CONTRIBUTED PAPER

More robust local governance suggests positive effects of long-term community conservation

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Abstract

Community-based conservation (CBC) is essential to promoting biodiversity protection and livelihood development. Despite significant financial and institutional investment, performance of CBC interventions is mixed, with shortcomings especially evident in wildlife-based CBC in Africa. CBC outcomes are typically evaluated through household livelihood gains, or through policy analysis at higher administrative levels such as the central state. Surprisingly, village or local governance capacity is often missing from project assessment. Through a controlled study, we evaluate CBC interventions at multiple scales in Tanzania. Employing Bayesian multilevel latent trait models, we find that CBC participation predicts stronger village governance institutions. Additionally, compared to control villages, CBC villages have more local civic organizations and small business enterprise, but do not experience greater elite capture of public goods. Together, and in the absence of direct CBC benefits provisioned to households or signs of success at the higher level of multi-village CBC bodies, these findings point to the possibility that village-level governance institutions can adapt in beneficial ways to prolonged CBC interventions.

KEYWORDS
adaptive capacity, africa, community-based conservation, governance and institutions, wildlife-based tourism, tanzania

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1 | INTRODUCTION

Community-based conservation (CBC) aims to conserve biodiversity while supporting people's livelihoods and wellbeing. These shared goals have increasingly characterized conservation and development strategies over recent decades, at local to global scales (Berkes, 2004). Indeed, supporting people living adjacent to protected areas and wildlife is a central conservation tenet (Pathak, Bhatt, Balasinorwala, Kothari, & Borrini-Feyerabend, 2004; Roe, Mohammed, Porras, & Giuliani, 2013). In sub-Saharan Africa, the majority of CBC interventions attempt to balance the conservation of biodiversity in strictly protected areas against the livelihood costs for people living nearby (Kabiri & Child, 2014; Shackleton, Willis, Brown, & Polunin, 2010; Songorwa, Bührs, & Hughey, 2000). Costs include conflicts with wildlife, lost land and natural resource access, limited economic opportunity, and limited decision-making power over resource use (Borgerhoff Mulder & Coppolillo, 2005; West, Igoe, & Brockington, 2006). Positive biodiversity-livelihood outcomes exist, yet examples of tradeoffs and failures may outweigh successes (Brooks, 2017; Galvin, Beeton, & Luizza, 2018). Nonetheless, CBC can still be an effective tool for conservation, particularly when interventions prioritize local capacity building and equitable benefit sharing (Brooks, Waylen, & Borgerhoff Mulder, 2012; Oldekop, Holmes, Harris, & Evans, 2016).

CBC strategies are implicitly based on theory of collective action and self-governance of common-pool resources (Nelson & Agrawal, 2008). Common-pool resource theory suggests that local user groups can sustainably manage shared environmental resources (Ostrom, 1990). Successful resource systems are often characterized by specific contextual conditions, for instance resource user participation in the governance process and the recognition of local rights by external authorities (Ostrom, 1990). Such robust institutional arrangements are central to strong local governance (Agrawal & Gibson, 1999; Andersson & Agrawal, 2011), which are more likely to lead to positive conservation outcomes (Bennett et al., 2019; Persha, Agrawal, & Chhatre, 2011; Wright, Andersson, Gibson, & Evans, 2016).

Indeed, strong local institutions—the formal and informal norms and rules shared within communities—contribute to CBC project success (Persha et al., 2011). Such institutions underlie good governance, which we define as effective, formalized decision-making processes that create and enforce socially binding arrangements about collective problems (Matson, Clark, & Andersson, 2016). While good governance is often an implicit goal for donor-funded CBC interventions (Brooks et al., 2012), particularly for wildlife-based CBC in Africa (Roe et al., 2013; Salerno, Borgerhoff Mulder,

Grote, Ghiselli, & Packer, 2016), outcomes are rarely evaluated in terms of governance and leadership processes (Galvin et al., 2018; Lockwood, 2010). Though local leaders may respond to CBC efforts by building social networks and stronger institutions, evaluations more commonly track ecological and economic indicators (Berkes, 2009; Seixas & Berkes, 2010). Moreover, the degree to which local institutions and leaders are granted authority to manage their own resources is variable and often unclear (Murombedzi, 2010; Nelson & Agrawal, 2008). On the boundaries of strictly protected areas specifically, the limited understanding of *in situ* governance processes impedes more effective design and implementation of CBC and other conservation interventions (e.g., mitigating negative human-wildlife impacts, transferring benefits of wildlife tourism to communities; Salerno et al., 2016).

It is apparent however that wildlife-based CBC interventions struggle to link specific project goals to the local governance processes within target participating communities (Corrigan, Robinson, Burgess, Kingston, & Hockings, 2017; Shackleton et al., 2010). Specifically, an important shortcoming characterizes CBC policy and practice: CBC administrative bodies are created by external interventions (e.g., conservation NGOs) to represent multiple member villages and manage wildlife, while the functional pre-existing governance unit, the village, is often ignored (Agrawal & Gibson, 1999; Songorwa, 1999). The creation of multi-village CBC administrative bodies is motivated by the need for wildlife areas to be large enough to sustain wildlife populations and attract photographic tourism and trophy hunting (Salerno, Cassidy, Drake, & Hartter, 2018). However in practice, CBC interventions may create a scale mismatch (Berkes, 2004; Cassidy & Motsumi, 2014), where interventions will create and monitor new, multi-village CBC administrative bodies, while inadequately engaging preexisting village governance arrangements, like the village councils, or their response to intervention activities (Alexander, Andrachuk, & Armitage, 2016; Bluwstein, Moyo, & Kicheleri, 2016; Shackleton et al., 2010).

We propose that the observed dearth of positive CBC outcomes, both for biodiversity and people, could potentially be explained by this scale mismatch (Berkes, 2004; Galvin et al., 2018). We further propose that existing local governance institutions and leadership will likely adapt to long-term CBC interventions, perhaps in unexpected ways, such as through learning and applying CBC-directed capacity building to local endeavors (Berkes & Turner, 2006). We therefore investigate a candidate pathway whereby a long-term, top-down CBC intervention (i) can affect change in governance capacity among residents and leadership in participating CBC villages and (ii) in turn may support an environment of equity and trust observed

through the proliferation of collaborative and business groups (Dawson, Martin, & Danielsen, 2018; Seixas & Berkes, 2010). We define governance capacity as residents' assessment, or perceptions, of their representative village leadership and the strength of their collective choice arrangements (Andersson & Van Laerhoven, 2007; Bennett et al., 2019; operationalized in Section 2). Conservation science stands to make a significant contribution to ongoing and future CBC efforts, including their role in biodiversity conservation, by more explicitly examining ways in which interventions lead to evolution and adaptation of local governance (Biggs et al., 2019; Galvin et al., 2018; Wright et al., 2016).

1.1 | CBC in Tanzania

CBC in Tanzania is conducted through the nation's Community Wildlife Management Areas (CWMAs). This - national-scale program, similar to others across Africa, adheres to a predominantly economic model— communities protect wildlife zones and tolerate wildlife interactions in exchange for a portion of safari tourism revenue (Leader-Williams, Kayera, & Overton, 1996; Songorwa, 1999; Walsh, 2003). Intervention efforts largely began in 1997, with conservation organizations playing the primary role in shaping policy and conducting on-ground activities. Nine CBC pilot programs received official authorization in 2003, and many continue to receive active support from external interventions. Long-running CBC programs show that decreased resource access and often frequent wildlife conflicts can significantly impact CBC households (Benjaminsen, Goldman, Minwary, & Maganga, 2013; Kaswamila, Russell, & McGibbon, 2007; Salerno et al., 2016). Yet few CBC households in Tanzania receive direct payments from CBC administrative bodies, despite the nation's profitable wildlife tourism sector and in some cases appreciable CBC revenue (Bluwstein, 2017; Keane et al., 2020; Maliasili, 2013; Sekar, Weiss, & Dobson, 2014). More commonly, program benefits come in the form of new schools, health facilities, roads, and irrigation works, as well as funding for scholarships and civil society organizations.

In theory, strong, representative local governance is a necessary feature of effective CBC. Village bylaws must be passed for a community to join others and designate land as part of a CWMA, and bylaws typically stipulate that rules of use, including the use of CBC revenue, must be decided democratically by village residents and overseen by elected leaders (Government of Tanzania, 2012). However, the political history of Tanzania, including marginalization of certain ethnic groups and socialist policies, or *Ujamaa*, shapes significant variation and often

inequality in village governance and alignment with state policy (Brockington, 2007; Hydén, 1980). This variation in governance context has clear implications for CBC and biodiversity conservation on community lands. For example, as community-based strategies have become nearly ubiquitous themes in conservation interventions, local elites have adopted environmental narratives and wielded conservation as a tool to gain wealth and influence (Brockington, 2006; Lund & Saito-Jensen, 2013). Village- or CBC-level leaders may misappropriate resources intended for village game scouts, environmental education, or livelihood support, and although in theory community members have recourse through electing new leadership, higher-level government officials and private interests can corrupt the village-level policy process (Bluwstein et al., 2016). Such dynamics can affect wildlife areas coming under increased threat from illegal extraction or encroachment, while also constraining benefits to residents, undermining the goals of the CBC program (Leader-Williams et al., 1996; Songorwa, 1999).

Although economic and social influences of CBC interventions have been suggested to support stronger governance in Tanzania (Salerno et al., 2016), interventions are more often associated with these above governance challenges (Benjaminsen et al., 2013; Bluwstein et al., 2016; see also Muyengwa, Child, & Lubilo, 2014). In response to the unclear impacts of CBC in Tanzania (Keane et al., 2020; Maliasili, 2013), along with evidence showing the importance of supporting local governance through clear programmatic strategy (Brooks et al., 2012; Galvin et al., 2018), we undertake a multi-site investigation into the potential for an ongoing 18-year CBC intervention to influence governance capacity at the village level.

2 | METHODS

2.1 | Measuring governance capacity

In our system, we view local governance capacity as the decision-making processes that create and enforce socially binding agreements to maintain collective goods and services (Matson et al., 2016), supported by accountability, legitimacy, transparency, trust, and rule of law (Bennett et al., 2019; Lockwood, 2010). In the case of our study communities, these processes principally involve the elected village chairman and council, the government-appointed executive officer, and village residents. Bylaws are proposed, evaluated by the village assembly, and then enacted if sufficient support is present. The Tanzanian State is the protectorate of all lands, and these village governance processes are responsible for land allocation and designation, including if village

lands are to be gazetted as part of a larger CBC area. Yet local governance capacity is a concept that is challenging to measure empirically (Lockwood, 2010)—it is an unobservable, latent trait of group decision-making (Andersson & Van Laerhoven, 2007).

We therefore measure *perceived governance capacity*, or the effectiveness of local leadership (Galvin et al., 2018), through the assessment of village leaders' own constituents using a household survey (see Bennett et al., 2019; Dawson et al., 2018). Specifically, respondents assess the effectiveness of village leadership in maintaining collective goods and services regarding six important elements of village life: health, education, natural resources, agriculture, HIV/AIDS, and human-wildlife conflict (each as a four-category ordinal response). Six questions are posed as, "How effective have your village leaders and committees been at solving problems and addressing issues about [e.g., *health*] in this village?", where the question is repeated for each of the six elements listed. The six questions assessing local leadership were developed and validated as part of an evaluation tool for use in similar park-adjacent areas in Tanzania (Borgerhoff Mulder et al., 2010). Perceptions of governance are shown to be indicators of conservation outcomes across various systems (Andersson & Van Laerhoven, 2007; Bennett et al., 2019), but we acknowledge the limitation of designing questions based on potentially contentious political relationships. With this in mind, we triangulate our perceived governance capacity measure against wealth inequality and village assembly attendance, while sampling across variation in ethnicity, livelihood strategy, and migrant status, among other dimensions (described below in Section 2; see also Section 4, Supporting Information, and Figure S1).

In a controlled design, we fit a statistical model to test for associations between perceived governance capacity and the "treatment effect" of CBC. The responses to these six survey questions are modeled together, as a joint outcome variable, representing a single latent trait describing governance capacity (see Section 2.4, below). A positive value in the CBC treatment associated with this trait will be interpreted as CBC associated with stronger or improved governance capacity. Following our proposed pathway, we then explore the extent to which CBC-associated differences in governance capacity explain differences in wealth inequality and presence of village-level collaborative and business groups.

2.2 | Study region

We conduct our study across the Ruaha-Katavi landscape, a globally important conservation region that extends over 115,000 km^2 in southern Tanzania (Figure 1). The landscape is of central importance to the national CBC program, containing one of the original pilot CBC areas, MBOMIPA, and three additional sites still in planning stages at the time of data collection. While MBOMIPA has generated substantial revenue for the CBC administration, predominantly from trophy hunting contracts, households have not received direct cash payments. The CBC area has also experienced challenges with maintaining consistent revenue flow, along with the governance issues noted above that have plagued other CBC efforts. Tanzania currently has 22 registered CWMAs, with an additional 16 areas undergoing registration (Maliasili, 2013; pers. comm. P. Genda).

2.3 | Sampling frame and empirical data

We define our study population as all 46 villages associated with the 1 established WMA and 3 planned areas in the study region (Figure 1), with control and treatment groups representing similar levels of park-associated impacts (e.g., human-wildlife interactions, resource use restrictions), mobility, and socioeconomic, ethnic, and agroecological variation. For our cross-sectional study, we define villages in the MBOMIPA area as the CBC treatment, having been under active development since 1997 before legal establishment in 2003. Pre-establishment CBC intervention activities were limited to communities that later became MBOMIPA members (Figure S1; Murphree, 2000; Walsh, 2003). We define the villages and households associated with 3 planned areas—Mpimbwe, UMEMARUWA, and Waga—as the control population. While the CBC planning process had been initiated in the control areas, the process existed only at higher levels of authority at the time of data collection, such as in the regional and district offices of Iringa, Mbeya, and Rukwa, and in ministries of the central government. Our data confirmed that household knowledge of the CBC area plans was extremely limited, if not entirely absent, among control respondents.

We implemented two separate but parallel data collection efforts during 2015. Protocols were approved by the University of California Institutional Review Board (#343343); informed consent was granted by all study participants. First, we conducted a randomized household survey in 11 villages (4 CBC treatment, 7 control). Sample villages were randomly selected from the population of 46 total villages. The sampled areas were ethnically heterogeneous, reflecting the changing livelihoods and migration dynamics of Tanzania at large (Salerno, Borgerhoff Mulder, & Kefauver, 2014). The dominant resident or long-residing ethnic groups (Hehe, Bena, Kinga,

FIGURE 1 Study region comprised of four community-based conservation areas across Tanzania's southern network of national parks. Community conservation treatment communities have undergone conservation intervention activities since 1997 (MBOMIPA, black polygon). Control communities are sited within planned community conservation areas (dark gray polygons). The study region spans the Ruaha-Katavi Landscape, inclusive of Ruaha, Kitulo, and Katavi National Parks (NPs, light gray polygons). The conservation intervention conducted in treatment communities is representative of the national community-based conservation program in Tanzania, which includes registered areas sited adjacent to the other 12 national parks (hashed polygons) and other conservation areas across the country

Sangu, Pimbwe) in both treatment and control sites are largely agriculturalists settled in village or sub-village clusters, with livestock and central-place grazing integrated at varying degrees. In-migration of pastoralists (Maasai, Barabaig) and agro-pastoralists (Sukuma, Gogo) to the sites is ongoing, with settlement patterns and grazing strategies of these groups being generally more dispersed around village settlements (Quandt et al., 2020; Salerno, 2016), though all residents retain rights to participation in the village assembly. Table S1 shows the within-village ethnic and livelihood variation present in the sample, along with years of in-migrant arrival, in each village. Notably, in-migrants often settle together, resulting in small pockets of ethnic homogeneity (Salerno, 2016). To minimize bias in our household survey, we implemented a stratified random sample, using sub-villages as strata. This allowed us to identify representative sub-villages, for example along dimensions of agroecological conditions, land use, and ethnicity; selection of sub-villages was based on research experience in the region and discussions with partner institutions and village representatives. Households were randomly selected from sub-village rosters. The resulting survey data describe 90 treatment households and 210 control

households in 4 treatment and 7 control villages, respectively.

In addition to governance questions, the household survey produced information on household composition, education, and assets, which we use to calculate a wealth index following country-specific protocol (PPI, 2012). While this index is an imperfect measure of wealth (e.g., different households may get different utility from the same asset such as an iron or table), the index primarily relies on indicators of education, gender equity, and material assets that are nearly universally sought in the study region (e.g., durable roofing material, bicycle, and radio). We argue that these measures adequately describe the variation present in the predominantly agricultural and agropastoral households in our sample, which lacks exclusively pastoralist livelihoods (Table S1; pers. comm. A. Dickman and P. Genda).

To complement household surveys, we conducted 31 semi-structured interviews with village leaders from the sample of the same population of 46 Ruaha-Katavi villages. The interview villages included all of the 11 household survey villages, plus 20 additional randomly selected villages. Interviews followed a structured template and produced comprehensive lists of registered, active

organizations (both civil society and business associations), such as youth development clubs, crop and livestock cooperatives, and savings and lending groups. Interviews also produced qualitative data describing ethnic groups and migration history within each village, livelihood activities, and challenges reported by participants, which we use as checks to assess potential biases in data collection. Details are provided in Supporting Information.

2.4 | Analytical approach

We test for an observable association of CBC intervention with perceived governance capacity by fitting a Bayesian multilevel item response model to the household data. While governance is a group-level property, we have operationalized governance capacity as individual residents' own perception of their collective choice arrangements as provisioned by their leaders (Andersson & Van Laerhoven, 2007; Bennett et al., 2019). The model structure allows for each household respondent's assessment of the six specific elements of local governance to jointly describe a latent property, and we estimate the treatment effect of CBC participation on this latent outcome. This represents a more conservative approach than evaluating the six household responses as separate regression models (Schacht & Grote, 2015; Supporting Information). Nonetheless, for comparison we fit six separate ordinal logistic regression models corresponding to each governance capacity question (Figure S2).

We specify the latent trait model with a hierarchical, nested structure of households within village groups (i.e., sub-villages, following Jackman, 2009, ch. 9). We use this specification—varying intercept effects for sub-villages—in order to account for clustering in our governance outcome variable (Gelman, Carlin, Stern, & Rubin, 2013). We would expect such clustering and potential for bias if similar households were grouped together (Salerno, 2016), and under similar pressure to provide biased responses to governance questions, as might be expected if a group of marginalized households feared retribution from village leaders (Browne-Nuñez & Jonker, 2008). The model is fit using Bayesian methods in Stan, which we call through the R Statistical Environment, following McElreath (2015); also, Supporting Information.

We interpret results first through descriptive summary plots of the household survey data describing perceived governance capacity. Second, we plot the model-estimated effect of CBC treatment on the household-level latent trait of perceived governance capacity, drawn from the joint
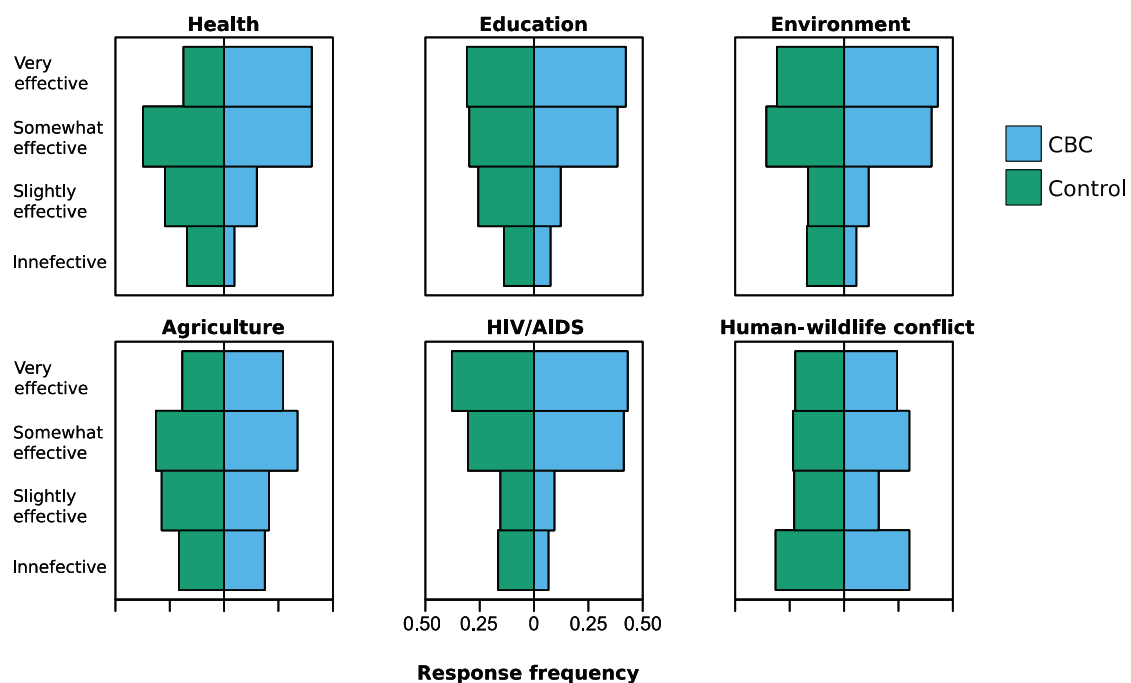
FIGURE 2 Household response distributions to questions of perceived governance capacity. Back-to-back histograms plot household responses (i.e., item scores) regarding the six elements of local governance capacity ($n = 210$ control households in seven villages; $n = 90$ households in four treatment villages). The x-axis displays the frequency in the sample of each response, separated by CBC (blue/right) and control (green/left) communities. Plots indicate CBC communities generally have a higher proportion of "Very effective" and "Somewhat effective" responses regarding each governance dimension
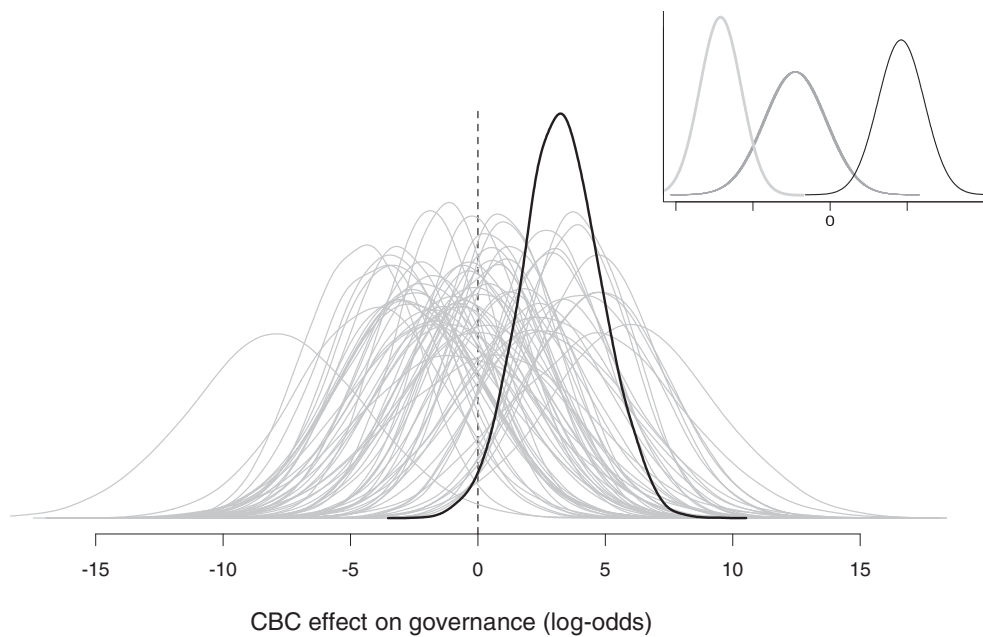
FIGURE 3 Coefficient estimates from the multilevel item response model predicting perceived governance capacity. The statistical model estimates a positive effect of CBC on local governance capacity at the household level, drawn from the joint-posterior density (black curve, main figure). To aid in interpretation, the inset represents hypothetical model estimates from a posterior density: negative estimate to the left of zero (light gray curve, inset); uncertain or "nonsignificant" estimate where the density overlaps zero (dark gray curve, inset); positive effect to the right of zero (black curve, inset). The statistical model estimates a positive effect of CBC participation at a 95% credibility level, indicated by >95% of the mass of the curve falling to the right of 0 (dashed gray line). Village-level varying effects (gray curves) represent place-specific adjustments to the household-level treatment effect, indicating substantial variance in local governance capacity clustered or shared within village areas. Data represent 90 CBC households and 210 control households
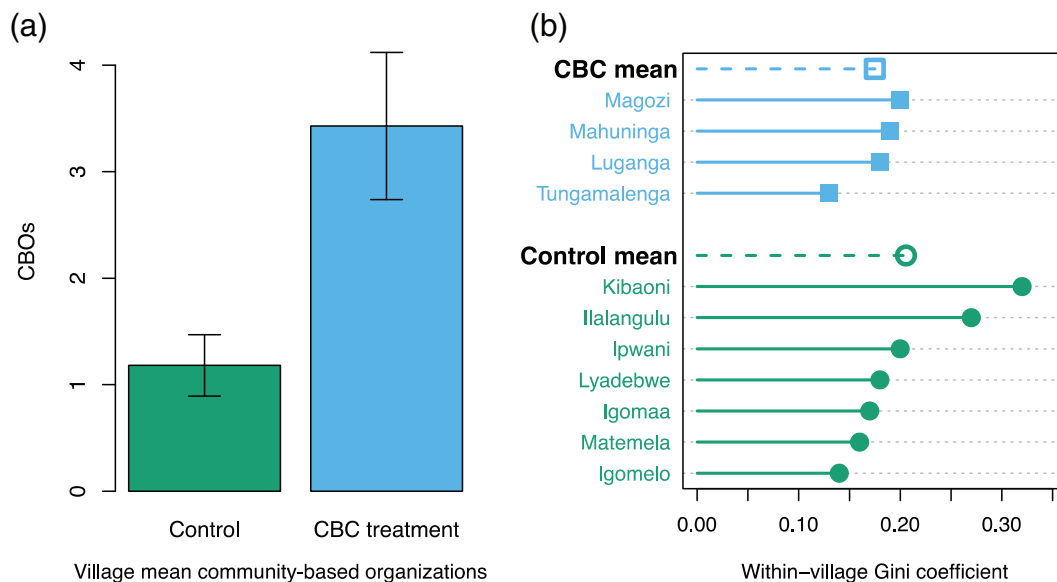
FIGURE 4 Indicators of village-level gains. (a) Mean number of collaborative and business groups. Bars represent registered community-based organizations (CBOs) per village in CBC (i.e., treatment; blue/right) and control communities (green/left). Whiskers show 95% confidence intervals on the mean. Data were drawn from qualitative group interviews conducted independently from household surveys. (b) Village-level measures of inequality. The *x*-axis displays Gini coefficients calculated for each of the CBC (blue squares) and control villages (green circles). Gini calculations are based on household values of an asset-based wealth index. The mean Gini value of the control communities is slightly higher than the value of CBC communities (open symbols). Raw means are not compared due to the small number of observed values

posterior density. Third, we use village-level group interviews to explore the potential for long-standing CBC programs to influence local institutions. To do this we present descriptive summaries of the number of local civil society and cooperative business organizations registered in CBC villages compared to control villages. Fourth, we compute Gini coefficients of inequality within each of the treatment and control villages to assess if any measurable effects of CBC projects could be explained by disproportionate elite capture of benefits. We contextualize quantitative findings with qualitative data gathered through the village-level group interviews. Although we triangulate findings using multiple data sources (Ferraro, Sanchirico, & Smith, 2019), we acknowledge the complexity of the system and the many factors potentially influencing local governance outcomes.

3 | RESULTS

CBC households reported a higher degree of support for their local leadership across each of the six governance elements measured in the household survey: agriculture, education, environment and natural resources, community health, HIV/AIDS, and human-wildlife conflict (Figure 2). These differences were more pronounced across some elements (environment, education, and health) than others. Separate statistical models predicting each of the governance elements separately showed similar results: CBC households have higher odds of reporting effective leadership in areas of health, education, environment, and HIV/AIDS (at 95% credibility; Figure S2). Models suggest CBC households may have higher odds of effective leadership in agriculture and human-wildlife interactions, but estimates are not credible at 95% (Figure S2).

Our primary interrogation of the research question is conducted with the item response model. This model estimates that CBC membership predicts higher perceived governance capacity (Figure 3, black curve; posterior mean (log-odds), 3.30 [0.25, 6.39])—households in CBC villages trust their leadership and/or view them as more effective than do control households. The effect of increased perceived governance capacity is averaged across all households in CBC treatment villages, and is estimated in the presence of varying effects that control for between-village differences in governance capacity (Figure 3, gray curves); in some cases this variation is substantial. Varying effects estimates also show appreciable within-village variance in perceived governance capacity in some cases, indicated by relatively broad posterior densities.

CBC villages have a higher mean number of locally run collaborative organizations than do control villages

(3.43 vs. 1.18, respectively, >95% CI; Figure 4a). These organizations include youth development clubs, crop and livestock cooperatives, and savings and lending groups. To receive recognition, groups must be registered as community-based organizations, which carries an official designation as per village bylaws. Among the groups present, agricultural cooperatives (e.g., beekeepers, egg producers) and savings and lending groups (e.g., merry-go-round clubs, farm-based credit groups) were the most common. These data were gathered through the semi-structured interviews in 31 villages, representing a sampling effort conducted independently from the household survey. There is no clear ethnic or livelihood patterning in CBC versus non-CBC villages (Table S2). Hehe are by far the largest group in Iringa Rural District, with Pimbwe the largest group in Mpanda District; only two communities were visited where these groups were not the majority (both in Iringa, with Sukuma and Barabaig as majority groups). In-migrant groups were noted as arriving since the 1950s in appreciable numbers, with Sukuma present in both areas, and Maasai and Barabaig in Iringa.

Since establishment, revenue generated from wildlife tourism by the active CBC area of MBOMIPA was not transferred as cash to households, and instead funded various social service projects (e.g., construction of school buildings, water and road infrastructure, scholarships, and other community-proposed projects). It is possible that program revenue was subject to elite capture, and potentially utilized by elites to form cooperative organizations and business enterprises. If so, we would expect higher levels of inequality, as measured by Gini coefficients, in CBC villages. However, our data show no clear difference in mean Gini values between CBC and control villages (0.17 and 0.20, respectively; Figure 4b; Table S2). Two control villages have the two highest Gini values among the 11 in the sample. We avoid making statistical inferences given the small number of values (1 per village).

4 | DISCUSSION

CBC experiences significant challenges in transferring direct benefits to people, both in Tanzania and globally (Brooks, 2017; Galvin et al., 2018; Keane et al., 2020). Challenges include limited wildlife tourism revenue transferred from the central state to CBC administrative bodies and then to households, elite capture of benefits, and lack of decision-making authority held by member households. Local governance capacity is an important ingredient in successful project outcomes, both for biodiversity protection and livelihoods (Brooks et al., 2012;

Persha et al., 2011). Yet there is insufficient attention given by conservation interventions to the multilevel nature of governance relationships associated with interventions (i.e., households in villages represented by the externally created multi-village CBC administrative body; Berkes, 2004) and the ways in which local governance evolves (Alexander et al., 2016; Corrigan et al., 2017; Dawson et al., 2018). In wildlife-based CBC, strong village governance may be a necessary precursor to lasting livelihood gains and sustained protection of CBC wildlife areas (Salerno et al., 2016).

Substantial theoretical and empirical evidence shows that effective governance is reflected in opinions of local citizens or constituents regarding leadership (Andersson & Van Laerhoven, 2007; Bennett et al., 2019; Lockwood, 2010; Ostrom, 1990). Our findings suggest that CBC interventions may support strengthened governance capacity, as measured through perceptions of village constituent households. We also find that CBC villages have more registered local collaborative business and civic organizations than do control villages, although there are relatively few such groups across the sample. Finally, household data additionally suggest that these differences are observed in the absence of elite capture of public goods leading to greater inequality. These suggestive indicators of CBC impact at the village-level would be ignored if measured through typical monitoring and evaluation procedures targeting household income or management capacity within the multi-village CBC administrative body.

These findings suggest support for the hypothesis that a sustained CBC intervention may gradually help to develop greater accountability within village participatory governance while also contributing to improved collaborative networks among member-residents (Alexander et al., 2016; Andersson & Van Laerhoven, 2007; Seixas & Berkes, 2010). Our CBC treatment population was exposed to 18 years of intervention activities prior to data collection, targeting the multiple villages (and their local governments) that comprise a single CBC area and its administrative body (Murphree, 2000; Walsh, 2003). Beginning prior to registration and continuing through the study period, intervention activities included facilitating within- and between-village meetings, engaging with the policy process of CBC establishment and national-level registration, negotiating and ratifying village and CBC bylaws, designing and demarcating village land use areas, and resolving management conflicts. Meetings provided per diems and transport to convene village leaders separated by large distances along protected area boundaries. Bank accounts were established to handle financial transactions, and ranger forces were trained and outfitted.

It is plausible then that the above conservation intervention activities benefitted *village-level* local governance capacity. Intervention-supported knowledge and capacity are transferrable to institutions beyond the CBC administrative body itself, such as to village leadership or joint business endeavors, even if the CBC body struggles to achieve financial solvency (Berkes & Turner, 2006; Maliasili Initiatives, 2013). We suggest that CBC interventions can positively affect participating villages by contributing to knowledge and capacity and by facilitating local collaborative decision-making networks (Alexander et al., 2016; Brooks, 2017). Through intervention-supported activities (e.g., capacity-building workshops, finance and legal training, land-use planning, and management), residents may expand and strengthen social ties within and between villages, gain familiarity with the policy process, and build knowledge of administrative and financial management (Andersson, 2004).

Such changes could be consequential if participants in CBC intervention activities applied the knowledge and capacity gained to village-level institutions, relational networks, and small-scale enterprise (Seixas & Berkes, 2010), as is suggested by our results. When local governance processes are inclusive, transparent, and accountable, then communities will enjoy the benefits of good government, such as less conflict, less inequality, more stability, and more trust, which combine to help buffer against exogenous shocks and disturbances (Andersson & Agrawal, 2011; Persha et al., 2011). These benefits, in turn, can foster an enabling environment for innovation and investment, as suggested by our data on collaborative and business organizations, while decreasing inequality and risk (Ulambayar, Fernández-Giménez, Baival, & Batjav, 2016; Wright et al., 2016). Importantly, such successive village developments may occur independently of explicit CBC intervention goals, which are focused at the level of the multi-village CBC administrative body (Shackleton et al., 2010).

This process suggested by our findings complements recent, large-scale CBC meta-analyses. For example, Galvin et al. (2018) showed that few African CBC case studies examine governance-related outcomes specific to leadership, which is our focus here. Even so, their analysis identified improved social outcomes associated with conditions of enhanced networks, trusting relationships, and sense of reciprocity. It is possible that interventions, building on existing supportive institutions, may help facilitate the improved governance capacity, organizational and business environment, and absence of elite capture that we observe in CBC member villages. In addition, Brooks (2017) identified community capacity building, local engagement, conservation education, and project age as predictors of multiple positive outcomes.

Indeed, we observe such project design features present in CBC villages, and propose that improved governance capacity may be an important mediating factor preceding anticipated ecological, economic and social gains of CBC. Though generalizable, large-scale analyses come with inherent information loss. Such analyses are challenged by the majority of assessed cases being qualitative in approach (Galvin et al., 2018), while aggregating case studies tends to pose limitations of poor data quality (Brooks, 2017). Our study, however, may provide further insight into the ways in which these generalized program design and institutional features are transmitted through CBC administrative bodies to villages, and evolve to potentially affect household- and village-level outcomes.

4.1 | Competing explanations

Here we consider alternatives to the above interpretation of findings. Power relations in rural communities can significantly shape perceptions and actions. Externally imposed CBC interventions have long struggled with challenges associated with power, equality, and governance (Kabiri & Child, 2014; Murombedzi, 2010; Songorwa et al., 2000). For example, in our study, power relations could be expressed through introduced bias in household surveys. CBC households may have felt pressured to answer favorably to questions regarding local leadership, while control households did not. This source of bias could exist if powerful leaders of CBC villages were able to impose disproportionate coercion on certain resident groups, undermining representative village governance (Brockington, 2007), and respondents feared their answers were not confidential (Browne-Nuñez & Jonker, 2008). These dynamics could exist beyond the ability of our surveys and community interviews to detect them. If such implicit threats drive our observed association between CBC interventions and governance capacity, one would expect that governance capacity would be associated with relatively high inequality, since it is in a context of power differentials and inequality that such threats exist (Bluwstein et al., 2016). However, we do not find such a relationship. In fact, we find the opposite: our governance measure is weakly associated with *lower* village inequality, suggesting that implicit threats from wealthy elites are not driving our results (Figure S1).

Imbalance in CBC and control village governance could also result from selective migration and settlement by certain ethnicities (Salerno, 2016). Such spatial patterning in ethnicity might confound our measures of village governance if migrants were excluded from participation and only native residents or a dominant ethnicity engaged in participatory processes. Although migration certainly shapes village ethnicity, separate questions in the household surveys reveal that slightly more CBC households than control households consistently attend village assembly meetings (87 vs. 74%, respectively), suggesting widespread governance engagement and an absence of obvious bias or coercion shown through disproportionate participation. In addition, qualitative data from community interviews show relative balance between CBC and treatment groups with respect to ethnic heterogeneity and years of settlement by major groups (Table S1).

We report main findings from qualitative data that show a higher number of local collaborative groups associated with CBC, which we interpret as suggestive of a supportive environment for enterprise. While it is possible that village leaders could appropriate CBC resources and personally establish such enterprise, which would amount to a form of elite capture and serve to increase inequality (Lund & Saito-Jensen, 2013; Muyengwa et al., 2014), our analysis of village-level wealth inequality does not support this interpretation—on average, CBC villages are no more or less equitable.

Importantly, we are limited in our ability to account for various exogenous factors which could potentially influence conservation-governance dynamics. Such factors include state economic policies, NGO missions, or agroecological conditions, which could disproportionately impact our treatment and control populations. While we observe no evidence of such factors patterning bias (e.g., a state policy or pest outbreak selectively affecting treatment vs. control samples), our focus on individual-community-CBC dynamics represents a limitation. In sum, our triangulation of findings with different data sources and approaches helps to address various alternative explanations (Ferraro et al., 2019), but future studies should attempt to integrate careful measures of governance with more robust qualitative checks, while also explicitly acknowledging the multilevel dynamics at play within community conservation systems (Galvin et al., 2018; Shackleton et al., 2010).

4.2 | Looking ahead

CBC and communities adjacent to protected areas will continue to face challenges, some of which are beyond the scope of conservation policy and strategy (Gomera, Rihoy, & Nelson, 2010; Roe et al., 2013). However, our results suggest that improved village governance is an achievable goal of conservation interventions, while at the same time governance is a complex and evolving process within CBC (Alexander et al., 2016; Lockwood, 2010).

Although we show that CBC is associated with overall stronger leadership, including leadership regarding environmental conservation issues, our analyses suggest only weak differences in leadership regarding human-wildlife conflict. These findings highlight that communities will respond in unanticipated ways to conservation interventions, and that interactions with wildlife remain a significant challenge in CBC systems (Salerno et al., 2016). We echo others in arguing that supporting communities is a conservation imperative, necessary to both offset costs of living with wildlife and to enlist people as conservation partners rather than adversaries (Barua et al., 2013; Biggs et al., 2019).

There is indeed substantial variation in CBC governance processes, and in the ways these processes influence conservation and wellbeing outcomes of CBC interventions. For instance, conservancies in Namibia retain relative autonomy of decision-making at the community and CBC level, such as in managing lands and wildlife for consumptive and nonconsumptive tourism (Naidoo et al., 2015), though the central government still maintains some authority (Hoole & Berkes, 2010). Botswana, by comparison, is undergoing a recentralization of control over wildlife and natural resources, with implications for the limited role local CBC governance can play in supporting livelihoods (Cassidy, 2020). And as is the case in Tanzania, even within a particular national context, CBC initiatives experience a diversity of opportunities and constraints, such as in endowments of wildlife, economic development potential, and existing social structure, all of which shape the interactions among communities, CBC interventions, and central states (Shackleton et al., 2010).

To promote biodiversity within protected areas along with livelihoods at protected area boundaries, programmatic design for CBC interventions must recognize and account for the multilevel nature of CBC governance institutions, including how processes evolve (Alexander et al., 2016). More explicitly aligning CBC intervention goals with existing local governance institutions can support greater adaptive capacity and innovation within communities (Biggs et al., 2019; Seixas & Berkes, 2010). Conservation science is well-positioned to help identify such opportunities for realignment. Focusing on rigorous analyses of governance, and specifically community-scale leadership, indeed may uncover more effective ways for CBC to contribute to improved biodiversity and livelihood outcomes (Bennett et al., 2019; Galvin et al., 2018).

CONFLICT OF INTEREST
At the time of research, Aaron Nicholas, Claire Bracebridge, and Harold Rutabanzibwa were employed by the Wildlife Conservation Society.

AUTHOR CONTRIBUTIONS
Jonathan Salerno, Claire Bracebridge, Harold Rutabanzibwa, and Aaron Nicholas contributed to research design. Jonathan Salerno, Harold Rutabanzibwa, KM, and IDS collected data. Jonathan Salerno, Krister Andersson, Karen Bailey, Tom Hilton, Lazaro Johana Mangewa, and Joel Hartter analyzed data and wrote the article.

DATA AVAILABILITY STATEMENT
Data to reproduce analyses are available at https://doi.org/10.25675/10217/212215 (Salerno et al., 2020).

ETHICS STATEMENT
Research protocols were approved by the University of California Institutional Review Board (IRB; #343343). IRB protocols and the lead author were permitted under the Tanzania Commission for Science and Technology.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.