In agriculture, many smaller

landowners would need to remove significant portions of their existing crop- or pastureland from production to plant new riparian buffers. Therefore, the costs for providing salmon habitat were much higher for agriculture, making agreement tricky.

Congruence between costs and benefits (b): By bringing in flood and farmland management into salmon habitat discussions the collaborative efforts assured that all parties had something to gain from participation. This **congruence between costs and benefits** was created by increasing the **diversity of objectives** of collaboration. Instead of a zero-sum trade-off between habitat and farmland, the new framing acknowledges the **complexity** of the resource system and the need to address the interlinked issues important to all parties.

Nested enterprises: While a major region-wide agreement around agriculture and salmon remains elusive, numerous local-scale initiatives are working to find common ground and collaborative management of a suite of interlinked issues often described as 'Fish, Farms, and Floods' (FFF). The Snoqualamie Valley Fish, Farms, and Flood Advisory Committee spent three years to develop an agreement in 2017. Another sub-regional group (REAL) in Whatcom county highlights farmers' leadership in stewardship actions. The Pierce County Floodplains for the Future partnership has focused on creating a safe space to voice differences and monitor outcomes that include agricultural, salmon, and flood variables. Another sub-regional group, the Snohomish County Sustainable Lands Strategy convened in 2010, has tackled the challenge by focusing on a smaller scale – the river reach (a section of river and associated area). By working on these smaller scales, customized plans and compromises are easier to reach. Communication and integration between local-scale initiatives is facilitated by a region-wide network, the Puget Sound Partnership, that works towards collaboration on a suite of issues related to ecosystem recovery and human well-being.

Face-to-face dialogue: One mechanism that proved helpful in this case was the sharing of a meal. Stakeholders from diverse sectors were invited to sit down together for dinner. Given the **history of conflict**, this simple act of breaking bread together served to help the individuals involved come together and see each other as reasonable people with valid concerns. The 2016 event was so successful (a 'watershed moment' according to one participant) that a follow up 'Farm and Fish Come Together' was held in 2018. The events were spearheaded by a local leader who worked for many years to promote collaboration **(leadership)**.

Capacity: In Puget Sound, funding for ecosystem management is embracing a multi-benefit framework as exemplified by the Washington State Department of Ecology's Floodplains by Design grant program. This involves coordination among agricultural, salmon, and flood control interests to develop projects that advance their collective interests. For outcome of the case study, please see Table 3.

Case 3 – White Mountains Stewardship Project, Arizona, USA (2004 – 2014)

Introduction to the case and context

The White Mountains Stewardship Project (WMSP) was a formal **(collaboration formality)** collaborative governance program focused on restoring forest ecosystems in eastern Arizona within the Apache-Sitgreaves National Forest **(clear boundary)** to reduce the threats of wildfire (especially in the wildland urban interface zones) by restoring 150,000 acres **(ecosystem scale)** of degraded federal forests over 10 years (Abrams and Burns 2007). In the Southwest region of the US, where many of the forests are fire-adapted ecosystems, a century of fire

Table 3. Outcomes of the Pacific NW America Salmon Habitat case study as of 2019. Many key outcomes are slow moving variables that will probably not respond quickly even to the best efforts. Below are a few key variables identified in this case study as well as some of the vital signs tracked by a major regional collaborative effort – the Puget Sound Partnership – described in its 2019 State of the Sound report. Outcomes vary by region and collaborative group; the below table offers a region-wide overview.

	Environmental Outcomes	Social Outcomes	Process Outcomes (internal to the collaboration)
Positive/ Improved	• Floodplain restoration • Slowed rate of forest cover loss to development • Restoration of freshwater riparian habitat (improved but not yet meeting the Puget Sound Partnership target)	• Increasing trust and understanding between different groups in the region, such as tribes, farmers, and government. • Paradigm shift among participating individuals from 'farms OR fish' to recognizing the common vision of 'fish, floods and farms.'	• Creation of various 'FFF' groups, sharing of values and perspectives in their meetings. • Various local policy documents or plans created to work towards resilient communities and food systems
Negative/ Degraded	• No improvement in Chinook Salmon population abundance • Decrease in Orcas (Southern Resident killer whales)		• Some participants have left collaborations out of frustration from what they see as a lack of tangible outcomes.

suppression has created unhealthy forests that also endanger communities nearby **(history of colonialism)**. These overly dense forests are of low economic and ecological value, containing 300–3000 small-diameter trees per acre rather than 20–60 healthy trees per acre. They are dangerous particularly during dry summers when wildfires often threaten these forests and the towns and cities nearby. Drought and invasive insects exacerbate the existing problems caused by fire suppression (USDA, n.d.) **(congruence of rules with local ecological conditions; congruence of rules with local culture).**

During the 1990s, legal battles and social conflict surrounding federal forest management in the US intensified. Environmental organizations aimed to protect forest habitats, and forest products industries were impacted by new rules. While rural communities have often seen their logging industry decline in recent years, partly due to lack of availability of trees large enough in diameter, they are also seeing their outdoor recreation industries rise, which are usually dependent upon healthy forests **(resource dependence)**. The wildlands-urban interface area is also increasing, and with it, a growing interest in thinning and restoring forests to prevent large wildfires from spreading throughout the overly dense national forests.

The White Mountains Stewardship Project ran from 2004 through 2014 **(collaboration status)**, the first ten-year Stewardship Contract in the USA established by the United States Forest Service (USFS) **(funding level)**. Importantly, this may not have happened without the work of the Natural Resources Working Group (NRWG), established in 1997 to build community capacity and create a multi-stakeholder collaborative forum (Abrams and Burns 2007), which brought together diverse stakeholders around forestry **(resource type)** issues faced by the community.

The purpose of a stewardship contract is to achieve key land management goals such as ecosystem restoration through an open, collaborative process focusing on the end results (rather than the value of commodities removed from the land) and without getting stuck in litigation. A stewardship contract emphasizes dialog **(conflict resolution mechanisms)** through the oversight authority of a multi-party monitoring board **(collaborative boundary)**, consisting of various stakeholders from different backgrounds and perspectives. In the WMSP, the multiparty monitoring board included individuals representing about 15 stakeholder organizations **(group size)** including state agencies such as AZ Game and Fish, regional government representatives, local citizens and businesses, an academic institute at Northern Arizona University, and environmental organizations such as The Nature Conservancy. They met monthly for the first year to develop the monitoring goals for the project, and quarterly in subsequent years **(decision-making level; monitoring the resource)**. They listened to experts, asked hard questions and found common ground to achieve consensus **(governance of the collaboration)**, eventually working together as a cohesive team (Sitko and Hurteau 2010).

The Project was initiated by stakeholders already organized through the NRWG. That group was formed and facilitated by Stephen Campbell of the University of Arizona Cooperative Extension over several years in the late 1990s, to create a dialog and bridge the divide between the environmental community and the forest products community in eastern AZ **(prior networks; history of collaboration/conflict; facilitation; face-to-face dialog)**. Despite epistemological differences, the group was able to come to agree upon a common vision for what the forests should look like in the region, setting a good precedent for WMSP to begin **(recognition of rights to organize)**.

The WMSP has been influential in Arizona and across the US, having established a model for collaborative governance for forest restoration via stewardship contracts, and also producing a proven model of mechanical thinning of overly dense forest thickets that worked to prevent wildfires from spreading through the wildlands-urban-interface (Abrams and Burns 2007; Sitko and Hurteau 2010; USDA 2011; Mottek Lucas and Kim 2016) **(collaboration goals; diversity of objectives)**. Although there were challenges regarding the USFS rules and oversight of the contracting process, the WMSP provided a successful precedent for the establishment of the Four-Forest Restoration Initiative (4FRI) in Arizona, which extends the project to three other national forests and is ongoing at this time **(nested enterprises)**. The information on this case study is from interviews and archival review of the literature.

Mechanism (process) variables this case highlights

Prior networks: The NRWG, a network led and facilitated by an extension professor at the University of Arizona, was functional for about 8 years prior to the formal stewardship project and was essential for the establishment of the WMSP and the ease with which the collaborators worked with one another as a result of that prior network.

Level of trust among stakeholders: Starting from an atmosphere of low trust and social capital across political and social divides, the NRWG deliberately worked to bridge divides and bring a diverse array of actors to agreement on a common vision for restored forests in eastern AZ. This provided a basis from which trust and social capital could be built.

Social learning & knowledge building: The process of social learning was a key instrument in the process of this collaborative effort – social learning led to an agreement on the 'clumpy' model for thinning the overgrown national forests of eastern AZ. The group commissioned studies that guided them through discussions of the pros and cons of the different thinning models until they collectively arrived at the best model.

Capacity-building: The WMSP was able to build significant capacity – both in the community, to collaborate across boundaries, and in the industry – to build the capacity to make use of small-diameter trees and recover from the prior collapse of the forestry industry in the region.

Leadership: Key individuals had the vision and skill to guide a diverse set of stakeholders in collaboratively building a common goal for the public forest lands of eastern Arizona. These individuals were patient and committed and saw their project through.

Shared vision and long-term commitment: From the early process of building a shared vision in NRWG throughout the long process of managing or steering the stewardship contract, collaborators maintained commitment to their shared goal of forest restoration and revitalization of the forestry industry based upon small-diameter trees. For outcome of the case study, please see Table 4.

Case 4 – Collaborative management and governance of water resources in the Laikipia Region, Upper Ewaso Ng'iro basin, Kenya Collaborative

Introduction to the case and context

This is the case of an endogenously initiated collaboration through forming community water groups (CWG), in Laikipia County Kenya. As water policy changed, CWGs became part of the decentralization process in the water sector to involve local-level actors in water management through the Water Resources Users Association, a form of 'mandated collaboration' by the Kenyan government.

The Laikipia region refers to the area around the equator, at the west- and north-west foot-slopes of Mount Kenya. It covers a large part of the upper Ewaso Ng'iro river basin (**ecosystem scale**), is largely semi-arid and sub-humid, characterized by high rainfall variability and droughts, and has inadequate water infrastructure in its rural areas (Ogalleh et al. 2012). Laikipia is a migration destination, characterized by its diverse ethnic communities – the Mukogodo Maasai, Kikuyu, Meru, Turkana, Samburu, and White Kenyans (**history of colonialism**). The population in 2018 was about 541,985 (County Government of Laikipia) and is predominantly rural with a poverty rate of 48% (US$ 0.72 - per day) (Kenya National Bureau of Statistics 2014). Large-scale wheat and horticultural farms and smallholder farms dominate in the upper foot-slopes of the mountain while in the lowlands, pastoral rangelands, large reserves, wildlife parks and tourist enterprises are prevalent. With highly variable rainfall and inadequate water infrastructure, access to water is a critical development concern (**resource type**).

Since the 1970s, people facing a common problem (e.g. limited water availability and access) have formed self-help Community Water Groups (CWGs) (**history of collaboration/conflict**) with the aim of pooling their resources (e.g. material, financial, intellectual, social) to solve the water problem (**collaboration goals**), which otherwise would have

Table 4. Outcomes of the White Mountains Stewardship Project case study.

	Environmental Outcomes	Social Outcomes	Process Outcomes (internal to the collaboration)
Positive/ Improved	• Mechanical thinning of the areas treated by the contractor proved successful in stopping wildfire from spreading. The wildfire stopped at the edge of areas that had been thinned – these thinned areas did not burn.	• Community Wildfire Protection Plans were created for communities near forests. • Revitalized the forest products industry in the region, which had been collapsing in recent years. Positive outcomes for family businesses, with an outlook of sustainable production of small-diameter wood.	• WMSP was able to bring a very diverse set of stakeholders together to agree on a common vision, common goals and keep them working together. This community was previously fractured and this project helped bring people together around forest restoration.
Negative/ Degraded	• There is still much of these national forests that needs to be thinned in this manner to prevent wildfire. Only about 5% of the total forest area was thinned within the project timeframe. This rate is too slow and expensive to continue in that fashion.	• The problems caused by having just one single contractor to complete the work raised questions about the purpose for this USFS rule in stewardship contracts. • Challenge in scaling up the restoration efforts to include northern Arizona forests, in the Four Forest Restoration Initiative (4FRI).	• The cost per acre and total % of the area thinned over the 10 years has opened some questions about the USFS process for choosing a contractor, what society should expect of the contractor, and the oversight of the contractor.

been more difficult or impossible to solve (Ifejika Speranza et al. 2016).

The need for stable access to water triggered the vision of most CWGs to develop water, for domestic needs, livestock, crop farming, fish farming, and tree nurseries (**resource dependence, diversity of objectives**). To be recognized as a corporate entity, the CWG had to be registered with the Directorate of Culture and Social Services (Cooperatives and Social Development Sector) to obtain a certificate as a self-help group (**collaboration formality**). Subsequently, the CWG registered with the Ministry of Water and Irrigation (MWI) as a water project (Note: The MWI transitioned to the Ministry of Water and Sanitation (MWS) through the Government Executive Order No. 1 of 2018. After this step, the MWI sent its experts to survey the appropriate point in the river/spring where the CWG wants to abstract water whereby the CWG bears the costs.

Through the reforms associated with the Kenyan Water Act of 2002, the Kenya government established the Water Resources Management Authority (WRMA). Further reforms (Section 11 of the Water Act, 2016) transitioned the WRMA into the Water Resources Authority (WRA). At the regional and basin level, the Basin Water Resources Committee (BWRC), which replaced the Catchment Area Advisory Committees (CAACs), developed in consultation with the WRA basin water resources management strategies (formerly, catchment management strategies), advised the WRA and Counties on WRM and conservation including granting and cancelling water permits.

As an additional outcome of the 1990s-early 2000 water sector reforms, the Kenyan Water Act of 2002 formally stipulated the creation of Water Resources Users Associations (WRUAs) (**collaboration formality**), institutionalizing the WRUAs as the grassroots institutions to foster and promote participation in WRM and governance towards improved equity and reduced conflicts (**collaboration goals**). In this context, most CWGs became members of WRUAs, even though some of them existed long before the institutionalization of WRUAs (**collaboration status, history of collaboration/conflict**).

At the sub-catchment levels, WRUAs are formed with corporate membership (all water projects and corporate water users in a given sub-catchment) (**group size**). WRUAs are responsible for formulating and implementing the Sub-Catchment Management Plans (SCMP). The WRA facilitates this process together with other supporting organizations in the respective sub-catchment. The CWG projects must be consistent with the SCMP. Due to their limited capabilities, the high costs of developing the SCMP and a lack of organized funding (**funding level**), many WRUAs in Laikipia depend on external support such as from national research organizations, international NGOs, and international development co-operations. Thus, some WRUAs in Laikipia have not yet completed their SCMPs and the demand from the WRUAs for support in preparing the SCMP remains very high.

A CWG comprises individual members and represents these members as one corporate entity in the WRUAs. Unlike the WRUAs at the sub-catchment level, the CWGs have no hydrological delimitation and are mostly at a much smaller geographical/spatial scale (**ecosystem scale**). Important to note is that the CWGs, which are self-help groups have mandates and objectives that may not necessarily cover the broader theme of WRM and governance but are much more limited to the basic concern of securing supply and access to water (**collaboration goals, complexity**).

CWGs have to pay water abstraction fees (**user rights**), which were also introduced as part of the water sector reforms. The WRA ensured that each CWG installed a meter at the intake and charged the CWGs between KSH0.7 and KSH1 per cubic meter (**property rights**). The Project Management Committee (PMC) of a CWG then shares the levies among the CWG-members (e.g. each member of the Nyakairu CWG paid KSH1200 per year; ca. US$12) (**facilitation**). The water sector reforms thus could act as a trigger and a window of opportunity. The reforms and associated developments also catalyzed the existing CWGs to transition to become members of WRUAs in order to adjust their water development to the water policy regulations.

Mechanism (process) variables this case highlights

Prior networks: Research on water resources and CWG is based on long-term collaboration between researchers, government organizations, private sector, and civil society organizations spanning more than 30 years – extending back to the late 1970s. The idea of Harambee (Kenyan tradition of communal support and fund raising) and collaboration is widespread in Kenya and actively promoted for community development. Through this long-term research engagement, the relevance and credibility of a collaborative approach could be demonstrated and used by the various involved actors, leading to reduced water conflicts and increased interactions between water users.

Nested Enterprises: At the operational level members of the CWG are integrated into decision-making through participating in decisions concerning their groups – horizontal collaboration. Vertically, collaboration around water resources management and governance in Laikipia cuts across levels, in terms of administrative/jurisdictional mandates and in terms of the basin/watershed/catchment/sub-catchment, according to the Kenyan water policy. The Kenya water policy set collective-choice level and

Table 5. Outcomes of the Water Management in Laikipia Region of Kenya case study.

	Environmental Outcomes	Social Outcomes	Process Outcomes (internal to the collaboration)
Positive/ Improved	• Improved vegetation cover along some water sources, which can be measured by kilometres of protected areas • Stabilized river flow (Existing data of over 10 years) • Wetlands and springs rehabilitated	• Awareness raised about water resources and better management • More equitable water sharing (in some catchments) • Reduced water-related conflicts • Increased feeling of ownership/ confidence in water resource management • Improved access to water and livelihoods/ health • Employment for some people • Additional water infrastructure	• Some increased cohesion and participation • Increased support from donors • Increased stake of communities in the management of water and forest resources
Negative/ Degraded	• Some catchments still have low or no flow during the dry season despite collaboration	• Decreased access to resources without membership • In some CWGs/WRUAs. inadequate governance due to power differentials (Limited elections and misuse of resources)	• Elite capture and control, nepotism and mistrust • Disfunctional and non-transparent decision-making processes • Downstream users – largely still not organized in CWGs • Sustainability of WRUAs in terms of resources (donor dependency)

constitutional-choice level rules through the Kenya Water Act 2002. The Water Act 2016 set the conditions for rule-making (e.g. the CAAC/BWRC), rule changing (the KWA 2002; 2016), and rule enforcement processes (water monitors; periodic control by officers of the Kenya water authority).

Social learning: The watershed can be considered a learning watershed with different types of knowledge exchange actively promoted by researchers, by other actors including the CWGs and WRUAs who receive training and capacity building from government, NGOs and research organizations. However, the requirement or demand is more than the supply of such learning. Through the different workshops and focus group discussions, individual actors also exchanged knowledge and learned more about the water resources conditions and their various uses. Through contact with other water users, each individual user learns about the water needs of the other water users. Plans are underway by research organizations in Laikipia to establish an open-access internet platform on water resources conditions. For outcome of the case study, please see Table 5.

Analysis and discussion

Our four cases have identified contextual variables that influence how mechanism variables lead to diverse outcomes. The cases highlight the importance of the context – the milieu and history – in which the collaboration takes place. In some cases, similarities in mechanism variables still lead to different outcomes due, in large part, to the different contexts in which this appears. As an example, the Pacific salmon habitat case and the White Mountain Stewardship case both exhibit strong leadership, social learning in a complex, multi-functional landscape, and build on prior networks – mechanism variables identified as means to achieving desired outcomes. While both have had successes and failures in goal achievement, the White Mountain case now serves as an exemplar for the US Forest Service to scale up collaborative governance to the 4FRI forestry initiative. At the same time, the FFF is still fighting to secure wins and improve outcomes in place. Some of the difference in outcomes across cases can be explained through the contextual variables. Intuitively, we know this. Our analysis provides a standardization and categorization of the contextual factors to allow for deeper cross-case comparison and scaling up of conclusions and thereby a richer understanding of how mechanism variables are mediated by the social-ecological system embedding the case.

Our qualitative analysis of four diverse, distinctive cases provides insights that expand upon the past identification of success factors/design principles by accounting for context. Many of the contextual variables and mechanism variables are well-studied. We highlight some of the relevant background literature as specific variables are described below. Our methodological approach combines context and mechanism in a comparative cross-case analysis. In doing so, we have identified several cross-cutting themes that emerge from the four cases and can analyze how contextual variables interact with mechanism variables and, in turn, lead to the outcomes that we assess. We highlight the contextual and mechanism variables assessed through the four cases here in Table 6.

A comparison of contextual variables

One of the first insights in looking across the cases is that attempts to collaborate often arise when existing institutional structures fail to address resource

Table 6. Compilation of Contextual and Mechanism Variables across the Case Studies.

Context Variables	Case 1: Zambia	Case 2: Pacific NW North America	Case 3: Arizona, USA	Case 4: Kenya
Collaboration Goals/ Objectives	Improve environmental management effectiveness		Restoring forest ecosystems to reduce the threats of fire	Address limited water availability and access
Collaboration Status	Ongoing since 1998	Long-term commitment (>100 years)	Active from 2004–2014	Ongoing since the 1970s
Collaboration Formality	Legally recognized	Formal	Formal	Legal corporate entities
Group Size	"Various; generally involving tribal, government, and NGOs		15 stakeholder organizations	All water projects and corporate water users
Resource Type	Wildlife	Salmon & riparian habitat	Forest	Water
Resource Dependence	High dependence on bushmeat	Important cultural, commercial and recreational fishing resource	Low economic and ecological value	High
Ecosystem Scale	37,500 km2	Ocean & estuaries	150,000 acres	River basin
Complexity	Multifunctional landscape	Multi-scalar		Single resource
Diversity of Objectives		Fishing & agriculture	Restoration & fire prevention	domestic use, farming, nurseries
History of Collaboration/ Conflict	Reformed accountabilities	Series of treaties	Divide between forest uses	Self-help groups since 1970s
History of Colonialism		Relinquished traditional lands	Fire suppression techniques	Diverse ethnic communities
Power Asymmetry	Power imbalances	Between settlers and tribes		
Funding Level	No direct control over revenues to minimize financial misappropriation		Stewardship contract with USFS	Depend on internal and external support
User Rights		Tribal-treaty rights to fish salmon		Pay for water
Property Rights	Custodians of the wildlife without any property rights			Can purchase by the cubic meter
Decision-Making Level	The Department of National Parks and Wildlife	Across jurisdictions and scales	Set monitoring goals	BWRC (CAACs) advise WRA on water resource management
Facilitation	Supported by conservation & development orgs	Puget Sound Partnership	University of Arizona Cooperative Extension	Project Management Committee
Culture Type	Hierarchical relationships			
Governance of the Collaboration			Consensus	

Table 7. Compilation of Mechanism Variables across the Cases.

Mechanism Variables	Case 1	Case 2	Case 3	Case 4
Resource Boundary	Yes			
Congruence with local ecological conditions	Yes			
Congruence of the rules with local culture	Yes			
Congruence between benefits and costs	Yes	Yes		Yes
Collective choice arrangements	Yes			Yes
Monitoring the resource users and the resource	Yes			Yes
Graduated sanctions for violations of rules	Yes			Yes
Minimal recognition of rights to organize	Yes			Yes
Nested enterprises		Yes		Yes
Institutional adaptability	Yes			
Social learning		Yes	Yes	Yes
Shared vision and long-term commitment			Yes	Yes
Leadership	Yes	Yes	Yes	Yes
Capacity building	Yes	Yes	Yes	Yes
Knowledge building			Yes	Yes
Prior networks			Yes	Yes
Face-to-face dialogue		Yes		Yes
Trust among stakeholders	Yes		Yes	

management problems that **cross scales**, species, or sectors (Cash et al. 2006; Guerrero et al. 2015). Collaboration can help bridge the borders between governmental agencies, departments within government, and across a spectrum of managers and decision-makers – public and private (York and Schoon 2011). Collaboration helps to minimize the transaction costs of social learning and decision-making in nested, polycentric systems of governance by providing alternative or previously non-existent communication channels.

The first three cases all allude to one of the biggest changes in the context of natural resource governance. These are all complex, multi-functional resource systems. However, the complexity for managers is multiple. Decision-makers have to manage a wide suite of **resources** for a broad set of stakeholders with a **diversity of objectives** (Cousins 1996; Cockburn et al. 2020). Natural resource management has always occurred in complex systems and the past two decades have seen a shift from single species management to ecosystem management (Van Wilgen and Biggs 2011). Management, particularly of common pool resources, including public land, has also regularly included multiple uses. However, the past decade has seen an acceleration of these complexities. Collaboration is often viewed as a means to address such challenges.

At first glance, the cases presented here resemble those of the classic commons dilemmas – with cases on fish, on forests, and on water. However, only the Kenyan water case remains a classic example of commons management. The others are about multiple **resources**, multiple and **diverse stakeholders** and across **broader scales** than the classic small-scale commons dilemma (Cockburn et al. 2020). This shift in the complexity of context has had major implications for managers, resulting in increased efforts to collaborate to bring in a diversity of knowledge, opinions, and expertise. One consequence of this is that only the White Mountains has the relatively small **group size** of traditional collaboratives (Wondolleck and Yaffee 2000; Agrawal and Goyal 2001). The others more closely resemble collections of collaborations at various scales and sizes, depending on the specific governance issue being addressed. However, as typical of commons cases, all of the cases exhibit a high level of **resource dependence** (Mills et al. 2013). These are some of the cross-cutting issues of context that influence how the mechanism variables below affect outcomes.

A comparison of the mechanism variables

Building on the contextual factors above, of key importance is that these cases all nest within a broader, multi-level governance system **nested enterprises** (Ostrom 1990; Blomquist 2009). Perhaps the classic commons cases, when examined in retrospect, may take an overly naïve view of governance systems, or perhaps this is a massive change in the ways society views and manages complexity in these systems. These cases all show multiple levels of governance with diverse authorities and spheres of power – from the traditional leaders in the CBNRM study and the salmon case to groups of farmers in the salmon case and the Kenya water example and from local levels of government to broader governmental authorities See Table 7.

The cases all demonstrate the importance of building **trust** and **social capital** in support of the rich literature in these areas (Ostrom and Walker 2003; Diedrich et al. 2017; Coleman and Stern 2018). The cases often spoke of past conflict and the use of time together in the field and through planned meetings and dining together as means to build trust and social capital over time as in the White Mountains and NW Pacific Salmon cases. In the case of Water Resources in Laikipia and CBNRM in Zambia, issues of mistrust still made meeting collaborative goals challenging.

We see evidence of how **social learning** can build trust over time through dialogue (in the salmon case), in finding commonalities (in the White Mountains) and viewing watersheds as places for knowledge transfer (Kenya) (Cundill, 2010; Cundill and Rodela, 2012). Similarly, transparency in decision-making improved trust in the Zambian case, while a lack of transparency hindered it in the Kenyan case (Lockwood et al. 2010). We see that trust and social learning are needed to develop a shared vision, which may also require defining roles and responsibilities about governance and decision-making more broadly (Plummer and Fitzgibbon 2004).

Likewise, the first three cases showcase the importance of **leadership** with the Zambian case highlighting the importance of harnessing traditional leaders towards the desired outcomes (Olsson et al. 2006; Bodin and Crona 2008). The Salmon case saw gains possible only through the long-term commitment of local leaders over years. In the White Mountains, leaders crafted goals and a common vision for the collaborative to aim towards. In each case, a **shared vision and long-term commitment** to champion the collaborative was required to build the support (and trust), to craft a shared vision, and to build a supportive structure in which the collaborative could function (Wondolleck and Yaffee 2000).

A comparison of outcome variables

A core insight that emerges from looking across the four cases is that the outcomes can be readily divided into fast and slow variables. In particular, in spite of the longevity of some of these collaborative programs, many of the process outcomes have changed more rapidly than the environmental or social outcomes. For example, in the salmon case, new policies were created and new programs enacted – positive process outcomes. However, habitat restoration still lags with low levels of improvement. Likewise, there have been no improvements in Chinook salmon populations. Of particular interest as a process outcome is social capital and trust. It acts as a slow variable for improvement, as in the White Mountains and the salmon cases (Mottek Lucas et al. 2017). However, mistrust and the destruction of social capital act as fast variables as in the Zambian and Kenyan cases. The longevity of the Kenyan case shows how social and environmental slow variables can be improved, as with the rehabilitation of wetlands, improved vegetation and reduction in conflict over water resources. Much of these longer-term gains came after the fast process outcome variables of improved participation and donor support. In short, many of the process outcomes are fast variables. Additionally, some social and ecological variables may change quickly through the process outcomes. However, others are slow and may require substantial time to show improvement. In looking across the four cases, there are no unmitigated wins, but all showed signs of improved governance through collaboration.

Reflections on the proof-of-concept

We tested a new application of a framework, assessing how the CMO framework can be used to draw comparisons across cases, as a proof-of-concept study to analyse the importance of context for successful collaboration. In applying this framework to four cases, we identified a few of the benefits and limitations of the CMO framework and then conclude by identifying attributes of context that influence the purpose, mechanisms and outcomes of collaboration.

Importantly, such a framework allows researchers to add contextual elements in an organized, systematic, and systemic fashion for the study of their individual cases. Likewise, it serves as a formalization necessary for cross-case comparison. In doing so, it enables researchers to tackle the idiosyncratic nature of context and begin to draw generalizations. Often case studies focus on the contextual factors that make the research unique, and we acknowledge the usefulness of this approach. However, as researchers we also want to step outside of individual cases, begin to aggregate our findings and be able to generalize and learn from past studies (Ostrom 2007). This framework offers a step towards discerning principles for improving collaborative initiatives contingent on combinatory, contextual variables, despite some remaining shortcomings.

The first shortcoming is that details not included in our contextual variables go missing. In all meta-analyses, scientists must balance the desire to add additional variables with the challenge of being able to 1) collect the additional data; 2) analyze the results of additional variables in a meaningful way; and 3) do this across multiple combinations of variables. We attempt to mitigate this limitation through providing common variables underpinned by an extensive literature review, the expertise of dozens of case researchers (four of whom are represented in this analysis) and providing multiple opportunities for longer text answers in the coding manual to underscore additional factors of importance.

The second shortcoming is that the qualitative aspects of cases are often difficult to quantify. Through moving from qualitative to quantitative research, we have identified a number of 'sticky variables'. These may emerge because the quantification process overlooks the distribution of responses to focus on averages, maximums or minimums. For instance, if we had a community with a bimodal income distribution, it is not clear how to code a question about the average income in a way that

accurately represents the case on the ground without adding additional variables. Another challenge is to quantify a variable like levels of trust into a categorical measure. There are more elaborate studies that do this, but these go beyond what is feasible for the multiple cases explored here. We have provided examples in the coding manual of typical and atypical cases for each variable and how to code them. We have also provided extensive training to coders as well as conducted intercoder reliability checks. However, this shortcoming still exists. Third, on a related issue, case studies provide different insights than more generalized studies. As we noted in the methods section, Geertz (1973) describes thick description as the qualitative data that emerges from ethnographic studies that are more descriptive than typical quantitative data. As addressed above, we try to alleviate this by providing mechanisms for capturing more detailed textual explanations. Overall, however, we assess the utility of our concept in providing generalizable lessons and insights across cases as very high, and outweighing these three limitations. Ultimately, we strive to find ways to better integrate the essence of qualitative data into the structured comparison enabled by qualitative comparative analysis. This is a goal for future research on this topic.

Conclusion

Our goal in this manuscript was twofold. First, we wanted to provide a proof-of-concept assessment for a new methodological approach to studying environmental collaborations as described in the reflections above. Second, we highlighted and analyzed how context influences and mediates the mechanism variables with regards to the outcomes of collaborative governance initiatives in social-ecological systems. By using the CMO Framework, we are able to see patterns emerging in the small, qualitative, cross-case comparison and the mediating effect of context on the traditional mechanism variables studied in collaborative governance of social-ecological systems. We also see the challenge of contextual analysis across cases, as the range of important variables is potentially unlimited. However, we appreciate the improved capability to compare across cases in a rigorous way and assess the overall concept as highly useful. The approach enables us to analyze across cases and compare impacts of specific sets of variables. We find great value in scaling up the cross-case comparisons within this framework to allow researchers to take a diagnostic approach to assess how key variables like trust or social learning interact with other important variables (Young 2002; Ostrom 2007). With this in mind, our next steps include coding 25 cases or more under this framework and then analyzing them in aggregate through Qualitative Comparative Analysis – an analytical approach based on set theory that is well suited for studies including an intermediate large pool of cases. Ultimately, our goal is to move towards a typology in which we see categories of contextual variables interacting in consistent ways with the mechanism variables.

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References

Abrams J, Burns S. 2007. *Case Study of a Community Stewardship Success: the White Mountain Stewardship Contract*. Ecological Restoration Institute, Northern Arizona University. Flagstaff (AZ). http://openknowledge.nau.edu/1294/1/Abrams_Burns_2007_ERIWhitePaper_CaseStudyOfACommunity.pdf

Agrawal A, Goyal S. 2001. Group size and collective action: third-party monitoring in common-pool resources. Comp Polit Stud. 34(1):63–93. doi:10.1177/0010414001034001003.

Ansell C, Gash A. 2008. Collaborative governance in theory and practice. J Public Admin Res Theory. 18(4):543–571. doi:10.1093/jopart/mum032.

Armitage DR, Plummer R, Berkes F, Arthur RI, Charles AT, Davidson-Hunt IJ, Diduck AP, Doubleday NC, Johnson DS, Marschke M, et al. 2009. Adaptive co-management for social–ecological complexity. Front Ecol Environ. 7(2):95–102. doi:10.1890/070089.

Baggio JA, Barnett AJ, Perez-Ibarra I, Brady U, Ratajczyk E, Rollins N, Rubiños C, Shin HC, Yu DJ, Aggarwal R. 2016. Explaining success and failure in the commons: the configural nature of Ostrom's institutional design principles. Int J Commons. 10(2):417–439. doi:10.18352/ijc.634.

Barnett AJ, Baggio JA, Shin HC, Yu DJ, Perez-Ibarra I, Rubiños C, Brady U, Ratajczyk E, Rollins N, Aggarwal R. 2016. An iterative approach to case study analysis: insights from qualitative analysis of quantitative inconsistencies. Int J Commons. 10(2):467–494. doi:10.18352/ijc.632.

Blomquist W. 2009. Multi-level governance and natural resource management: the challenges of complexity, diversity, and uncertainty. In: Beckmann V, Padmanabhan M, editors. Institutions and sustainability. Dordrecht: Springer; p. 109–126.

Bodin Ö, Crona BI. 2008. Management of natural resources at the community level: exploring the role of social capital

and leadership in a rural fishing community. World Dev. 36(12):2763–2779. doi:10.1016/j.worlddev.2007.12.002.
Borrini-Feyerabend G. 1996. Collaborative management of protected areas: tailoring the approach to the context. Gland (Switzerland): IUCN-The World Conservation Union.
Breslow SJ. 2014. Tribal Science and Farmers' Resistance: a Political Ecology of Salmon Habitat Restoration in the American Northwest. Anthropol Q. 87(3):727–758. doi:10.1353/anq.2014.0045.
Carpenter SR, Folke C, Norström A, Olsson O, Schultz L, Agarwal B, Balvanera P, Campbell B, Castilla JC, Cramer W, et al.. 2012. Program on ecosystem change and society: an international research strategy for integrated social–ecological systems. Current Opinion Environ Sustain. 4(1):134–138. doi:10.1016/j.cosust.2012.01.001.
Carr Kelman C, Brady U, Baggio. J, Lee J, Rojas C, Srinivasan J, Vallury S, Schoon M. 2018. Practitioner Brief on Factors for Effective Environmental Management Collaboration. Center for Behavior, Institutions and the Environment Working Paper Series. #CBIE-2018-003
Carr Kelman C, Brady U, Schoon M. 2019. *Key criteria for successful collaborative management of natural resources*. Paper presented at the Sustainability and Development Conference, Ann Arbor, Michigan, 2019 Oct 11.
Cash DW, Neil Adger W, Berkes F, Garden P, Lebel L, Olsson P, Pritchard L, Young O. 2006. Scale and cross-scale dynamics: governance and information in a multilevel world. Ecol Society. 11(2). doi:10.5751/ES-01759-110208.
Chapman M, Satterfield T, Chan KMA. 2019. When value conflicts are barriers: can relational values help explain farmer participation in conservation incentive programs? Land Use Policy. 82:464–475. doi:10.1016/j.landusepol.2018.11.017
Chapman M, Satterfield T, Chan KMA. 2020. How value conflicts infected the science of riparian restoration for endangered salmon habitat in America's Pacific Northwest: lessons for the application of conservation science to policy. Biol Conserv. 244:108508. doi:10.1016/j.biocon.2020.108508
Chen H. 2005. Practical program evaluation. Thousand Oaks (CA): SAGE.
Child B, Dalal-Clayton B. 2004. Transforming approaches to CBNRM: learning from the Luangwa experience in Zambia. In: McShane TO, Wells MP, editors, Getting biodiversity projects to work: towards more effective conservation and development. Columbia University Press; p. 256–289.
Chomba C, Mwenya AN, Nyirenda N. 2011. Wildlife legislation and institutional reforms in Zambia for the period 1912–2011. J Sustain Dev Africa. 13:218–236.
Cockburn J, Schoon M, Cundill G, Robinson C, Aburto JA, Alexander SM, Baggio JA, Barnaud C, Chapman M, Garcia Llorente M, et al.. 2020. Understanding the context of multifaceted collaborations for social-ecological sustainability: a methodology for cross-case analysis. Ecol Society. 25(3):3. doi:10.5751/ES-11527-250307.
Coleman K, Stern MJ. 2018. Exploring the functions of different forms of trust in collaborative natural resource management. Soc Nat Resour. 31(1):21–38. doi:10.1080/08941920.2017.1364452.
Cousins B. 1996. Conflict Management for Multiple Resource Users in Pastoralist and Agro-Pastoralist Contexts. IDS Bull. 27(3):41–54. doi:10.1111/j.1759-5436.1996.mp27003005.x.
Cox M. 2014. Understanding large social-ecological systems: introducing the SESMAD project. Int J Commons. 8(2):2. doi:10.18352/ijc.406.
Dalkin SM, Greenhalgh J, Jones D, Cunningham B, Lhussier M. 2015. What's in a mechanism? Development of a key concept in realist evaluation. Imple sci. 10(1):1–7. doi:10.1186/s13012-015-0237-x.
DeGeorges PA, Reilly BK. 2009. The realities of community based natural resource management and biodiversity conservation in Sub-Saharan Africa. Sustainability. 1(3):734–788. doi:10.3390/su1030734.
Diedrich A, Stoeckl N, Gurney GG, Esparon M, Pollnac R. 2017. Social capital as a key determinant of perceived benefits of community-based marine protected areas. Conser Biol. 31(2):311–321. doi:10.1111/cobi.12808.
Douthwaite B, Mayne J, McDougall C, Paz-Ybarnegaray R. 2017. Evaluating complex interventions: A theory-driven realist-informed approach. Evaluation. 23(3):294–311.
Emerson K, Nabatchi T, Balogh S. 2012. An integrative framework for collaborative governance. J Public Admin Res Theory. 10(2):1–29. doi:10.1093/jopart/mur011.
Epstein G, Pittman J, Alexander SM, Berdej S, Dyck T, Kreitmair U, ... Armitage D. 2015. Institutional fit and the sustainability of social–ecological systems. Current Opinion Environ Sustain. 14:34–40.
Fabricius C, Koch E, Turner S, Magome H, eds.. 2013. Rights resources and rural development: community-based natural resource management in Southern Africa. London (UK): Routledge.
Folke C, Hahn T, Olsson P, Norberg J. 2005. Adaptive governance of social-ecological systems. Annu Rev Environ Resour. 30:441–473.
Garibaldi A, Turner NJ. 2004. Cultural Keystone Species: implications for Ecological Conservation and Restoration. Ecol Society. 9(3):art1. doi:10.5751/es-00669-090301.
Geertz C. 1973. Thick description: toward an interpretive theory of culture. Turning Points Qualitative Res Tying Knots Handkerchief. 3:143–168.
Guerrero AM, Mcallister RR, Wilson KA. 2015. Achieving cross-scale collaboration for large scale conservation initiatives. Conser Letters. 8(2):107–117.
Gujadhur J 2000. Organisations and their Approaches in Community Based Natural Resources Management in Botswana, Namibia, Zambia and Zimbabwe.
Ifejika Speranza C, Kiteme B, Wiesmann U, Jörin J. 2016. Community-based water development projects, their effectiveness, and options for improvement: lessons from Laikipia, Kenya. African Geograph Rev. doi:10.1080/19376812.2016.1253485
Kenya National Bureau of Statistics, Centre for Training and Integrated Research in ASAL Development, Centre for Development and Environment, 2014, 2016
King EC, 2014. Hunting for the problem: an investigation into bushmeat use around North Luangwa National Park, Zambia (Doctoral dissertation, Department of Life Sciences, Silwood Park, Imperial College London).
Koontz TM, Thomas CW. 2006. What do we know and need to know about the environmental outcomes of collaborative management? Public Adm Rev. 66:111–121.
Leventon J, Schaal T, Velten S, Loos J, Fischer J, Newig J. 2019. Landscape-scale biodiversity governance: scenarios for reshaping spaces of governance. Environ Policy Governance. 29(3):170–184.
Lockwood M, Davidson J, Curtis A, Stratford E, Griffith R. 2010. Governance principles for natural resource management. Soc Nat Resour. 23(10):986–1001.
Margerum RD, Robinson CJ. 2016. The Challenges of Collaboration in Environmental Governance. Barriers and Responses. Cheltenham, UK: Elgar Press.

Marks SA, Fuller RJ (2008). Enclosure of an important wildlife commons in Zambia. In International Association for the Study of the Commons conference at University of Gloucestershire, Cheltenham, UK.
Mbaiwa JE. 2004. The success and sustainability of community-based natural resource management in the Okavango Delta, Botswana. South African Geograph J. 86(1):44–53.
Mills M, Pressey RL, Ban NC, Foale S, Aswani S, Knight AT. 2013. Understanding characteristics that define the feasibility of conservation actions in a common pool marine resource governance system. Conser Letters. 6(6):418–429.
Mottek Lucas A, Kim Y. 2016. White Mountain Stewardship Project Final 10-year Socioeconomic Assessment. Ecological Restoration Institute, Northern Arizona University. Flagstaff (AZ). https://cdm17192.contentdm.oclc.org/digital/collection/p17192coll1/id/28/rec/3
Mottek Lucas A, Kim YS, Greco B, Becker DR, Hjerpe EE, Abrams J. 2017. Social and economic contributions of the White Mountain Stewardship Project: final 10-year assessment—lessons learned and implications for future forest management initiatives. J Forestry. 115(6):548–558.
Mwale G. 2019. The Elite Choice–'Unpacking the elite'in Mukungule Chiefdom, Zambia. Rural Development and Natural Resource Management – master's Programme. Uppsala: Department of Urban and Rural Development.
Newig J, Lenschow A, Challies E, Cotta B, Schilling-Vacaflor A. 2019. What is governance in global telecoupling? Ecol Society. 24:3.
Nyirenda VR (2012) Zambia´s community based natural resource management status for 2010. Technical Report.
Nyirenda VR, Chansa WC, Myburgh WJ, Reilly BK. 2010. Social capital and community responses to natural resource management in the Luangwa Valley, Zambia. J Sustain Dev Afr. 12 (8):158–180.
Ogalleh SA, Vogl CR, Eitzinger J, Hauser M. 2012. Local perceptions and responses to climate change and variability: The case of Laikipia District, Kenya. Sustainability. 4(12):3302–3325.
Olsson P, Gunderson L, Carpenter S, Ryan P, Lebel L, Folke C, Holling CS. 2006. Shooting the rapids: navigating transitions to adaptive governance of social-ecological systems. Ecol Society. 11:1.
Ostrom E. 1990. Governing the commons: the evolution of institutions for collective action. Cambridge UK: Cambridge university press.
Ostrom E. 2007. A diagnostic approach for going beyond panaceas. Proc Nat Academy Sci. 104(39):15181–15187.
Ostrom E, Walker J, Eds.. 2003. Trust and reciprocity: interdisciplinary lessons for experimental research. New York, USA: Russell Sage Foundation.
Pawson R, Tilley N. 1997. Realistic evaluation. London: SAGE.
Plummer R, Armitage D. 2007. A resilience-based framework for evaluating adaptive co-management: linking ecology, economics and society in a complex world. Ecol Econ. 61 (1):62–74.
Plummer R, Fitzgibbon J. 2004. Co-management of natural resources: a proposed framework. Environ Manage. 33 (6):876–885.
Ribot J. 2002. Democratic decentralization of natural resources: institutionalizing popular participation. Washington DC: World Resources Institute.
Schoon M, Brady U, Kelman CC, Baggio J, Goddard K, Vallury S, Rojas C, Lorenzo T, Srinavasan J, Whittaker D, et al.. 2020. "Coding Manual: characteristics of Collaborative Governance", CBIE Working Paper Series #CBIE-2020-001, Arizona State University.
Schoon M, York A, Sullivan A, Baggio J. 2017. The emergence of an environmental governance network: the case of the Arizona borderlands. Regional Environ Change. 17(3):677–689.
Schoon ML, Cox ME. 2018. Collaboration, Adaptation and Scaling: perspectives on Environmental Governance for Sustainability. Sustainability. 10(3):679.
Shackleton S, Campbell B, Wollenberg E, Edmunds D. 2002. Devolution and community-based natural resource management: creating space for local people to participate and benefit. Nat Resource Perspectives. 76(1):1–6.
Simasiku P, Simwanza HI, Tembo G, Bandyopadhyay S, Pavy JM. 2008. The impact of wildlife management policies on communities and conservation in Game Management Areas in Zambia: message to policy maker, Edited by Buus CL, Bank W. Lusaka, Zambia.
Sitko S, Hurteau S. 2010. Evaluating the Impacts of Forest Treatments: the First Five Years of the White Mountain Stewardship Project. Phoenix: The Nature Conservancy. http://azconservation.org/dl/TNCAZ_White_Mountain_Stewardship_Project_5years.pdf
USDA. 2011. "How fuel treatments saved homes from the 2011 Wallow Fire." Fuel Treatment Effectiveness Assessment Report. U.S. Department of Agriculture Forest Service. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5318765.pdf
USDA. (n.d.). "Open Space Conservation: white Mountain Stewardship." U.S. Department of Agriculture Forest Service, Apache-Sitgreaves National Forests http://www.fs.fed.us/openspace/apache.html
Van Der Westhuizen E, Morkel P, Groenendijk J, Lewis C, Sayer E, Van Der Westhuizen HF, Dunham KM. 2010. The re-introduction of the black rhinoceros to North Luangwa National Park, Zambia. In: Soorae PS, editors. GLOBAL RE-INTRODUCTION PERSPECTIVES: additional case-studies from around the globe. Abu Dhabi, UAE: IUCN; p. 249.
Van Wilgen BW, Biggs HC. 2011. A critical assessment of adaptive ecosystem management in a large savanna protected area in South Africa. Biol Conserv. 144(4):1179–1187.
Wondolleck JM, Yaffee SL. 2000. Making collaboration work: lessons from innovation in natural resource managment. Washington DC, USA: Island Press.
York AM, Schoon ML. 2011. Collaboration in the Shadow of the Wall: shifting Power in the Borderlands. Policy Sci. 44(4):345–365.
Young OR. 2002. The institutional dimensions of environmental change: fit, interplay, and scale. Cambridge, USA: MIT press.