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Fostering Coexistence Between People and Large Carnivores in Africa: Using a Theory of Change to Identify Pathways to Impact and Their Underlying Assumptions

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Coexistence with large carnivores poses challenges to human well-being, livelihoods, development, resource management, and policy. Even where people and carnivores have historically coexisted, traditional patterns of behavior toward large carnivores may be disrupted by wider processes of economic, social, political, and climate change. Conservation interventions have typically focused on changing behaviors of those living alongside large carnivores to promote sustainable practices. While these interventions remain important, their success is inextricably linked to broader socio-political contexts, including natural resource governance and equitable distribution of conservation-linked costs and benefits. In this context we propose a Theory of Change to identify logical pathways of action through which coexistence with large carnivores can be enhanced. We focus on Africa's dryland landscapes, known for their diverse guild of large carnivores that remain relatively widespread across the continent. We review the literature to understand coexistence and its challenges; explain our Theory of Change, including expected outcomes and pathways to impact; and discuss how our model could be implemented and operationalized. Our analysis draws on the experience of coauthors, who are scientists and practitioners, and on literature from conservation, political ecology, and anthropology to explore the challenges, local realities, and place-based conditions under which expected outcomes succeed or fail. Three pathways to impact were identified: (a) putting in place good governance harmonized across geographic scales; (b) addressing coexistence at the landscape level; and (c) reducing costs

and increasing benefits of sharing a landscape with large carnivores. Coordinated conservation across the extensive, and potentially transboundary, landscapes needed by large carnivores requires harmonization of top-down approaches with bottom-up community-based conservation. We propose adaptive co-management approaches combined with processes for active community engagement and informed consent as useful dynamic mechanisms for navigating through this contested space, while enabling adaptation to climate change. Success depends on strengthening underlying enabling conditions, including governance, capacity, local empowerment, effective monitoring, and sustainable financial support. Implementing the Theory of Change requires ongoing monitoring and evaluation to inform adaptation and build confidence in the model. Overall, the model provides a flexible and practical framework that can be adapted to dynamic local socio-ecological contexts.

Keywords: large carnivore conservation, African semi-arid, community-based conservation, human wildlife conflict, community-based natural resource management, adaptive co-management, rangeland management, climate change adaptation

INTRODUCTION

As the global human population, accompanied by rapidly rising per capita consumption, climbs toward 10 billion (Crist et al., 2017; United Nations, 2017), the intensifying impacts of climate change and environmental degradation pose an increasing threat to global biodiversity (IPCC, 2014). Africa, with a projected doubling of its current population over the next three decades (United Nations, 2017), faces particularly acute pressures on its natural resources in the near future. It is also a continent that has already been heavily impacted by climate change, including a higher frequency and intensity of droughts, increased desertification, reduced rangeland productivity, and heightened food insecurity (IPCC, 2019). These impacts are predicted to intensify over the coming years as the planet continues to warm, and pressures on natural resources increase (Shukla et al., 2019). Mitigating against the consequent impacts on biodiversity will require transformative change that supports the sustainable coexistence of people and wildlife, while increasing resilience and contributing to the development of rural communities.

In this context, Africa's large carnivores present both challenges and opportunities for navigating through contentious and often opposing demands on land, biodiversity, and natural resource extraction. In the face of Africa's rapidly growing human population, setting aside additional protected areas that exclude human activities may raise insurmountable challenges for many vulnerable and marginalized rural communities, who are often dependent on natural resources for their livelihoods. Yet, a substantial proportion of the distributional range of Africa's large carnivores [e.g., 78% of cheetah *Acinonyx jubatus* (Durant et al., 2017) and 83% of leopard *Panthera pardus* (Jacobson et al., 2016)] is outside current protected areas in mixed-use landscapes. Outside protected areas large carnivores face increasing and multiple threats, including conflicts due to livestock depredation, loss of prey and habitat, and land degradation and fragmentation (Ripple et al., 2016). However, large carnivore presence also indicates alternative possibilities for the management of multiple-use landscapes, if wildlife can provide value to local communities. Ultimately, the continued survival of large carnivores will depend on long-term support for their conservation and on the tolerance of communities who share their landscapes.

What Do We Mean by Coexistence?

A myriad of interactions between people and wildlife may occur when communities share their land with wild animals. Although coexistence generally describes situations when these human-wildlife interactions result in sustainable wildlife populations (Phalan et al., 2011), our understanding of coexistence does not exclude the presence of conflict, since an expectation of rural people to develop overwhelmingly positive attitudes toward carnivores and to share a landscape with them without incurring conflict is unrealistic (Linnell, 2013). Indeed, peoples' relationships with wild carnivores are rarely static or constant, but encompass multiple emotions including fear, admiration, reverence, or anger, sometimes even simultaneously (Bhatia et al., 2021). Moreover, climate change is expected to modify relationships between people and large carnivores, often exacerbating conflicts (Abrahms, 2021), but may also support coexistence in some areas. For example, in the forests around Golestan National Park in Iran, declines in humidity have reduced disease outbreaks which have, in turn, mediated a reduction in conflict between livestock keepers and leopards (Khorozyan et al., 2015).

We seek to understand coexistence dynamically and holistically, including positive aspects of human-wildlife relationships, alongside the more widely publicized negative interactions such as crop damage, livestock depredations, attacks on humans, and retaliatory killing (Pooley, 2021). We therefore accept coexistence as "a state where conflict exists but where interactions are kept within acceptable limits" (Linnell, 2013, p. 26). This is a characterization of coexistence as a dynamic state in which interactions between people and carnivores can

be governed by diverse institutions to ensure the sustainability of carnivore populations, social legitimacy, and tolerable levels of risk (Carter and Linnell, 2016). Thus, this definition has the flexibility to encompass the politics that govern both the interactions between people and carnivores and the relations between people with competing interests concerning carnivores (Redpath et al., 2013; Carter and Linnell, 2016; Jepson et al., 2018). Because this definition is dynamic, it can also encompass changing environmental states, such as may result from climate change (Abrahms, 2021).

Multiple ethnographic studies have examined coexistence from the perspectives of local communities demonstrating the complex, and often ambivalent, ways in which local people establish relationships with the natural world, via their livelihoods, cultures, lived experiences and everyday practices. For example, research by Pooley (2016) has documented nuanced and varied human relationships with crocodiles across African geography and history; Baynes-Rock (2013) and Gebresenbet et al. (2018) describe cultural beliefs that bring communities in Ethiopia to view hyenas as beneficial and reasonable beings, despite high rates of livestock depredation, and attacks on humans; whilst Goldman et al. (2010) document the ways in which superficially negative relationships between Maasai and lions, rooted in conflict (Ikanda and Packer, 2008), conceal the role that ritual lion killing plays in providing the cultural underpinning of powerful feelings of respect and admiration for lions. Approaches that build on such deep cultural relationships with large carnivores can play fundamental roles in promoting the value of carnivores as a social as well as a natural resource (Nijhawan and Mihu, 2020). These examples contribute to an understanding of coexistence as complex, multi-layered and deeply rooted in culture, and demonstrate the importance of viewing coexistence through different perspectives and cultural lenses (Adams and Mulligan, 2003; Peterson et al., 2010; Pooley, 2021).

The relationships between people and wildlife are also impacted by external political and economic processes, which influence the shape of conservation interventions and their social and economic impacts on local communities. There has been substantial research revealing the impacts of centrally imposed protected areas on local communities, including land dispossession, community displacement, and livelihood disruption (Igoe, 2006; West et al., 2006). Other research has looked at the ways in which financial instruments, intended to offset the costs of coexistence, have reconfigured human-animal relations (Nyhus et al., 2005; Fletcher, 2010); the effects of tourism businesses on local communities (Bluwstein, 2017; Homewood, 2017); and the disruption of traditional and cultural practices due to policies around community-based natural resource management (Nelson and Agrawal, 2008). This growing body of research exposes how political negotiations and decisions can shape coexistence, and demonstrates how conservation and development interventions may have unintended impacts due to the complex ways in which they are mediated by local cultures, and historical and contemporary power dynamics.

International conservation paradigms may also mediate local relationships with nature and experiences of coexistence (Robbins, 2012). From the turn of the century, conservation has been dominated by a utilitarian approach to nature requiring a careful evaluation of the economic and material costs and benefits of coexistence within an ecosystem services framework (Mace, 2014). However, more recently, there has been a shift to a more nuanced understanding of the two-way relationships between people and nature, incorporating less tangible and more multifaceted components of well-being that constitute a "good life" and shape socio-ecological relations (Woodhouse et al., 2017; Pascual et al., 2021). Here, well-being is conceptualized across three main dimensions: objective material needs; subjective meaning and satisfaction, including feelings of value, fairness, and change; and social needs, including people's ability to fulfill social obligations and conventions by pursuing, for example, livelihoods that contribute to people's sense of identity and way of life (Chan et al., 2016; Woodhouse et al., 2017). The inclusion of social and subjective components of well-being, in addition to material components, enables the accommodation of diverse needs and aspirations within communities across different gender, age, ethnicity, class, and livelihood groups. This multidimensional approach to well-being has been incorporated into the "nature's contribution to people" discourse of the Intergovernmental Panel on Biodiversity and Ecosystem Services (Diaz et al., 2018) and facilitates a deeper understanding of the quality and local experience of coexistence with wildlife.

In this article we use a Theory of Change approach to identify logical pathways that can promote and improve the multidimensional experience of coexistence of local communities living alongside large carnivores in Africa's dryland landscapes. This model draws on our knowledge as scientists and practitioners of carnivore conservation: our understanding of coexistence varies based on our personal and disciplinary backgrounds, our field experiences, and the geographical contexts of our work (see also Kiik, 2018). Our Theory of Change is also informed by critical and place-based experiences of coexistence and well-being. After a brief introduction to the study context and description of the Theory of Change and its development, we detail the main pathways of change identified, their expected outcomes, and the assumptions on which they are based. We finish up with a discussion of potential frameworks through which the model may be locally implemented and operationalized. Throughout our analysis, unless otherwise stated, our use of the terms "costs" and "benefits" is intended to encompass the multiple dimensions of material, subjective, and social well-being, in line with Woodhouse et al.'s (2017) framework.

STUDY CONTEXT

Our analysis focuses on coexistence between people and large carnivores in Africa's drylands. These are defined as lands where annual precipitation is less than two thirds of potential evaporation, and range from subhumid areas through to hyper-arid deserts (Millennium Ecosystem Assessment, 2003). Africa's drylands extend across 43% of the continent's land mass (FAO,

2008) and are home to five species of conflict-causing large carnivores: lion (*Panthera leo*), leopard, cheetah, African wild dog (L*ycaon pictus*), and spotted hyena (*Crocuta crocuta*).

Our study context, therefore, stretches across a vast region, encompassing landscapes that are historically, politically, economically, culturally, and ecologically diverse and that are disproportionately impacted by climate change (IPCC, 2019). Local experiences of coexistence will vary considerably from place to place (Pooley, 2016) and across the range of species present within each area (Dickman et al., 2014). Our Theory of Change is therefore designed to provide a broad and flexible framework that can encompass different place-based contexts and facilitate management approaches that recognize and value a wide diversity of experiences of coexistence. It can be used in areas that still support populations of large carnivores, that provide corridors for such populations, or in areas of wildlife recovery.

METHODS

The Theory of Change Approach

A Theory of Change approach was chosen over other conservation decision frameworks (Bower et al., 2018; Núñez-Regueiro et al., 2020), as it is qualitative and relatively simple, yet can provide a big picture approach to help understand complex socio-ecological systems. Theories of change are process-oriented tools, they are particularly suited to development through expert and stakeholder consultation. In making explicit the logical connections and assumptions between activities, outcomes and impact, theories of change help facilitate an understanding of the pathways and steps through which interventions result in their desired impact, and allow testing of these assumptions (Biggs et al., 2017; Rice et al., 2020). They are widely adopted in the field of international development (Vogel, 2012; Valters, 2014) and are increasingly used in conservation to design, monitor and evaluate interventions (Biggs et al., 2017; Balfour et al., 2019; Rice et al., 2020; van Eeden et al., 2021).

Our Theory of Change was used to understand how a complex range of factors and their interactions can foster coexistence between people and large carnivores and to identify major pathways that can lead to change. It was generated through expert consultations, initiated in a workshop process, working backwards from the intended impact through to the changes, actions and conditions needed for its achievement. As a first step we developed a clear understanding of the issue at hand to identify the intended impact. In the second step we identified barriers to achieving the impact. For the third step we identified the various objectives or outcomes needed to overcome the barriers to deliver the impact, breaking down the changes that need to occur before the impact can be achieved. In the fourth step we listed the specific outputs, actions or interventions needed to bring about the identified outcomes. In the fifth and final step we reflected on and questioned the assumptions under which outputs and outcomes are believed to be linked. We structured outputs into overarching pathways and identified enabling conditions, or rather, principles and contextual elements, based around our assumptions, that determine the successful progression from an intervention through to its intended impact. Our approach follows that taken by Biggs et al. (2017) in their analysis of the illegal wildlife trade, and as such follows a uniquely tailored approach.

The Workshop

A workshop was designed with the express purpose of developing a Theory of Change to improve coexistence with large carnivores. The workshop took place at the Brackenhurst Conference Center, near Nairobi, in Kenya, in 2018 and was attended by 14 scientists and practitioners in carnivore conservation with experience covering the full guild of conflict-causing large carnivores (lion, leopard, spotted hyena, cheetah, and African wild dog) and across 19 countries in Africa. Two additional experts working in Europe and Asia also participated in the workshop to provide alternative perspectives and experiences from other regions. Participants included government, NGO and academic representatives, and most had substantial experience in multi-disciplinary research and/or practice. Three participants were leaders of community-based projects, and their lived experiences working within these communities helped inform the workshop. The framework for the Theory of Change was developed over 2 days, with the discussion facilitated and guided by SMD. The model was further developed after the workshop and simplified through remote discussions with workshop participants (**Figure 1**). Three additional coauthors participated in the writing process, bringing additional expertise, including in anthropology, monitoring, and evaluation. Details of contributors are provided in the **Supplementary Table S1**.

RESULTS

A Theory of Change to Enhance Coexistence Between Large Carnivores and Local Communities

In line with our understanding of coexistence as a dynamic state, but where interactions between people and large carnivores are kept within sustainable limits, we defined the desired impact of our Theory of Change as enhanced coexistence between large carnivores and local communities in Africa's dryland landscapes.

Outcomes

Coexistence is intrinsically a socio-ecological state, hence outcomes needed to enhance coexistence necessarily span both social and conservation goals (**Figure 1**). These outcomes recognize the multiple material, subjective, and social well-being components to coexistence (Woodhouse et al., 2017).

The achievement of sustainable large carnivore populations depends on a series of outcomes linked to material as well as other components of people's well-being. These well-being components concern the ability of local people to organize the use of natural resources, and to build stable, sustainable and resilient livelihoods to meet their needs and aspirations. In logical order, starting with lower level outcomes and working up to final outcomes, these include improved rule enforcement and compliance arising from agreed systems that underpin sustainable natural resource management (O.1), alongside measures that reduce

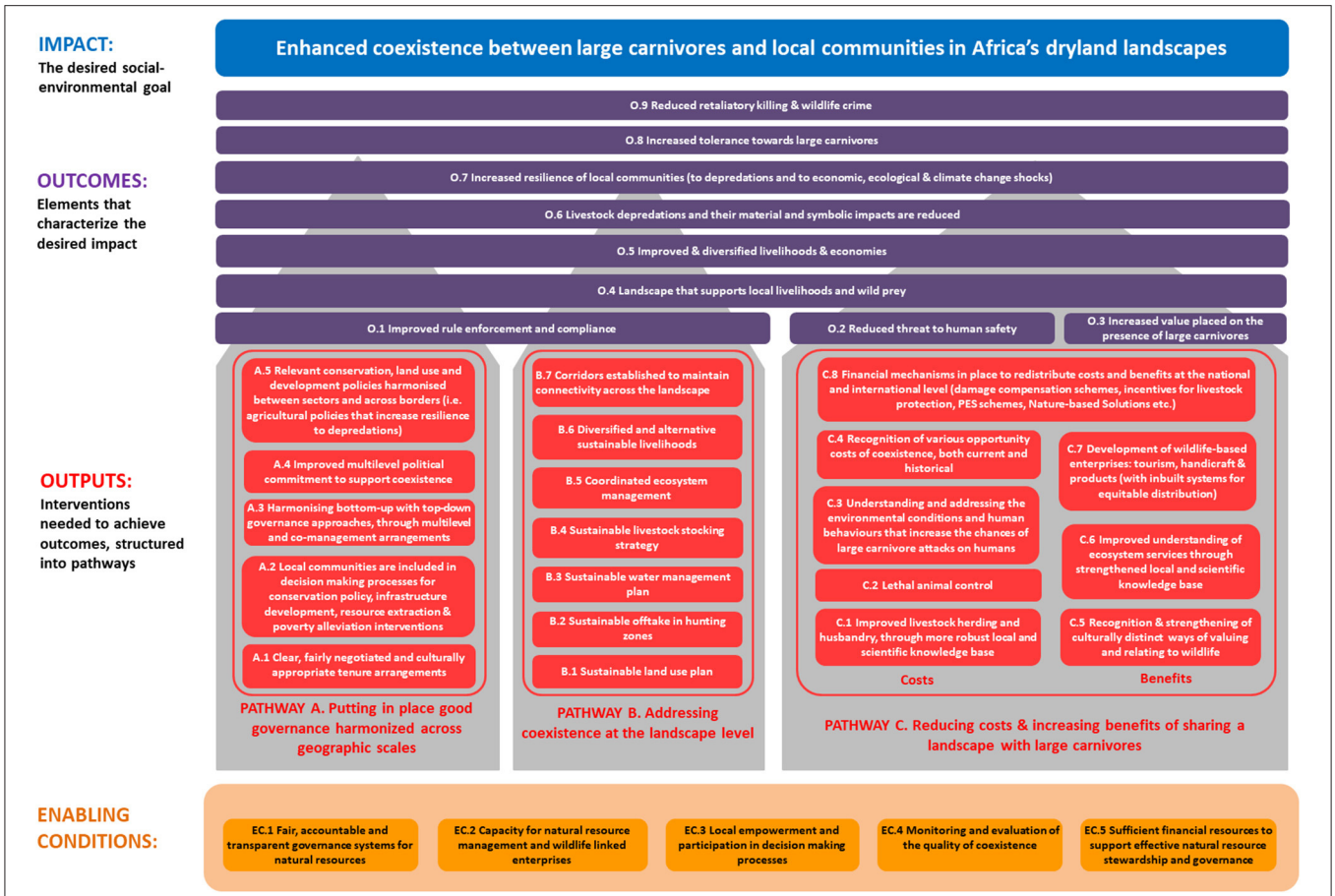

FIGURE 1 | The Theory of Change for enhanced coexistence between large carnivores and local communities in Africa's dryland landscapes.

the threats to human safety posed by large carnivores (O.2) while generating value for communities (O.3). Landscapes that support local livelihoods and wild prey (O.4) should result from sustainable rangeland management, while improved and diversified livelihoods and economies (O.5) should reduce reliance on natural resources. Communities bear costs of living alongside large carnivores, in addition to threats to human safety (O.2), and hence it is important that measures are taken to reduce to a minimum the material and symbolic impacts of these events (O.6). Climate change is projected to increase desertification and the frequency and intensity of extreme climate events, including droughts, dust storms and floods, all of which already exert catastrophic impacts on African dryland systems (Middleton and Sternberg, 2013; IPCC, 2019). Thus, the implementation of sustainable approaches to rangeland management should help to secure the resilience of communities in the face of climate change (O.7). Finally, these steps should result in increased tolerance toward large carnivores (O.8), and contribute to a reduction in retaliatory killing and wildlife crime (O.9). These outcomes together contribute to the overall impact of enhanced coexistence between large carnivores and local communities.

The outcomes we identify not only address material components of well-being, but also link to subjective components of well-being, as their delivery requires addressing issues of distribution, equity, and justice in environmental resource management and in conservation related policies. In addition, they link to social components of well-being because of the need to structure and mediate relations within communities and between communities and other actors, and to support livelihoods and practices tied to people's identity and to their sense of belonging and of place. Any changes in the material value of large carnivores will also, most likely, affect the subjective and social value of these species. These subjective and social dimensions of outcomes must be addressed, alongside material dimensions, in order to ensure that local interests and socio-ecological relations are recognized and valued. This requires a holistic consideration of "the complexity of people's lives, incentives and aspirations, which are both shaped by and shape their natural environment" (Woodhouse et al., 2017, p. 97).

The progression from pathways through to outcomes and impact relies on a series of assumptions that are difficult to examine in isolation, as they will interact with each other in different ways, depending on context. Therefore, rather than listing each separate assumption, we discuss them in the following section.

Pathways to Outcomes and Impact

Three pathways were developed that incorporate actions and interventions that lead to the expected outcomes. A set of enabling conditions are required to provide the underpinning foundations to support the pathways, and are key for effective, fair and transparent stewardship and governance of natural resources. They include systems for fair, accountable and transparent governance (EC.1); capacity (EC.2); local empowerment in decision making (EC.3); monitoring and evaluation (EC.4); and sustainable financial resources (EC.5). Supported by the enabling conditions, the pathways, taken together, are expected to enhance the socio-ecological sustainability of resource use, thereby increasing the resilience of livestock keepers to economic, ecological, and climate change shocks.

Pathway A—Putting in Place Good Governance Harmonized Across Geographic Scales

Pathway A aims to integrate local perspectives into different levels of decision-making by putting in place good governance and harmonizing interventions across governance scales. The pathway is intended to facilitate fair and equitable negotiation of rules over access and management of natural resources, including large carnivores, and also addresses larger processes that structure local economies with the aim of improving livelihoods. Developing governance approaches that can fairly and sustainably address the complexities of people's relations with nature has proven to be challenging (Roe et al., 2009), particularly given widespread government reluctance to devolve autonomy and control over natural resources to communities (Nelson et al., 2020). Self-governance and devolution are the guiding principles behind community-based natural resource management (Ostrom, 1990) and are considered essential for community-based conservation (CBC) arrangements to thrive (Nelson and Agrawal, 2008). However, under these principles, CBC success depends on communities valuing large carnivores as a resource, which is very often not the case. Moreover, even where carnivores are valued as a resource, the efficacy of CBC in delivering positive conservation outcomes for these wide-ranging species is limited by the local scale of CBC activities.

Governance approaches that involve higher levels of governance, through regional, national, multinational, and supranational engagement and through partnerships with NGOs, businesses or international networks (Lemos and Agrawal, 2009) are therefore necessary for several reasons. Firstly, they can accommodate the ecology and population dynamics of large carnivores, which extend beyond community boundaries, across national, and regional borders (Woodroffe and Ginsberg, 1998; Trouwborst, 2015; Durant et al., 2017). Secondly, they allow for national and international interests in conservation, and human and indigenous rights to be represented and negotiated, thus also facilitating the creation of multilevel partnerships and international community networks (Lemos and Agrawal, 2009; https://www.iccaconsortium.org). Thirdly, they can more adequately account for the global structural processes, both historical and ongoing, that underpin current patterns of poverty, inequality, and extractive resource use (Robbins, 2012; Moore, 2015). Global structures affect local communities and large carnivores in multiple ways, for example, driving the conversion of land with high value to biodiversity and pastoral communities for more intensive activities like agriculture or mining (Batterbury and Ndi, 2018). They can result in lasting changes to rural economies and agrarian practices, impacting the sustainability and resilience of community livelihoods and resource use strategies, for example by changing patterns of livestock predation and human-carnivore interactions (Lescureux and Linnell, 2013; Margulies and Karanth, 2018).

In order to reconcile these complex national, regional, and global processes with the place-based contexts relevant to people and their livelihoods, conservation of large carnivores requires governance that can empower and engage local communities in decision-making that extends beyond individual communities. Designing governance structures that span across different levels of scale is a challenge when the interests of local communities conflict with the interests of the national, regional or global community (Nelson et al., 2020). In such situations, systems of governance using a "freedom within frames" approach can be useful, whereby large carnivore management works within a nested hierarchy of governance structures (Linnell, 2005). Here, high-level policy frameworks provide general guidelines and principles and set boundaries within which lower levels can operate, while communities are able to make autonomous and locally adapted decisions within the limits of these frameworks (Linnell, 2005). Such systems need to account for legitimate grievances from those who shoulder the burden of living alongside large carnivores against the imposition of higher-level policy frameworks that limit their freedom, say, to manage or eliminate threats posed by these species (Linnell and Kaltenborn, 2019). High-level policy should also provide mechanisms that increase resilience of the socio-ecological system in response to climate shocks, that sustain coexistence, while supporting the adaptation of communities to a changing climate (Abrahms, 2021).

To be effective, governance frameworks need not only to be harmonized across geographic scales but should also provide mechanisms that empower communities to negotiate their interests at these different scales. Thus, the measures in this pathway address both bottom-up and top-down approaches to governing nature, and improve negotiations between them. Bottom-up approaches include local-scale governance of wildlife and natural resources through negotiation processes that integrate local knowledge into management (Folke et al., 2005; Armitage et al., 2009; Linnell, 2015; Redpath et al., 2017; Butler et al., 2019), and theoretical and practical facets of community-based conservation (CBC) (Nelson and Agrawal, 2008; Mishra et al., 2017). Progress in this pathway requires ensuring that local communities have meaningful roles in decision-making processes.

The interventions we identified within this pathway therefore aim to make coexistence approaches complementary and compatible across different levels and scales. They require clear, fairly negotiated and culturally appropriate tenure arrangements (A.1) and the inclusion of local communities in large-scale decision-making processes for conservation policy,

infrastructure development, resource extraction, and poverty alleviation interventions (A.2). This requires harmonizing bottom-up with top-down approaches as discussed above (A.3). These actions will help to build a multilevel political commitment to support coexistence (A.4), which requires local understandings of coexistence to be recognized, valued and integrated into large-scale planning. Finally, the relevant conservation, land use and development policies should be harmonized across geographic borders as well as between government sectors (environment, infrastructure, economic development, agriculture etc.; A.5). This includes, therefore, the development of transnational cooperation and, for example, of national and international agricultural policies that increase local resilience to livestock depredation (A.5). It also requires improving policy alignment at all levels, both within and between sectors, which should be based on a sound understanding of the interactions between micro and macro level structures that govern processes of resource extraction and conservation (Agrawal and Ostrom, 2006; Igoe, 2006), as well as adaptation to climate change (IPCC, 2019). Adaptable multilevel solutions are needed that can integrate complexity and facilitate the dialogue, information exchange, cooperation, and negotiation needed to establish both upward and downward accountability (Cash et al., 2006; Berkes, 2009; Butler et al., 2019, 2021). The success of these interventions depends on cooperation between neighboring land management authorities and owners including, where appropriate, protected area management authorities.

Adaptive co-management has been proposed as an approach to governance systems that can navigate across different geographic scales while addressing the inherent complexity of socio-ecological systems and their associated uncertainties (Folke et al., 2005; Armitage et al., 2009; Butler et al., 2019, 2021). Adaptive co-management has been defined as "a process by which institutional arrangements and ecological knowledge are tested and revised in a dynamic, on-going, self-organized process of trial and error" (Folke et al., 2002, pg. 20; Plummer and Armitage, 2007; Berkes, 2009; Plummer and Baird, 2013; but see also Butler et al., 2019). By linking actors horizontally and vertically (Plummer and Baird, 2013), as is essential for successful large carnivore management, adaptive co-management supports communities to become managers of natural resources, to invest in long-term sustainable management of ecosystem services, and to make informed and difficult trade-offs to support their long-term well-being (Fabricius et al., 2007). Adaptive co-management is also implicitly dynamic which, crucially, enables it to be agile and flexible in the face of climate change.

Pathway A, therefore, fundamentally, aims to tie together multiple approaches to governance in order to secure community engagement and ownership in decision-making, and to ensure that stewardship can be coordinated at the large geographic scales needed for the survival of large carnivores.

Pathway B—Addressing Coexistence at the Landscape Level

Interventions within pathway B aim to improve the governance and stewardship of natural resources at the landscape level. This pathway emphasizes building and strengthening local institutions at scale in order to improve enforcement and compliance with rules about the use, management, and conservation of resources important to both local livelihoods and large carnivore habitat and prey requirements (Agrawal and Gibson, 1999). This includes a series of interventions targeted at sustainable rangeland management that are based on an understanding of coexistence between people and large carnivores embedded within a broader set of socio-ecological relations (Ghosal et al., 2015; **Figure 1**). A focus on the landscape level enables conservation interventions to be directed not just toward carnivores themselves but also toward their habitat, wild prey and interspecific interactions. Landscape approaches to conservation also enable the integration of cultural, political and ecological considerations so that humans, their livelihood practices, and everyday tasks, are understood as integral elements of the local ecology (Sayer et al., 2013).

The interventions we identified in this pathway involve developing community-led natural resource management plans that are both ecologically and socially sustainable. These include plans for ecosystem management (B.5), including livestock stocking strategies (B.4), water extraction (B.3), hunting (B.2), and different types of land use which may include protected areas (B.1). Underpinning these management plans is the need for clear, fairly negotiated and culturally appropriate tenure arrangements addressed under pathway A (A.1; Western et al., 2020). Tenure arrangements may concern individual or communal ownership, control, access, use of land, and natural resources, including rights to include and exclude outsiders from key resources such as hunting grounds, grazing land and water, or from tourism development (Ostrom, 1990; Bluwstein, 2017; Homewood, 2017). In some cases alternative and diversified sustainable livelihoods (B.6) may also play a role in reducing pressure on natural resources (Roe et al., 2015). Finally, interventions to safeguard wildlife movement corridors to maintain connectivity across multiple-use landscapes (B.7), including careful consideration of any fencing interventions (Durant et al., 2015), will be needed to secure the viability of large carnivore populations and increase their resilience to climate change. This requires collaboration between adjacent communities and regions, and with protected area managers and policy-makers, to combine and harmonize community-level management at the landscape level, integrated with recent information on environmental change. These interventions together involve the engagement of institutions that structure relationships between local actors, and relationships between local communities and external actors, such as other communities, NGOs, private companies and states (Pathway A; Agrawal and Gibson, 1999). Approaches could build on existing community-based natural resource management or similar frameworks adopted across Africa's semi-arid landscapes (Nelson et al., 2020).

The importance of recognizing the diversity of norms and interests within and between communities is particularly important for this pathway, as groups, subgroups, and individuals may have different priorities for resource use and distribution. Negotiations over resource access will also have impacts across different dimensions of well-being, with

implications for the material well-being of communities and individuals, for their perceptions of equity and justice, and for their ability to maintain culturally specific socio-ecological relations that encompass traditional livelihoods and practices (Martin et al., 2016; Oldekop et al., 2016; Lichtenfeld et al., 2019). Local notions of identity and stewardship are often centered around natural resource use, and underpin cultural dimensions of well-being, hence an understanding of the cultural diversity of perceptions relating to conservation and sustainability needs to be integrated into management (Lewis, 2008; Homewood, 2017). This will require an understanding and recognition of current and historical grievances, which may include exclusionary practices such as the gazetting of protected areas (Brockington and Igoe, 2006; Büscher and Fletcher, 2020). For example, new forms of land grabbing by multiple powerful actors, including the state and multinational corporations, primarily for large-scale agricultural production (Dell'Angelo et al., 2017) but also for conservation purposes, risk reproducing past injustices and further alienating local communities (Homewood, 2017; Davis et al., 2020).

Pathway C—Reducing Costs and Increasing Benefits of Sharing a Landscape With Large Carnivores

Interventions within pathway C aim to reduce the costs and increase the benefits of coexistence by raising the economic and cultural value placed on the presence of large carnivores; reducing the threat of large carnivores to human welfare and safety; and providing linked support and funding streams to enable local communities to improve or diversify their livelihood strategies (**Figure 1**). The pathway also aims to redress the inequitable distribution of costs and benefits at local, national and international scales. This depends on understanding what an equitable distribution might mean to a community and to its different members. Moreover, it relies on the multilevel structures discussed in pathway A, through which distribution can be fairly and equitably negotiated, alongside securing sustainable stewardship at a landscape level through pathway B.

A key technical intervention in this pathway is aimed at improving livestock herding and husbandry practices to reduce livestock injury or loss (C.1). Livestock depredations and the implementation of measures to prevent them can result in significant financial, labor and emotional strain for farmers (Inskip and Zimmermann, 2009). Measures to prevent attacks on livestock should be co-designed with livestock keepers, prioritizing herder knowledge and experience, while providing scientific, technical and material support to build on existing capacity (Lichtenfeld et al., 2019). This enables interventions to be adapted to on-the-ground physical, economic, labor and cultural opportunities, and constraints. Another intervention provides for the possibility of legal avenues for targeted lethal control (C.2). Carefully managed lethal control may be an important management tool where local socio-ecological relations rely on notions of reciprocity and control or on longstanding hunting traditions (Goldman et al., 2010; Lescureux et al., 2011). Moreover, it may be necessary under conditions of intense conflict or imminent threat to human safety, where other solutions have proved futile or are not available (Packer et al., 2019). The removal of individuals that are causing problems to local communities will necessarily have to be balanced against the conservation status of the species or population in question, and exceptional circumstances may require negotiation between trade-offs. Understanding the environmental conditions and human behaviors that increase the likelihood of large carnivore attacks on humans (C.3) is also crucial for the development of new approaches to their prevention, and for mitigating interactions with carnivores that have the potential to be highly traumatic for local communities.

Interventions aimed at addressing the costs of carnivore conservation borne by local communities must also recognize that these often extend beyond the economic impact of livestock depredations. Historical and contemporary opportunity costs (C.4) may include foregone revenue from land use change, more intensive livestock stocking strategies, or hunting. For many, the collective memory and ongoing trauma of land dispossession and community displacement, through the creation of national protected areas or private hunting or tourism reserves, may be the dominant lens through which carnivore conservation interventions are perceived (Neumann, 2001; Brockington and Igoe, 2006; West et al., 2006; Homewood, 2017). Carnivore conservation strategies aimed at engaging local communities must consider the legacy of such past conservation projects, including their links to colonial history and state-building endeavors. Top-down approaches may reconfigure the local political landscape in unexpected ways, and reinforce the perception of carnivores as symbols of state, foreign or elite power (Duffy et al., 2019). Militarized approaches to conservation, in response to the global demand for wildlife products, may also contribute to community alienation. In the long-term, community-based and supported policing of illegal activities, including the incorporation of value-based approaches to anti-poaching, may secure better protection and help prevent the escalation of violence (Neumann, 2004; Duffy et al., 2019). Carefully designed outreach and awareness raising campaigns can also decrease illegal activities (Holmes, 2003; Steinmetz et al., 2014; Biggs et al., 2017; Chen et al., 2019), and underpin good governance and effective stewardship of natural resources to enhance coexistence.

Alongside the costs in pathway C, are a series of interventions that aim to increase the benefits of coexistence. The first two interventions are based on recognizing and strengthening culturally distinct ways of valuing, benefiting from and relating to wildlife (C.5). As mentioned previously, perceptions and attitudes toward carnivores are diverse, multi-layered, and often ambivalent (Goldman et al., 2010; Baynes-Rock, 2013). In practice, incorporating local community needs into large carnivore conservation may mean integrating scientific discourse on ecosystem services with local understandings of nature and of sustainability (C.6). These may include the provision of secure livelihoods, balanced herbivore populations, access to food, safe water, mineral licks, and grazing land, and extending further to notions of social resilience, spirituality, identity, stewardship, socio-ecological diversity, community, and sovereignty (Diaz et al., 2018). Ethnographic studies have explored people's sensory, spiritual and emotional connections with wildlife, demonstrating

the complex ways though which local people care for and benefit from their environment that extend beyond the realm of economic profit (Singh, 2018). Greater attention should be paid to these culturally rooted socio-ecological relations, as these represent place-specific forms of coexistence and conservation in their own right (Sandbrook, 2015), and may further be harnessed as foundations to forge synergistic partnerships with external conservation organizations (Peterson et al., 2010). However, there are perils in cherry-picking congenial coexistence narratives and practices, without recognizing their diversity on the ground, their evolving nature and how they are shaped by politics. Culturally-rooted relations with nature may be co-opted in local power struggles (Brockington, 2006), representing what Homewood (2010, p. 179) refers to as "politically loaded statements about identities and aspirations." This highlights the importance of engaging with local perceptions of wildlife on people's own terms, acknowledging the existence of a full range of beliefs and practices that may be at times beneficial and at other times harmful to conservation (Homewood, 2010).

Wildlife-based enterprises provide mechanisms to generate material, cultural, and social benefits from the presence of wildlife (C.7). Wildlife tourism is the most widely used intervention to enable local communities to secure benefits from sharing a landscape with large carnivores. Notable examples of tourism for carnivores and other charismatic species across Africa have been promoted as conservation and development successes (Lindsey et al., 2013). Whilst most offer wildlife photography-based safaris, some also allow trophy hunting or include handicrafts or other wildlife-based products (Mishra et al., 2003; Lindsey et al., 2006). However, individual schemes may function through very different levels of engagement with communities, the state, NGOs and the private sector. Positive experiences, where wildlife tourism contributes to combined social, ecological and economic outcomes, have been recorded, particularly for well-designed, long-term projects (Brooks, 2017). For example, in Namibia, long-term CBC schemes in conservancies on marginal land have benefitted from technical and financial contributions from external agencies, and have provided more tangible benefits to local people than alternatives (Dressler et al., 2010). However, some tourism-based CBC schemes have faced criticism regarding their ability to provide benefits that are sufficient to outweigh the costs of living alongside problematic wildlife, and to reach those who shoulder the greatest burden of coexistence (Songorwa, 1999; Gandiwa et al., 2013).

Many places lack the well-developed infrastructure and political stability required to attract and accommodate tourism, which makes development through wildlife tourism unrealistic (Walpole and Thouless, 2005; Brito et al., 2018). The recent Covid-19 pandemic has also had drastic impacts on tourism revenue generation across Africa, and highlights the volatility of the tourism industry and the risks associated with an over-reliance on tourism to deliver conservation and community development (Lindsey et al., 2020). Even where tourism thrives, tourism experiences targeted at foreign visitors may provide a depiction of wilderness that is disconnected from its historical and social context, that conflicts with local conceptions of nature, and exacerbates nature-society divisions in the context of global uneven development (Büscher and Fletcher, 2020). The cultivation of more engaged, long-term, local, and every-day nature-based experiences is likely to be critical to ensuring a more reliable and sustainable tourism sector and to democratize access to nature (Vannelli et al., 2019; Büscher and Fletcher, 2020; Lindsey et al., 2020). The promotion of environmental education at community and national levels, aimed at valuing biodiversity, traditional knowledge and existing biocultural relationships may provide cultural and conservation benefits that extend beyond economic profit, highlighting also the importance of creating opportunities for nature-based experiences that are accessible to local and domestic residents (Black, 2016; Büscher and Fletcher, 2020).

A series of financial mechanisms exist to redistribute the material costs of coexistence on a national and international level (C.8), including incentives for livestock protection (van Eeden et al., 2018) and damage compensation and insurance schemes (Dickman et al., 2011). However, the success of damage compensation schemes in increasing tolerance for damages appears to be limited, particularly when they are applied in isolation (Agarwala et al., 2010). Nonetheless, such mechanisms may help to demonstrate a wider political commitment toward sharing the costs of carnivore conservation (Agarwala et al., 2010; Dickman et al., 2011). Importantly, they should be incorporated into a holistic approach to large carnivore conservation that avoids unintended outcomes, as they otherwise risk removing incentives to safeguard livestock against attacks or disrupting important cultural values associated with large carnivore conservation (Nyhus et al., 2003).

Opportunities to support more integrated approaches to nature stewardship may be available through broader schemes that provide financial benefits from sustainable stewardship of natural resources, including payments for ecosystem services (PES), such as through carbon-based schemes (African Development Bank Group, 2015; Kiffner et al., 2019), and proposals of universal basic income (Fletcher and Büscher, 2020). The economic principles of these financial mechanisms can vary from market- to welfare-based arrangements, depending on the funding sources and how they are harnessed and distributed within communities. Debates regarding the efficacy of market-based PES schemes in delivering global and local ecological and social benefits are heated and ongoing (Corbera, 2012; Fletcher et al., 2016; Fletcher and Büscher, 2017; Ferraro, 2018). Many of the pitfalls encountered by PES schemes at the community level mirror those encountered by CBCs (Roe et al., 2009), centering around issues of governance, transparency, tenure, equitable benefit distribution, and ability to secure long-term funding (Dougill et al., 2012; Corbera et al., 2019). However, opportunities for generating income from sustainable stewardship are likely to become more widely available in future. Nature-based solutions (NbS) have recently attracted considerable international attention, and could provide substantial financial resources for local communities to support responsible nature stewardship (Pettorelli et al., 2021; Wood et al., 2021). Moreover, debates over climate and ecological justice have seen growing calls for an explicit recognition of the ecological debt accumulated by the global north through centuries of colonial domination and

resource exploitation in the global south (Bellamy Foster and Clark, 2004). Proponents of ecological and climate reparation have brought forth solutions that include the restructuring or canceling of financial debt owed by the global south, and the creation of a Global Climate Stabilization Fund and Resilience Fund Programme, dedicated to meeting needs under the loss and damage category of financial compensation, and funded by the countries most responsible for global ecological and climatic destabilization (Perry, 2020). As concerns for climate change galvanize opportunities for financial redistribution and reparation, it is important that emerging institutional and funding arrangements are designed to address the biodiversity crisis alongside the climate crisis, while also contributing to local communities' well-being and resilience (Seddon et al., 2020; Pettorelli et al., 2021). The development of holistic approaches to address these joint social and environmental challenges will require global commitment (Pettorelli et al., 2021; Seddon et al., 2021), and a careful attention to how these approaches are implemented on the ground (Dougill et al., 2012).

DISCUSSION

Our Theory of Change identifies multiple social and ecological goals, or outputs, leading to enhanced coexistence between large carnivores and local communities, and three broad pathways through which they can be achieved, namely: (A) putting in place good governance harmonized across geographic scales; (B) addressing coexistence at the landscape level; and (C) reducing costs and increasing benefits of sharing a landscape with large carnivores. The model is based on our knowledge as conservation practitioners and scientists, including our everyday experience of conservation challenges on the ground, and draws on the literature on conservation and coexistence. Our intent is to develop a framework as broad and comprehensive as possible, able to identify linkages between the overall intended impact of enhanced coexistence with specific outcomes and their pathways, and to report on key debates concerning these links. However, coexistence is by definition a situated experience, embedded in a place-based socio-ecological context, but which will also be subject to change, including changes due to a warming planet. Therefore, to be relevant, our overarching Theory of Change has been designed to be flexible, to enable local adaptation through meaningful community engagement with shifting place-based realities as they are experienced by communities and large carnivore populations.

The complexities inherent in people's relationships with nature, and particularly with large carnivores, mean that our Theory of Change is unlikely to reach an end point whereby sustainable coexistence is achieved. Rather, coexistence requires an ongoing process of negotiation that recognizes the diverse and changing relationships between large carnivores and local people, and identifies interventions that can minimize costs and increase benefits in ways that foster tolerance (Linnell, 2013). Climate change provides an additional layer of complexity, further modifying relationships between people and large carnivores in ways that may be difficult to predict (Abrahms, 2021). Our model thus represents the actions, structures, and processes that should be put in place to allow this negotiation to take place, and which move the tolerance "dial" toward enhanced coexistence, while allowing for change. This includes conservation and natural resource management governance structures that incorporate local interests, support sustainable management of habitat and wildlife, and ensure equitable distribution of the costs and benefits of living alongside large carnivores.

Well-being-based approaches offer a useful framework for involving local communities in Theory of Change adaptation processes and defining, qualifying, and monitoring implementation (Woodhouse et al., 2017). Woodhouse at al. (2017) provide examples of how communities have been engaged through participatory methods to define their own material, subjective, and social needs and aspirations, in order to identify relevant and meaningful social and ecological goals. Including people from different age, gender, class, ethnicity, and livelihood groups in the adaptation process helps address heterogeneity in local values and needs (de Lange et al., 2016). It also helps identify vulnerable groups who are most adversely affected by large carnivores to ensure that they are the main beneficiaries of designed interventions (Woodhouse et al., 2017). The goals identified by local communities can be incorporated into the desired outcomes of our Theory of Change, and used, and adapted as necessary, as part of a cycle of monitoring, evaluation, learning and adaptation (Lichtenfeld et al., 2019).

Large Carnivores, Communities, and the Problem of Scale

Pathways B and C represent a two-pronged approach to address site-based actions needed to enhance coexistence with large carnivores through the sustainable management of drylands and mitigation of conflict, while pathway A provides the governance pathway on which their success depends. Crucial to this pathway is the reconciliation of locally based governance with approaches that are able to work at the large geographic scales needed for large carnivore conservation. This points to the need for a "freedom within frames" approach, that supports meaningful community engagement with a wide range of stakeholders to achieve solutions that deliver social and ecological benefits across multiple scales.

Beginning in the 1980s, CBC approaches have provided mechanisms of governance at the local level. CBC is based on an ethos of participatory engagement through the inclusion of traditional knowledge and community interests in resource management and has been implemented across the African continent (Dressler et al., 2010). Key to CBC is the generation of economic benefits to local communities from nature protection and the provision of ecological services that provide income, socio-economic development and poverty alleviation (Büscher and Fletcher, 2020). CBC approaches, however, have often fallen short of delivering the social and ecological benefits initially claimed (Agrawal and Gibson, 1999; Songorwa, 1999; Newmark and Hough, 2000; Adams et al., 2004; du Toit et al., 2004; Galvin et al., 2018). They have been critiqued in the literature for their tendency to ignore the heterogenous

nature of communities and the power dynamics within them, obscuring the presence of multiple actors and interests within a community as well as the existence of both winners and losers of conservation and development interventions (Agrawal and Gibson, 1999). Several examples exist of cases where the domination of powerful state, private and elite interests further undermine already weak incentives, so that the benefits are often not sufficient to outweigh the opportunity costs of conservation for most community members (Dressler et al., 2010; Bluwstein, 2017; Homewood, 2017). Moreover, anthropological and ecological research has countered simplistic depictions of local and indigenous communities as natural stewards of their environment and its wildlife (Heatherington, 2010). This is further complicated by the fact that local communities, their traditions and their practices change over time, often in response to larger structural changes. For example, in many cases, colonial and state expansion and wider transitions into capitalism, have disrupted traditionally low impact and largely sustainable natural resource use and livelihoods (Robbins, 2012; Brightman and Lewis, 2017).

Perhaps the main critique to CBC is the limited extent to which it links to larger scale governance approaches, which limits meaningful control of communities over natural resources, due to conflicts with the interests of other stakeholders, including governments and private investors (Hutton et al., 2005). In this context, it is important that carnivore-focused conservation NGOs consider interventions that build trust and support from local communities even if they only provide marginal indirect benefits to large carnivores, since such interventions may ultimately enable broader and more direct outcomes (Young et al., 2021). This requires understanding and respecting local priorities even when they appear to depart from carnivore conservation goals. It also requires a long-term engagement. For example, technical and financial support from African People & Wildlife provided to small community projects, including water troughs, invasive species removal, and pasture beaconing and demarcation, demonstrated a genuine interest in community priorities. Such measures build positive relationships and trust with community decision-makers, and can be key to laying the groundwork for constructive discussions around carnivore conservation and coexistence (Mishra, 2016). Putting in place these building blocks of trust, shared goals, and mutual respect is critical for the effectiveness of interventions (Young et al., 2021), and can strengthen enabling conditions identified in our model, by supporting local governance, capacity and empowerment. In the challenging context of human-large carnivore coexistence, such approaches also support the establishment of strong democratic institutions that govern access and sustainable use of natural resources, which are founded on stakeholder dialogue and negotiation and facilitate compromises and synergies between local interests and conservation (Homewood, 2010).

Adaptive Co-management

As we have seen, large carnivore management is a dynamic and conflict-ridden space, where large carnivores can have serious impacts on local communities, and may even threaten public safety (Packer et al., 2019). The successful implementation of our Theory of Change will depend on management and governance frameworks that are able to mitigate conflicts between top-down large-scale policy and bottom-up local CBC-type approaches. This requires the empowerment and incentivization of local communities, alongside fair and equitable delivery of wider public goods such as biodiversity conservation (Brooks et al., 2013). The Theory of Change model provides a useful framework for an adaptive co-management approach, whereby the model can be used to structure on-going iterative learning integrated within participatory management of natural resource systems. This includes updating the model to address underlying uncertainties as more data become available, allowing adaptation and improvement in the model over time. In such an approach, knowledge and power are shared between stakeholders and conflict resolution is addressed dynamically through co-managed processes.

Approaches that may be helpful in initiating adaptive co-management structures for large carnivore conservation are procedures to obtain free and prior informed consent (FPIC) (Lewis et al., 2010; Buppert and McKeehan, 2013) or the social-license to operate (SLO), originally designed to negotiate over interventions that may not initially be welcomed by all members of a community (Kendal and Ford, 2018; Butler et al., 2021). Such frameworks have been recommended, for example, as an approach to rewilding by facilitating community engagement and negotiations between local interests and rewilding initiatives that may include restoration of large carnivores (Butler et al., 2019). An SLO could be used, for example, to negotiate community agreement on acceptable limits for the large carnivore population, in order to secure social acceptance.

Butler et al. (2019) propose an adaptive co-management cycle that uses participatory community and stakeholder engagement to develop agreed socio-ecological desired outputs (FPIC or SLO), and puts in place a series of interventions to achieve these outputs and a monitoring and evaluation plan to measure progress, allowing ongoing adaptation in line with learning. Crucial to the successful operation of this governance system is the establishment and maintenance of a facilitation team regarded as independent and trustworthy by all stakeholders (Cooke and Kothari, 2001). The facilitation team is responsible for identifying and engaging stakeholders, enabling dialogue and consensus-building, brokering knowledge and information and mediating any conflicts that may arise (Pound, 2015; Butler et al., 2019). The effectiveness of such an adaptive management system depends on an ongoing review of the Theory of Change to ensure that assumptions behind interventions are valid and that gaps are identified and addressed (Lichtenfeld et al., 2019). This governance system would then facilitate interactions between communities and larger scale boundary setting and can incorporate multidimensional goal setting in ways that can be adapted and adjusted over time, including in response to a changing climate (Todd, 2002; Mishra et al., 2017; Butler et al., 2021).

The development of improved governance systems such as those described above, that can support sustainable approaches to coexistence with large carnivores across the scales needed, are crucial for success. Such approaches need to equitably

reconcile different and legitimate sets of interests that may conflict within and between local communities and with broader national and international public interests. At the same time, they need to avoid the widespread problems that typically contribute to governance failure, such as corruption and elite capture (Linnell, 2015). This will require financial and technical support to strengthen capacity for governance and provide incentive structures to foster sustainable natural resource use. It is important, however, to avoid perfection being an enemy of the good. Whilst our aim was to design a model that was ambitious and comprehensive, our Theory of Change is meant to be adaptable to local financial, political, and other contextual constraints. It can be used to prioritize key interventions that are effective, practical and realistic in any given context, and additional interventions can be incrementally introduced during adaptive co-management cycles, as needed.

CONCLUSIONS

Our Theory of Change is intended to provide a broad framework that can be adapted to the specifics of local contexts. It can also be coordinated between communities to provide a harmonized framework at the wide geographic scales needed for large carnivore conservation. The Theory of Change will require ongoing monitoring and evaluation within an implementation framework, such as within an adaptive co-management approach, to test assumptions and address underlying uncertainties, while also responding to climate change. Further research is also needed to improve the underlying knowledge that forms the basis of the model and, here, reporting project failure should be regarded as just as valuable as reporting project success (Catalano et al., 2019). Our model has focused on large carnivores in African drylands, however, the Theory of Change can be readily adapted to other taxa and other systems.

Ultimately, the experience of sharing a landscape with carnivores is likely to improve only when communities are allowed to influence the terms and conditions of coexistence. This requires creating and strengthening institutions through which local people can discuss and prioritize management interventions, exploring incentives, facilitating systems of local rule enforcement, and centering local people within adaptive co-management roles (Homewood, 2017). CBCs provide a useful starting framework, but need improvement to secure genuine community self-determination and to allow their evolution into transparent and accountable approaches able to deliver social equity and justice alongside ecological outcomes (Homewood, 2017). Corruption, elite capture, privatization, rent seeking and resistance to decentralization by governments may also need to be addressed at local and landscape scales in order to secure meaningful community sovereignty (Nelson and Agrawal, 2008).

Even more challenging are contexts where incentives for carnivore conservation are very weak and conservation ranks low in local and national priorities. Our modeled pathways to enhanced coexistence recognize that conservation success relies on a holistic approach that incorporates avenues through which local well-being and priorities may be recognized, understood and valued in tandem with conservation goals. Tackling coexistence at the landscape level requires acknowledging that relations between carnivores and people form part of wider negotiations over land and resource use, and that people's livelihoods and aspirations should be viewed as integral elements of a socio-ecological system. Sustainable coexistence will depend on the harmonization of bottom-up community-led approaches, with top-down regulation that allows conservation to be effective at scale, but provides sufficient autonomy to be acceptable to communities.

Critical to success for our Theory of Change is for wider global structures to fully recognize the costs of coexistence born by local communities, and find new and sustainable financial mechanisms to ensure that the global value attached to large carnivores is transferred to those communities that pay the costs of living alongside them. This requires rethinking current economic arrangements, such as addressing issues of climate and ecological justice, as well as valuing culturally rooted relations with nature. Large carnivores, because of their potential to act as umbrella or flagship species (Belbachir et al., 2015), can help to secure international public support for new global financial mechanisms that translate the global value attached to large carnivores into local benefits (Rands et al., 2010; Durant et al., 2017). The challenge that climate change poses to communities across Africa's rangelands, could then be used to allow communities to harness financial mechanisms that support nature-based solutions to the ecological and climate crises. Such mechanisms will need to be carefully tied to local community concerns, which may often be linked to non-monetary values, to ensure successful community conservation (Davis and Goldman, 2019). Trust in the approach will depend on clear and transparent dialogue, including acknowledgment of situations when local needs and priorities do not align with conservation goals. Overall, we hope this framework will help drive transformative change in the implementation of holistic approaches to conservation and development that are grounded in trusting and stable partnerships with local communities. The global response to climate change presents an impetus to initiate such change, that includes rethinking our relationship with nature, and providing tangible value that supports sustainable coexistence for communities who are directly dependent on natural resources.

DATA AVAILABILITY STATEMENT

The research contains a meta-analysis of existing, public research. Further inquiries can be made to the corresponding author/s.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation

and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements. Ethical review and approval was not required for the animal study because the research provides a meta-analysis of existing research, leading to the development of a Theory of Change model.

AUTHOR CONTRIBUTIONS

SDu was responsible for the conception and design of the study, facilitated the workshop to develop the Theory of Change. SDu, JL, AO-C, SDI, SDo, PF, LH, JH, DI, AI, BK, LL, JM, NM, AS, and GY participated in the workshop and contributed to the design of the Theory of Change and its assumptions and theoretical underpinnings. AM synthesized and simplified the Theory of Change, identified the underpinning published literature. AM provided the first draft and SDu wrote the discussion. JL provided key concepts and ideas that informed the writing of the manuscript. All authors contributed to manuscript revisions, with the overall coordination of editing handled by SDu and AM.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcosc.2021.698631/full#supplementary-material

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