PRACTICE AND POLICY

Conservation Biology

Using incentive payments to promote human–carnivore coexistence

Adam Pekor[1] [iD] | Ingela Jansson[2] | Ololotu Munka[2] | William Ole Seki[2] | Sally Capper[2] |
Bernard Kissui[3,4] [iD] | Göran Bostedt[5,6,7] | Camilla Sandström[8] | Dennis Rentsch[9] |
Travis Gallo[1]

[1]Department of Environmental Science and Technology, College of Agriculture and Natural Resources, University of Maryland, College Park, Maryland, USA

[2]KopeLion, Ngorongoro Conservation Area, Arusha, Tanzania

[3]School for Field Studies, Karatu, Tanzania

[4]Maasai Steppe Carnivore Conservation Trust, Karatu, Tanzania

[5]Centre for Environmental and Resource Economics, CERE, Umeå School of Business and Economics, Umeå University, Umeå, Sweden

[6]Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå, Sweden

[7]Department of Business Administration, Technology and Social Sciences, Luleå University of Technology, Luleå, Sweden

[8]Department of Political Science, Umeå University, Umeå, Sweden

[9]Lincoln Park Zoo, Chicago, Illinois, USA

Correspondence
Adam Pekor, Department of Environmental Science and Technology, University of Maryland, 8127 Regents Drive, College Park, MD 20742, USA.
Email: apekor@umd.edu

Present addresses:
Sally Capper, Carbon Tanzania, Arusha, Tanzania, and Dennis Rentsch, Frankfurt Zoological Society, Frankfurt, Germany

Article impact statement: Incentive payments can transform the financial impact of carnivores on local people and improve attitudes toward these species.

Funding information
Wildlife Conservation Network; Lion Recovery Fund; Maliasili; FORMAS

Abstract

For many large carnivores, minimizing the financial burden they impose on local people is critical to their conservation. Incentive-based programs that provide people with financial benefits for taking pro-conservation actions or achieving conservation goals are a promising tool for promoting human–carnivore coexistence. Although the number of incentive-based programs aimed at conserving large carnivores is growing, there has been little published research on the use of this approach. We reviewed the design, implementation, and results of a novel lion conservation incentive payment (CIP) program piloted in Tanzania's Ngorongoro Conservation Area. Under the program, developed in collaboration with local stakeholders, villages earned direct payments based on the number of lions observed on their land each month. During the program's 3-year pilot period, villages earned more than double the value of livestock injured or killed by lions and used their earnings primarily to support education-related projects. A household survey conducted at the conclusion of the pilot indicated widespread awareness of and support for the CIP program. Lessons from this experience that may be valuable for the development of similar incentive-based conservation schemes in Tanzania and beyond include the importance of developing a practical and dynamic earnings framework, evaluating and adaptively managing program communications, supporting participating stakeholders to effectively deploy their CIP earnings, and identifying potential sources of sustainable funding.

KEYWORDS
CIP, community conservation, conservation incentive payments, human–carnivore coexistence, human–carnivore conflict, lions, performance payments

INTRODUCTION

In many low- and middle-income countries, a sharp disconnect exists between wildlife conservation policy and the economic interests of local people (Jordan et al., 2020; Kideghesho & Mtoni, 2008). For many communities, wildlife impose a significant financial burden, both directly, through crop damage and livestock depredation, and indirectly, through land-use restrictions designed to maintain suitable wildlife habitat (Salerno et al., 2020; Thondhlana et al., 2020). Yet, the economic benefits of wildlife (e.g., through tourism and hunting) are often captured by central governments or other outside actors (Nelson et al., 2010). As a result, protectionist approaches to conserving wildlife raise ethical concerns about their fairness to local people (Armitage et al., 2020; Matose et al., 2025) and are frequently ineffective at achieving conservation goals (Di Marzo & Espinosa, 2025; Fernández-Llamazares et al., 2020; Kaczan et al., 2013). Often, it is simply too costly for people to tolerate carnivores and other problematic wildlife, leading to retaliation against these species (Jordan et al., 2020).

Globally, compensation has been the main economic approach to mitigating human–carnivore conflicts to date (Bautista et al., 2019; Dickman et al., 2011; Nyhus et al., 2005; Ravenelle & Nyhus, 2017; Romañach et al., 2007). Although some compensation schemes have yielded positive results (Bauer et al., 2017; Hazzah et al., 2014), many have been plagued by problems that have made them largely ineffective, including long payment delays, high transaction costs, inadequate payment amounts, and fraud (Dickman et al., 2011; Mmopelwa & Mpolokeng, 2008; Ravenelle & Nyhus, 2017; Zabel & Engel, 2010; Zabel & Holm-Müller, 2008). As a result, even individuals who receive compensation are often dissatisfied with the program (Hazzah et al., 2009) and are no more tolerant of carnivores (Naughton-Treves et al., 2003).

Perhaps most importantly, compensation schemes generally do not condition the payment of funds on the achievement of tangible conservation goals (Dickman et al., 2011). Accordingly, under a compensation model, conservation dollars may be spent year after year on a program that is not delivering measurable results. As a result, various compensation schemes have failed to achieve satisfactory outcomes in Africa, Europe, and North America (Boitani et al., 2010; Marino et al., 2016; Mmopelwa & Mpolokeng, 2008; Naughton-Treves et al., 2003; Ravenelle & Nyhus, 2017; Romañach et al., 2007).

Incentive-based programs, which pay stakeholders directly for taking an agreed-on action or achieving an agreed-on outcome, are an alternative to the traditional compensation approach (Dickman et al., 2011; Ferraro & Kiss, 2002; Zabel & Engel, 2010). These programs are referred to by various terms, including *performance payments*, *payments for presence*, and *direct payments for conservation*. We use the term *conservation incentive payments* (CIPs), which we believe best describes the approach and best captures the variety of related incentive-based tools. The key feature of any CIP program is conditionality: benefits are provided if and only if the conservation objective is achieved (Milne & Niesten, 2009). This allows CIPs to align a community's economic interests with conservation goals and avoid many of the pitfalls of compensation schemes.

In theory, CIPs work by allowing local communities to derive financial benefits from carnivores, which can improve attitudes toward these species and reduce retaliation against them (Blackburn et al., 2016; Broekhuis et al., 2020; Dickman et al., 2011). Reduced retaliation can lead to carnivore population growth, which can, in turn, lead to even greater benefits for the community. Although CIPs have the potential to promote this type of virtuous cycle, they may also produce unintended consequences, including the crowding out of intrinsic motives for conservation (Fernández-Llamazares et al., 2020), backlash over lost benefits (Zabel & Roe, 2009), inequitable benefit sharing (Zabel & Engel, 2010), and challenges to social carrying capacity (Athreya et al., 2013).

In a growing number of cases, CIPs have been used to mitigate human–carnivore conflicts, most notably, in northern Sweden, where indigenous Sami reindeer (*Rangifer tarandus*) herding communities have historically suffered significant losses from depredations by wolverines (*Gulo gulo*) and lynx (*Lynx lynx*) (Zabel et al., 2013). Since 1996, the Swedish government has paid Sami villages for the number of documented wolverine and lynx offspring born on their land, incentivizing herders not to kill these animals (Persson et al., 2015; Zabel et al., 2013). Despite challenges with funding, limited tolerance levels, and a lack of trust in the monitoring system (Öhrman et al., 2019), the program has successfully increased wolverine and lynx populations beyond established targets (Zabel & Engel, 2010). Similar incentive-based schemes include programs targeting snow leopards (*Panthera uncia*) in Asia (Alexander et al., 2022; Mishra et al., 2003), wolves (*Canis lupus*) in the American West (Huggins et al., 2021), jaguars (*Panthera onca*) and other carnivores in Belize and Mexico (Harvey et al., 2017; Huggins et al., 2021), and leopard cats (*Prionailurus bengalensis*) in Taiwan (Chen et al., 2022).

In Africa, a small number of incentive-based programs aimed at conserving large carnivores have been established (Hamm et al., 2025). However, there has been almost no published research on the application of this approach on the continent. Here, we review a novel, collaboratively developed lion (*Panthera leo*) CIP program piloted in the Ngorongoro Conservation Area (NCA) (Figure 1), a multiple-use protected area in northern Tanzania. We examined the NCA's human–lion conflict, outlined the design and implementation of the CIP pilot program, detailed results of the program, and took stock of key lessons learned from it.

HUMAN–LION CONFLICT IN THE NGORONGORO CONSERVATION AREA

The NCA is an 8292-km^2 multiple-use protected area established in 1959 for the purposes of conserving natural resources, protecting the interests of the local people, and promoting tourism (NCAA, 2006). A critical site for lion conservation, together with Serengeti National Park and surrounding areas, the NCA forms one of the largest savanna ecosystems in the world, and its Ngorongoro Crater contains one of the densest and most well-studied lion populations in Africa (Kissui & Packer, 2004; Packer, 2023; Riggio et al., 2013). However, as a multiuse protected area, the NCA is also home to approximately
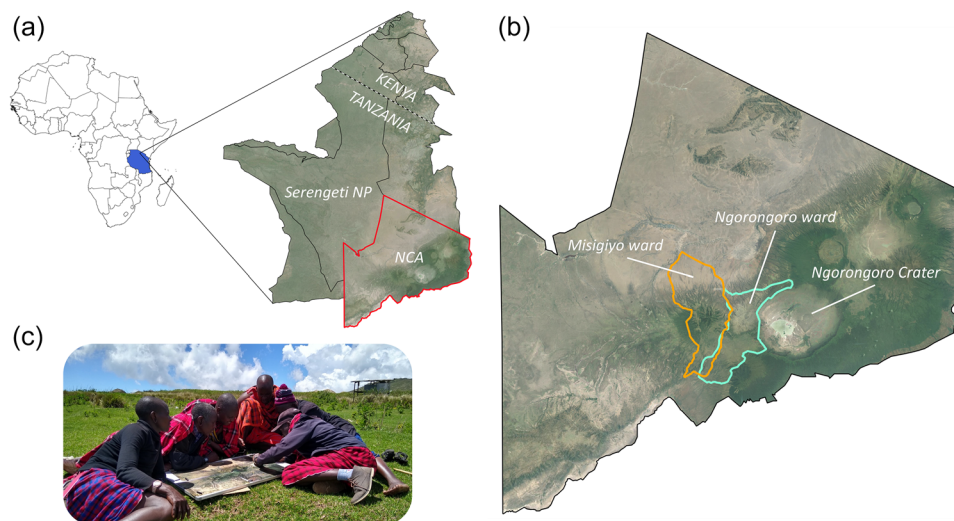
FIGURE 1 (a) The Ngorongoro Conservation Area (NCA) in northern Tanzania, East Africa, (b) location of Misigiyo and Ngorongoro wards, where the conservation incentive payment (CIP) program was tested, and (c) local elders engaged in demarcating ward boundaries for purposes of the CIP program.

100,000 people (URT et al., 2022), the vast majority of whom are traditional Maasai pastoralists who rely almost exclusively on livestock for their livelihood (Galvin et al., 2015; Homewood & Rodgers, 1991; NCAA, 2006).

Although the NCA generates substantial tourism revenue and lions are a top tourist attraction (BOT et al., 2024), their attacks on livestock cause an estimated USD 30,000 in livestock losses per year (Jansson, 2024). These losses are a significant burden on the NCA's residents, who rely largely on livestock for their livelihood and face rising levels of poverty (Kipuri & Sorensen, 2008; Melita & Mendlinger, 2013). Lion attacks on livestock have prompted numerous retaliatory killings over the past several decades, which, along with other factors, have led to a decline in both lion numbers and range within the NCA and largely isolated the Ngorongoro Crater lion population from the rest of the Greater Serengeti Ecosystem (Ikanda & Packer, 2008; Jansson et al., 2024; Kissui & Packer, 2004).

Since 2011, KopeLion, a local nongovernmental organization, has worked to mitigate the NCA's human–lion conflict by engaging local community members to monitor lions, find and retrieve lost livestock, warn herders of the presence of lions in the area, and prevent retaliation against lions, using a model developed by Lion Guardians in Kenya (Dolrenry et al., 2016; Parsons et al., 2025).

DEVELOPMENT OF THE CIP PILOT PROGRAM

Feasibility study

Given the impacts of the NCA's human–lion conflict on both people and lions, in 2017, KopeLion began to explore the feasibility of using direct financial incentives to complement its existing conservation strategies. KopeLion held a series of focus groups and interviews with members of key stakeholder groups, including NCA residents, the NCA Authority, tourism operators, and others. With each stakeholder group, KopeLion presented background information on CIPs and gathered opinions on human–lion conflict in the NCA and the prospect of establishing a CIP program (details in Appendix S1).

Program design

KopeLion's feasibility study showed substantial support for establishing a CIP program in the NCA. Accordingly, in March 2018, the organization convened a joint stakeholder workshop for the purpose of collaboratively outlining the framework for a pilot program. Over 3 days, 45 participants from 6 NCA villages, the NCA Authority, the tourism industry, and others, facilitated by a Tanzanian attorney and A.P., I.J., and W.O.S., developed proposals for the scope of a pilot program, conservation goals and metrics for measuring performance, the provision of benefits, program funding, and program administration (details in Appendix S2).

Based on the results of that workshop, insights shared by other incentive-based programs, and findings from the literature, KopeLion developed a CIP Pilot Program Plan (Appendix S3). Under the plan, participating wards (administrative units typically composed of 2–3 villages) earned ~USD 195 (450,000 TZS) for any month in which any lions were observed on their land, plus an additional ~USD 195 for each unique, individual lion (≥1 year old) or litter of cubs (<1 year old) observed on their land each month. Earnings were paid to the villages comprising each ward, rather than individuals, in the form of direct cash payments, and 6–12 months' earnings were subject to forfeiture for any unlawful lion killings. Table 1 outlines important attributes of CIP programs, key considerations for each, and the terms of the NCA's pilot program.

TABLE 1 Important attributes of payment programs that incentivize human-wildlife coexistence, key considerations for each, and collaboratively developed terms of the Ngorongoro Conservation Area (NCA) lion conservation incentive payment (CIP) pilot program.

Attribute	Key consideration	CIP pilot program term
Geographic scope	Setting program boundaries based on relevant ecological factors (Jack et al., 2008; Prager et al., 2016) and conservation goals (Nelson et al., 2010)	Two wards within KopeLion's area of operations, Misigiyo, with a population of ∼7000 and an area of 285 km^2, and Ngorongoro, with a population of ∼10,000 and an area of 229 km^2, each of which is composed of 3 villages
Performance indicators or metrics	Cost; reliability as a measure of conservation success (Zabel & Engel, 2010)	Direct observations of individual lions or signs of lions (e.g., tracks, scat, hair) on ward land verified through visual sightings and the use of radio telemetry, call-ups, and GPS collar data
Payment amount	Offsetting cost of depredation or making coexistence financially beneficial (Dickman et al., 2011)	∼USD 195 (TZS 450,000) for any month in which any lions were observed on ward land, plus an additional ∼USD 195 for each unique, individual lion (≥1 year old) or litter of cubs (<1 year old) observed on ward land each month; payment rate based on lion–livestock depredation data collected in 2018
Recipients of payments (groups vs. individuals)	Transaction costs and trust in community leadership (higher costs and trust favoring group payments) (Engel, 2016; Hayes et al., 2019)	Payments made to village governments in each participating ward
Cash vs. in-kind payments	Community autonomy (favoring cash payments) (Engel, 2016; Wunder, 2005); potential for corruption, elite capture, and waste (favoring in-kind) (Clifton, 2013; Engel, 2016; Wunder, 2005)	Direct cash payments, with ward earnings divided equally among all villages in the ward
Timing and frequency of payments	Make payments at intervals that will be most beneficial to the community (Engel, 2016; Zabel & Engel, 2010); local challenges accessing and handling funds (Petheram & Campbell, 2010)	Payments made every 4 months, with earnings measured from October to January, February to May, and June to September
Earnings cap	Balancing funding limitations against the need to adequately incentivize proconservation behaviors (Huggins et al., 2021)	∼USD 3880 (TZS 9 million TZS) per 4-month monitoring period; wards permitted to carry over excess earnings if the cap was not reached in a future monitoring period in the same year of the pilot
Penalties	Need to discourage retaliation through progressive system of sanctions (Niesten et al., 2008); possible inequities and loss of trust due to imposition of penalties (Wunder et al., 2018)	Forfeiture of 6 months' earnings for a lion killing or attempted killing on ward land or by residents of the ward (12 months if poison was used); killings determined to have been in self-defense do not incur a penalty
Spending conditions	Balancing flexibility and community autonomy against the potential for corruption, elite capture, and waste; regulatory constraints	Required to be used for the benefit of the community at large (not permitted to be distributed to individuals, except for educational scholarships); not permitted to be used for any purposes prohibited by law or NCA regulations
Accountability and reporting	Ensures effective use of funds and protection against corruption and elite capture of benefits (Niesten et al., 2008)	Each village required to submit a budget plan and receipts accounting for the use of all CIP earnings and to announce CIP earnings and expenditures at general assembly meetings
Program administrator	Technical expertise required to administer program (Milne & Niesten, 2009); community trust in administrators (Petheram & Campbell, 2010)	Day-to-day operations managed by KopeLion
Continued stakeholder engagement	Demonstrating support for and confidence in the program and demonstrate its legitimacy (Amit & Jacobson, 2018; Gonzalez & Jentoft, 2011; Milne & Niesten, 2009)	CIP Design Committee composed of representatives from all key stakeholder groups met twice per year to adaptively manage the program; in each village, program hired 2 CIP liaisons to promote awareness, provide updates, and help resolve disputes

Program implementation and administration

With the approval of the NCA's Board of Directors, in October 2020, the CIP program was launched in 2 wards in KopeLion's area of operations with historically significant levels of human–lion conflict, Misigiyo and Ngorongoro (Figure 1). To accurately credit each ward for the lions on its land, KopeLion needed to be able to reference and apply clearly defined ward boundaries. Because there are no official ward boundaries in the NCA, KopeLion engaged local elders to draw boundaries around the area they claimed as their ward and credited each ward with 0.5 lions for any observations in an area claimed by both wards (Figure 1).

Once ward boundaries were mapped, KopeLion tallied the number of unique, individual lions determined to have been present in each ward each month. Lion presence was verified through movement data from GPS-collared lions and observations of signs of lions in the area (e.g., tracks, scat, hair). These observations were made primarily by KopeLion's team of *ilchokuti* (i.e., custodians)—local community members who patrol a set zone searching for signs of lions and responding to community reports of lions in the area. Whenever possible, KopeLion attempted to visually observe lions for individual identification, often by using call-ups (broadcasted audio recordings of prey animals in distress [Brink et al., 2013]) once lions were detected in an area.

Every 4 months, KopeLion totaled each ward's CIP earnings and informed the participating communities of the amount. The villages within the ward, each of which was entitled to receive an equal share of the earnings, were then required to submit a budget plan for the use of their CIP funds. Villages were generally authorized to use their earnings for any community purpose that was consistent with law and NCA regulations. In the interest of promoting transparency, villages were required to announce their CIP earnings and budget plans at quarterly General Assembly meetings (customarily attended by a large proportion of the village) and to substantiate the use of all CIP funds.

CIP EARNINGS VERSUS LIVESTOCK LOSSES

Over the course of the pilot, Misigiyo ward averaged 5.64 (SD 2.48) unique, individual lions or litters of cubs observed on ward land per month, and Ngorongoro ward averaged 6.71 (1.99). Due to funding constraints, the CIP program included an earnings cap of approximately USD 3880 per ward per 4-month monitoring period, which was reached by Misigiyo ward in 6 and by Ngorongoro ward in 7 of the pilot's 9 monitoring periods. However, because of the allowance for carryover earnings, each ward received the maximum USD 3880 payment for each monitoring period, and each earned approximately USD 34,900 over the course of the pilot (Figure 2a).

During the 3 years of the pilot, there were a total of 96 lion–livestock depredation events in the participating wards (48 each in Misigiyo and Ngorongoro). Lions overwhelmingly attacked cattle, the most valuable livestock, and injured or killed livestock worth a total of USD 12,900 in Misigiyo ward and USD 12,140 in Ngorongoro ward (Figure 2a). Notwithstanding these losses, in Misigiyo and Ngorongoro wards, CIP earnings more than doubled the value of the livestock injured or killed by lions (Figure 2a). However, the economic impact of individual lions varied widely. Among 9 GPS-collared lions, net value per lion (CIP revenue generated by that lion minus the market value of any livestock it killed or wounded) ranged from USD 0 to 3000 (mean = USD 1356 [SD 1120]) (Figure 3).

EXPENDITURE OF CIP EARNINGS

Although villages used their CIP earnings for a variety of purposes (Figure 4a), education-related expenditures were most popular. For example, villages collectively used 12% of their earnings to provide meals at their local primary schools, which often experience food shortages that affect both attendance and performance. In addition, villages collectively spent 11% of their earnings to purchase desks for over 650 students in previously unfurnished primary school classrooms.

Most notably, villages spent a combined 43% of their total CIP earnings (approximately USD 30,000) on supplies necessary for students to attend secondary school. Although Tanzania offers universal secondary education, the start-up costs of required materials, including uniforms, a trunk, a mattress, a backpack, stationery, and other supplies, often prevent children from disadvantaged families from attending. In total, villages used CIP earnings to purchase enough supplies for 215 children to attend secondary school; priority was given to children from poorer families who were not otherwise receiving any support to attend (Figure 4b).

Although the villages in Ngorongoro ward were able to budget and spend their CIP earnings in a timely manner, the villages in Misigiyo ward experienced many challenges in this regard. For example, during the first year of the pilot, each village in Misigiyo ward proposed plans for the use of their earnings that were contrary to NCA regulations. Even after new budget plans were drawn up and approved, the Misigiyo ward villages experienced difficulties accessing their bank accounts and withdrawing funds. As a result of these delays, the villages in Misigiyo ward averaged 512 days between the time CIP earnings were announced and the time they were spent. By contrast, Ngorongoro ward averaged just 185 days between the time earnings were announced and the time they were spent.

COMMUNITY VIEWS

In September 2023, the 3-year pilot program ended. From 9 to 22 October 2023, we conducted a household survey to evaluate community views on the program (Appendix S4). Surveys were conducted in Maa (the local language) by a team of local enumerators and included randomly selected households from all 6 villages in which the CIP program was piloted (*n* = 212, 5.2% of all households within the participating villages). Enumerators
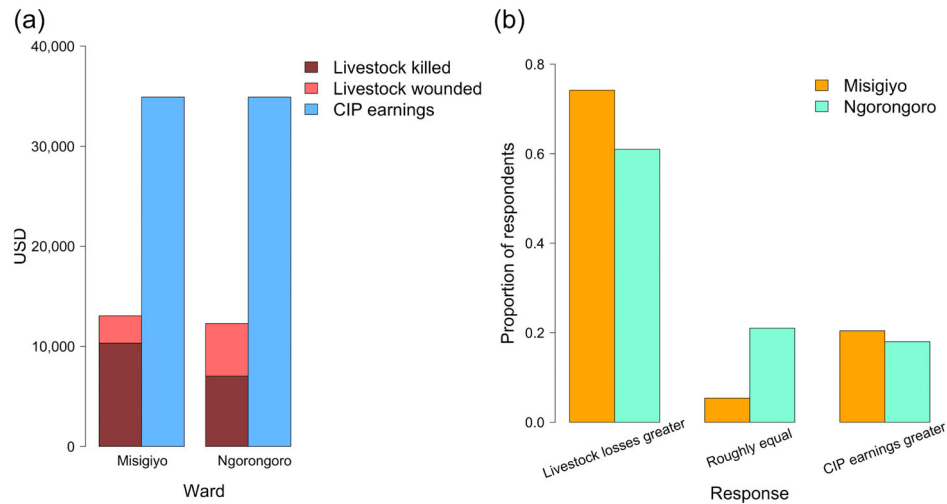
FIGURE 2 In Misigiyo and Ngorongoro wards, (a) cumulative market value of livestock killed and wounded relative to the value of conservation incentive payment (CIP) earnings during the pilot period and (b) residents' perceived costs of livestock losses from lions relative to CIP earnings during the pilot period.
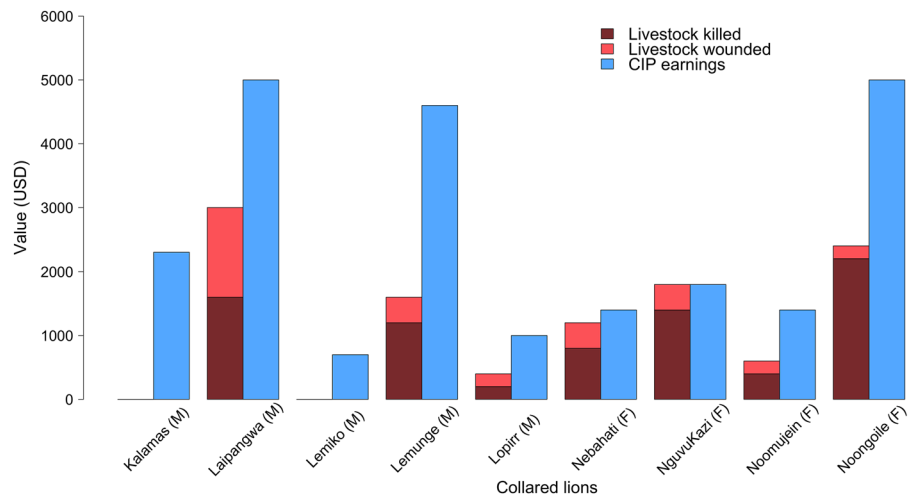
FIGURE 3 Value of livestock killed and wounded relative to conservation incentive payment (CIP) earnings generated for 9 GPS-collared lions (5 males, 4 females) during the pilot period. The difference in net value of male lions (mean [SD] = USD 1720 [1043]) and female lions (mean = USD 900 [1183]) was not statistically significant.
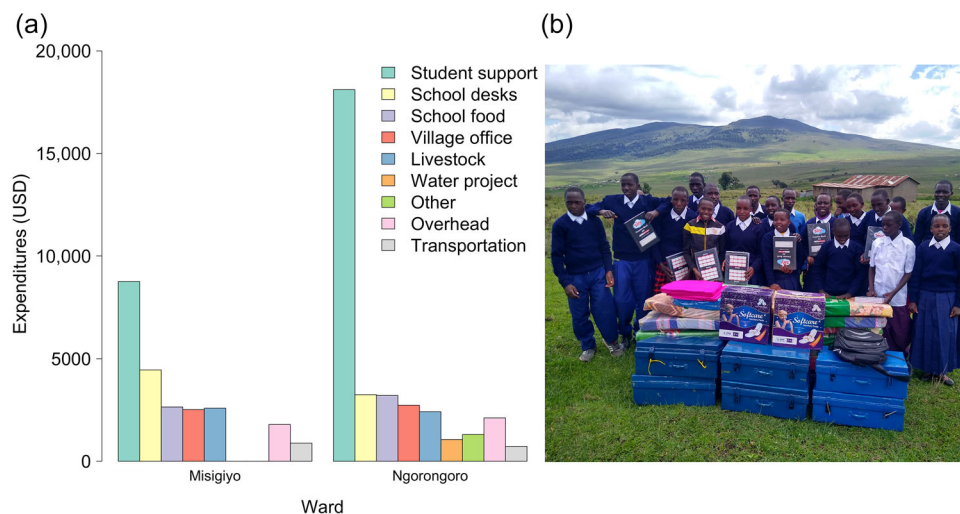
FIGURE 4 (a) Uses of conservation incentive payment (CIP) earnings in Misigiyo and Ngorongoro wards and (b) rising secondary school students in Kayepus village receiving mattresses and trunks of school supplies purchased with CIP earnings.

(a)

(b)
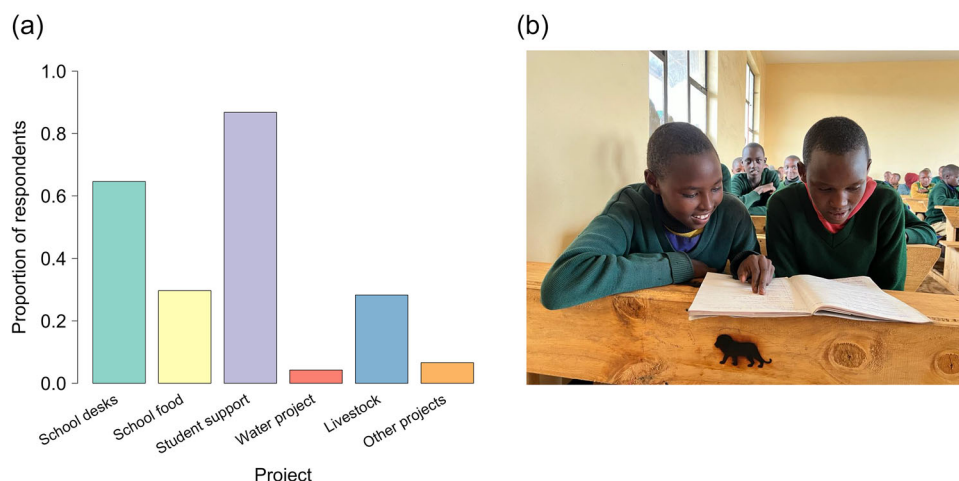
FIGURE 5 (a) Proportion of respondents aware of various projects funded with conservation incentive payment (CIP) earnings and (b) new school desks in Mokilal village primary school branded with a lion logo as a reminder that they were purchased with CIP earnings.

surveyed the first member of the household they encountered who was 18 years or older (if willing), which included 131 women and 81 men. Additionally, in November 2023, we conducted a series of focus groups to obtain opinions from CIP Design Committee members and other key stakeholders. This research was conducted with permissions from the Tanzania Commission for Science and Technology and the Tanzania Wildlife Research Institute (TAWIRI) and ethics approval from the University of Maryland's Institutional Review Board.

Awareness and perceived impacts of the CIP program

Overall awareness of the CIP program was high; 92% of survey respondents ($n = 196$) reported that they were aware of the program. Of those respondents who were aware of the program, 91% ($n = 179$) were aware of specific projects funded through their village's CIP earnings. By far, respondents were most aware of the education-related projects supported by the program (Figure 5a).

The perceived impacts of CIP-funded projects were positive. Ninety-three percent of respondents who were aware of the program ($n = 183$) reported that the program funded important projects in their village, and 60% ($n = 117$) reported that CIP-funded projects directly benefited their family. Trust in the CIP program was also high: 90% of respondents ($n = 176$) reported that they trusted that their village was paid all CIP earnings due, and 92% ($n = 180$) reported that they trusted their village government to handle their village's earnings.

Notably, although CIP earnings more than doubled the actual value of livestock losses from lions in both Misigiyo and Ngorongoro wards (Figure 2a), the majority of respondents in each ward estimated that the value of livestock losses from lions within their village exceeded CIP earnings over the same period (Figure 2b).

Criticisms of the program

Survey respondents and focus group participants expressed 4 main criticisms of the CIP program. First, several focus group participants expressed a preference for a compensation model over a community-based incentive program. As these participants explained, because the losses caused by lions are experienced on an individual basis, they are not adequately addressed by community projects. In the context of carnivore CIP programs, payments to groups can lead to inequitable outcomes because livestock losses are not shared equally (Zabel & Engel, 2010). Thus, finding ways to reduce individual losses is essential to complementing a CIP strategy (Dickman et al., 2025).

Second, although no unlawful lion killings occurred during the CIP period, most survey respondents (74%, $n = 145$) thought that the program's penalty for such killings—the forfeiture of CIP earnings for 6–12 months—was unfair. Focus group participants largely agreed, explaining that the penalty structure rendered their earnings vulnerable to outsiders or a rogue member of their own village killing a lion on their land. Because the CIP program effectively engaged the participating communities as stewards (Mathevet et al., 2018) or guardians (Kahler et al., 2023) of the NCA's lions, imposing a penalty for any lions killed on their land, especially by outsiders, may have been viewed as undermining this role.

Third, a number of focus group participants disfavored the program's earnings cap. As one respondent explained, the program should "pay according to lion presence in an area because the number of lions corresponds to the challenges faced." Fourth, community leaders were dissatisfied with the restrictions placed on the use of their earnings. Although these restrictions came from NCA regulations, not from the CIP program itself, respondents perceived them as a drawback of the program.

Overall views on the program

Despite these criticisms, overall views of the CIP program were positive. Ninety-five percent of respondents ($n = 187$) reported they were satisfied with the CIP program, 97% ($n = 191$) reported they had a more positive view of lions as a result of the CIP program, and 99% ($n = 195$) reported they wanted the CIP program to continue in their village.

LESSONS LEARNED

To more fully evaluate the social and ecological impacts of the CIP program, further research is needed to assess its effects on local attitudes and actions toward lions and lion behavior and habitat use in the pilot area. Nonetheless, our experience administering and evaluating the program revealed a number of lessons that may be valuable for others considering incentive-based conservation schemes.

Awareness of the CIP program

A CIP program can only help promote coexistence if people are aware of the benefits they are earning from wildlife (Herzon et al., 2018; Milne & Niesten, 2009). Here, awareness of the CIP program was high, with over 90% of respondents from CIP villages reporting having heard of the program. Anecdotally, we noticed a substantial uptick in both awareness of and enthusiasm for the program once the participating villages began using their earnings to support students in attending secondary school. These anecdotal reports were corroborated by our household survey, which showed that 87% of respondents in the CIP villages were aware of the support being provided to secondary school students and 65% were aware of the school desks purchased with CIP earnings, far more than any other project. Although communities should control the use of their earnings, these results suggest that using earnings on widely valued priorities like education may be most effective at raising awareness of and support for incentive-based conservation programs (Niesten et al., 2008).

Improving communications

Effectively communicating the value being generated by wildlife is essential to the success of a CIP program (Niesten et al., 2008). Throughout the pilot, KopeLion placed special focus on raising awareness about the CIP program and its benefits, leading an outreach campaign that reached nearly every village in the NCA, holding regular meetings in the participating villages, and preparing posters and other materials to promote CIP earnings. Despite these efforts, the fact that CIP earnings vastly exceeded the financial value of livestock injured or killed by lions in both Misigiyo and Ngorongoro wards during the pilot was largely unknown. Rather, respondents in both wards overwhelmingly believed that livestock losses were greater. This could be due to a lack of effective communication concerning the market value of livestock lost or because local people attach social and cultural value to livestock that is not captured by its market price. The latter cause is particularly plausible given the cultural and economic importance of cattle to the Maasai (Galvin et al., 2015; Quinlan et al., 2016). In either case, finding more effective ways to communicate the value that targeted species are bringing to the community and how that value compares to the losses they are causing is critical. Periodic surveys or focus groups, even if small-scale or informal, may be useful for evaluating and adaptively managing program communications.

Ensuring prompt use of earnings

The Misigiyo ward villages averaged more than 500 days between the time CIP earnings were announced and the time they were spent. These delays were a major challenge, especially during the first half of the pilot, and likely hindered early support for the program because members of the participating villages were not seeing tangible benefits from it. Thus, it may be advisable to structure a CIP program such that participating communities decide in advance how they will use their earnings. Especially where earnings are used for items, such as school supplies, that can be purchased in varying amounts depending on earnings, predetermining how funds will be spent would facilitate their timely and efficient use.

Capacity building

Notwithstanding the many budgetary challenges we observed in the early stages of the pilot, we also observed considerable growth in the capacity of village leadership to manage their earnings, especially in Misigiyo ward. By the third year of the pilot, villages had largely converged on student support as the best use of their CIP earnings and were spending those funds in a timely manner to purchase goods in bulk to take advantage of economies of scale. As a result, the participating villages were able to send over 200 students to secondary school. Anecdotally, these outcomes translated into a noticeable pride among village leadership in their success at effectively deploying their village's CIP earnings for the benefit of their community.

Ultimately, the effective and efficient use of earnings is critical to the success of a CIP program. If communities are not putting their earnings to good use, then those earnings are unlikely to generate the benefits that can help transform attitudes toward species like lions. Thus, ensuring at the start of the program that communities have the capacity to effectively manage their funds, or the support they need to develop that capacity, is essential to the success of an incentive-based conservation program.

Timing payments

Our experience administering the CIP program also taught us that the timing of payments is critical, as others have noted (Zabel & Engel, 2010). In this case, earnings were calculated every 4 months and paid out almost as soon as an acceptable budget plan was received. In one instance, that timing coincided with a major drought that brought extreme economic hardship to the NCA. Fortuitously, the payment of CIP earnings at that time, which several villages promptly used to purchase school supplies, made it possible for many children to attend secondary school despite the challenges their families were facing. Thus, working with communities to time the disbursement of earnings for when they are likely to be needed most could help enhance their impact and promote support for a CIP program. Ultimately, however, communities should retain control over the timing and use of funds in accordance with their own priorities.

Administrative feasibility

Our experience also taught us that the methodology KopeLion used to verify lion presence and calculate CIP earnings was too cumbersome to scale. Taking on the obligation to verify the presence of each individual lion on ward land each month was a burdensome task, especially for a small organization like KopeLion. Although measuring any ecological indicator entails a trade-off between accuracy and efficiency (Wells et al., 2017), we believe KopeLion's method of tracking lion presence on an individual basis did not effectively balance these interests. Other incentive-based programs in Africa, such as Lion Landscapes, use camera traps to monitor wildlife populations, an approach that requires fewer resources and allows for community involvement in placing and managing cameras (Dickman et al., 2025). Whatever method is chosen, it is imperative to think carefully about developing a set of earnings criteria that will effectively balance conservation goals and administrative feasibility.

Dynamic earnings framework

Ideally, a CIP program will provide greater benefits for greater conservation gains to reinforce the value of taking pro-conservation actions (Sommerville et al., 2011). When the CIP program was developed in 2018, we anticipated that the program's earnings framework would allow for substantial fluctuation in earnings throughout the pilot. However, due to an increase in lion activity in the years that followed, the combined effect of the program's earnings cap and its payment rate meant that the participating wards earned the maximum payment every monitoring period of the pilot. As a result, the program was not able to achieve any variation in earnings based on the number of lions observed on ward land. Other organizations considering incentive-based programs should focus closely on calibrating the program's earnings framework to allow earnings to fluctuate

based on conservation outcomes, thus maximizing the incentive effect of the program. In addition, because carnivore numbers may vary seasonally due to prey movements and other environmental factors, practitioners and communities should consider whether and how to account for these fluctuations, for example, by using dynamic baselines for measuring carnivore presence and community earnings.

Long-term sustainable funding

Although the CIP program's earnings cap was not ideal, it was necessary in light of the limited funding KopeLion had to operate the program. Before and during the pilot, KopeLion engaged the NCA Authority and local tour operators about funding the program, but the COVID-19 pandemic's sudden and severe impact on tourism revenues made that unfeasible. However, for this type of program to achieve durable results, long-term sustainable funding is necessary (Milne & Niesten, 2009). For an iconic safari destination like the NCA (BOT et al., 2024), tourism dollars could be a promising option to fund a community conservation initiative like a CIP program, whether in the form of a small "conservation fee" dedicated to supporting the program (Pengwei & Ji, 2023), individual donations from tourists (Sgalitzer et al., 2016), or direct contributions from tour companies that benefit from the protected area's wildlife (Nelson et al., 2010). Whatever form the funding for a CIP program takes, all stakeholders with an interest in successful conservation outcomes and the local communities' willingness to coexist with wildlife should work to find ways to support it.

CONCLUSION

Around the world, incentive-based programs continue to gain appeal as an innovative tool for conserving wildlife. In Tanzania, the Ministry of Natural Resources and Tourism recently identified these types of programs as part of its national human–wildlife conflict mitigation strategy (MNRT, 2020) and its plan to protect the country's wildlife corridors (MNRT, 2022). Internationally, the Global Biodiversity Framework agreed on at the UN Biodiversity Conference (COP 15) in 2022 listed both the development of positive incentives for conservation and the stimulation of innovative economic conservation schemes— hallmarks of a CIP program—as key targets to help conserve Earth's biodiversity (CBD, 2022). Increasingly, decision makers at all levels are recognizing the benefits that can be achieved for both people and wildlife when conservation and community interests are aligned.

Although we experienced a number of challenges administering the NCA's CIP pilot program, the success of the program from a social perspective is evident from its impacts in the participating villages, where 97% of respondents reported that the program gave them a more positive view of lions and 93% reported that it was funding important projects in their village. Given the limited research on the use of CIPs, the

findings and insights from the NCA's pilot program have significant potential to inform the development of CIPs as a tool for achieving key Global Biodiversity Framework targets and promoting human–wildlife coexistence in Tanzania and beyond.

ORCID

Adam Pekor https://orcid.org/0000-0003-2563-3595
Bernard Kissui https://orcid.org/0000-0002-5696-8454

REFERENCES

Alexander, J. S., Bijoor, A., Gurmet, K., Murali, R., Mishra, C., & Suryawanshi, K. R. (2022). Engaging women brings conservation benefits to snow leopard landscapes. *Environmental Conservation*, 49(3), 180–186.

Amit, R., & Jacobson, S. K. (2018). Participatory development of incentives to coexist with jaguars and pumas. *Conservation Biology*, 32(4), 938–948.

Armitage, D., Mbatha, P., Muhl, E.-K., Rice, W., & Sowman, M. (2020). Governance principles for community-centered conservation in the post-2020 global biodiversity framework. *Conservation Science and Practice*, 2(2), Article e160.

Athreya, V., Odden, M., Linnell, J. D. C., Krishnaswamy, J., & Karanth, U. (2013). Big cats in our backyards: Persistence of large carnivores in a human dominated landscape in India. *PLoS ONE*, 8(3), Article e57872.

Bauer, H., Müller, L., Goes, D. V. D., & Sillero-Zubiri, C. (2017). Financial compensation for damage to livestock by lions *Panthera leo* on community rangelands in Kenya. *Oryx*, 51(1), 106–114.

Bautista, C., Revilla, E., Naves, J., Albrecht, J., Fernández, N., Olszańska, A., Adamec, M., Berezowska-Cnota, T., Ciucci, P., Groff, C., Härkönen, S., Huber, D., Jerina, K., Jonozovič, M., Karamanlidis, A. A., Palazón, S., Quenette, P.-Y., Rigg, R., Seijas, J., … Selva, N. (2019). Large carnivore damage in Europe: Analysis of compensation and prevention programs. *Biological Conservation*, 235, 308–316.

Blackburn, S., Hopcraft, J. G. C., Ogutu, J. O., Matthiopoulos, J., & Frank, L. (2016). Human–wildlife conflict, benefit sharing and the survival of lions in pastoralist community-based conservancies. *Journal of Applied Ecology*, 53(4), 1195–1205.

Boitani, L., Ciucci, P., & Raganella-Pellicccioni, E. (2010). Ex-post compensation payments for wolf predation on livestock in Italy: A tool for conservation? *Wildlife Research*, 37(8), 722–730.

BOT, MNRT, NBS, Immigration Services Department, & ZCT. (2024). *The 2023 International Visitors' Exit Survey Report: Tourism Sector Survey Report*. Ministry of Natural Resources and Tourism.

Brink, H., Smith, R. J., & Skinner, K. (2013). Methods for lion monitoring: A comparison from the Selous Game Reserve, Tanzania. *African Journal of Ecology*, 51(2), 366–375.

Broekhuis, F., Kaelo, M., Sakat, D. K., & Elliot, N. B. (2020). Human–wildlife coexistence: Attitudes and behavioural intentions toward predators in the Maasai Mara, Kenya. *Oryx*, 54(3), 366–374.

Chen, W.-L., Meer, E. v. d., & Pei, K. J.-C. (2022). Determinants of attitudes toward wildlife in rural Taiwan and its implications for leopard cat (*Prionailurus bengalensis*) conservation performance payment. *Wildlife Research*, 50(4), 248–259.

Clifton, J. (2013). Compensation, conservation and communities: An analysis of direct payments initiatives within an Indonesian marine protected area. *Environmental Conservation*, 40(3), 287–295.

Convention on Biological Diversity (CBD). (2022). *Kunming-Montreal Global Biodiversity Framework* (CBD/COP/DEC/15/4). Author.

Di Marzo, D., & Espinosa, C. (2025). Conservation conflict: A political ecology meta-synthesis of East Africa. *Society & Natural Resources*, 38(4), 333–351.

Dickman, A. J., Cotterill, A., Asecheka, S., Mlaponi, Z., Mbugi, H., Grau, A., Mtandamo, W., Nyausi, G., & Cascio, B. (2025). Community camera trapping: A novel method for encouraging human–big cat coexistence on human-dominated land. *Wildlife Letters*, 3(1), 22–29.

Dickman, A. J., Macdonald, E. A., & Macdonald, D. W. (2011). A review of financial instruments to pay for predator conservation and encourage human–carnivore coexistence. *Proceedings of the National Academy of Sciences of the United States of America*, 108(34), 13937–13944.

Dolrenry, S., Hazzah, L., & Frank, L. G. (2016). Conservation and monitoring of a persecuted African lion population by Maasai warriors. *Conservation Biology*, 30(3), 467–475.

Engel, S. (2016). The devil in the detail: A practical guide on designing payments for environmental services. *International Review of Environmental and Resource Economics*, 9(1–2), 131–177.

Fernández-Llamazares, Á., Western, D., Galvin, K. A., McElwee, P., & Cabeza, M. (2020). Historical shifts in local attitudes toward wildlife by Maasai pastoralists of the Amboseli Ecosystem (Kenya): Insights from three conservation psychology theories. *Journal for Nature Conservation*, 53, Article 125763.

Ferraro, P. J., & Kiss, A. (2002). Direct payments to conserve biodiversity. *Science*, 298(5599), 1718–1719.

Galvin, K., Boone, R., McCabe, J., Magennis, A., & Galvin, T. (2015). Transitions in the Ngorongoro Conservation Area: The story of land use, human well-being, and conservation. In A. Sinclair, K. Metzger, S. Mduma, & J. Fryxell (Eds.), *Serengeti IV: Sustaining biodiversity in a coupled human-natural system* (pp. 483–512). University of Chicago Press.

Gonzalez, C., & Jentoft, S. (2011). MPA in labor: Securing the pearl cays of Nicaragua. *Environmental Management*, 47(4), 617–629.

Hamm, J., Holmes, G., Mabele, M. B., & Martin-Ortega, J. (2025). "Milking the lions": An analysis of conservation performance payments in eastern and southern Africa. *Conservation Science and Practice*, 7(3), Article e70015.

Harvey, R. G., Briggs-Gonzalez, V., & Mazzotti, F. J. (2017). Conservation payments in a social context: Determinants of tolerance and behavioural intentions toward wild cats in northern Belize. *Oryx*, 51(4), 730–741.

Hayes, T., Grillos, T., Bremer, L. L., Murtinho, F., & Shapiro, E. (2019). Collective PES: More than the sum of individual incentives. *Environmental Science & Policy*, 102, 1–8.

Hazzah, L., Borgerhoff Mulder, M., & Frank, L. (2009). Lions and warriors: Social factors underlying declining African lion populations and the effect of incentive-based management in Kenya. *Biological Conservation*, 142(11), 2428–2437.

Hazzah, L., Dolrenry, S., Naughton, L., Edwards, C. T. T., Mwebi, O., Kearney, F., & Frank, L. (2014). Efficacy of two lion conservation programs in Maasailand, Kenya. *Conservation Biology*, 28(3), 851–860.

Herzon, I., Birge, T., Allen, B., Povellato, A., Vanni, F., Hart, K., Radley, G., Tucker, G., Keenleyside, C., Oppermann, R., Underwood, E., Poux, X., Beaufoy, G., & Pražan, J. (2018). Time to look for evidence: Results-based approach to biodiversity conservation on farmland in Europe. *Land Use Policy*, 71, 347–354.

Homewood, K. M., & Rodgers, W. A. (1991). *Maasailand ecology: Pastoralist development and wildlife conservation in Ngorongoro, Tanzania*. Cambridge University Press.

Huggins, L., Hansen, O., & Naftel, H. (2021). *Cameras for conservation: Direct compensation as motivation for living with wildlife*. Center for Growth and Opportunity, Utah State University.

Ikanda, D., & Packer, C. (2008). Ritual vs. retaliatory killing of African lions in the Ngorongoro Conservation Area, Tanzania. *Endangered Species Research*, 6, 67–74.

Jack, B. K., Kousky, C., & Sims, K. R. E. (2008). Designing payments for ecosystem services: Lessons from previous experience with incentive-based

mechanisms. *Proceedings of the National Academy of Sciences of the United States of America*, 105(28), 9465–9470.

Jansson, I. (2024). *Connectivity of lions (Panthera leo) across a pastoralist landscape: Coexistence, conflict, and collective action for lion conservation in Ngorongoro, Tanzania* (Doctoral thesis). Swedish University of Agricultural Sciences.

Jansson, I., Parsons, A. W., Singh, N. J., Faust, L., Kissui, B. M., Mjingo, E. E., Sandström, C., & Spong, G. (2024). Coexistence from a lion's perspective: Movements and habitat selection by African lions (*Panthera leo*) across a multi-use landscape. *PLoS ONE*, 19(10), Article e0311178.

Jordan, N. R., Smith, B. P., Appleby, R. G., van Eeden, L. M., & Webster, H. S. (2020). Addressing inequality and intolerance in human–wildlife coexistence. *Conservation Biology*, 34, 803–810.

Kaczan, D., Swallow, B. M., & Adamowicz, W. L. V. (2013). Designing payments for ecosystem services (PES) program to reduce deforestation in Tanzania: An assessment of payment approaches. *Ecological Economics*, 95, 20–30.

Kahler, J. S., Reynald, D. M., & Gore, M. L. (2023). "I let it go:" Quantifying residential guardianship intentions when witnessing wildlife poaching. *Biological Conservation*, 277, Article 109829.

Kideghesho, J. R., & Mtoni, P. E. (2008). Who compensates for wildlife conservation in Serengeti? *International Journal of Biodiversity Science & Management*, 4(2), 112–125.

Kipuri, N., & Sørensen, C. (2008). *Poverty, pastoralism and policy in Ngorongoro: Lessons learned from the Ereto I Ngorongoro Pastoralist Project with implications for pastoral development and the policy debate.* International Institute for Environment and Development (IIED).

Kissui, B. M., & Packer, C. (2004). Top–down population regulation of a top predator: Lions in the Ngorongoro Crater. *Proceedings of the Royal Society of London. Series B: Biological Sciences*, 271(1550), 1867–1874.

Marino, A., Braschi, C., Ricci, S., Salvatori, V., & Ciucci, P. (2016). Ex post and insurance-based compensation fail to increase tolerance for wolves in semi-agricultural landscapes of central Italy. *European Journal of Wildlife Research*, 62(2), 227–240.

Mathevet, R., Bousquet, F., & Raymond, C. M. (2018). The concept of stewardship in sustainability science and conservation biology. *Biological Conservation*, 217, 363–370.

Matose, F., Fonjong, L., & Sonnenfeld, D. A. (2025). Protecting and benefitting from nature: Insights and policy dilemmas from Africa. *Society & Natural Resources*, 38(4), 299–309.

Melita, A. W., & Mendlinger, S. (2013). The impact of tourism revenue on the local communities' livelihood: A case study of Ngorongoro Conservation Area, Tanzania. *Journal of Service Science and Management*, 06(01), 117–126.

Milne, S., & Niesten, E. (2009). Direct payments for biodiversity conservation in developing countries: Practical insights for design and implementation. *Oryx*, 43(04), 530–541.

Ministry of Natural Resources and Tourism (MNRT). (2020). *National Human-Wildlife Conflict Mitigation Strategy, 2020–2024* [Unpublished report]. Author.

Ministry of Natural Resources and Tourism (MNRT). (2022). *Tanzania Wildlife Corridor Assessment, Prioritization, and Action Plan 2022–2026* [Unpublished report]. Author.

Mishra, C., Allen, P., McCarthy, T. O. M., Madhusudan, M. D., Bayarjargal, A., & Prins, H. H. T. (2003). The role of incentive programs in conserving the snow leopard. *Conservation Biology*, 17(6), 1512–1520.

Mmopelwa, G., & Mpolokeng, T. (2008). Attitudes and perceptions of livestock farmers on the adequacy of government compensation scheme: Human-carnivore conflict in Ngamiland. *Botswana Notes and Records*, 40, 147–158.

Naughton-Treves, L., Grossberg, R., & Treves, A. (2003). Paying for tolerance: Rural citizens' attitudes toward wolf depredation and compensation. *Conservation Biology*, 17(6), 1500–1511.

Nelson, F., Foley, C., Foley, L. S., Leposo, A., Loure, E., Peterson, D., Peterson, M., Peterson, T., Sachedina, H., & Williams, A. (2010). Payments for ecosystem services as a framework for community-based conservation in northern Tanzania. *Conservation Biology*, 24(1), 78–85.

Ngorongoro Conservation Area Authority (NCAA). (2006). *General Management Plan 2006–2016, Ngorongoro Conservation Area* [Unpublished report]. Ministry of Natural Resources and Tourism, the United Republic of Tanzania.

Niesten, E., Bruner, A., Rice, R., & Zurita, P. (2008). *Conservation incentive agreements: An introduction and lessons learned to date.* Conservation International.

Nyhus, P., Osofsky, S., Ferraro, P., Madden, F., & Fischer, H. (2005). Bearing the costs of human-wildlife conflict: The challenges of compensation schemes. In R. Woodroffe, S. Thirgood, & A. Rabinowitz (Eds.), *People and wildlife: Conflict or co-existence* (pp. 107–121). Cambridge University Press.

Öhrman, P., Ericsson, G., & Sandström, C. (2019). *En studie om tillit till inventeringssystemet för stora rovdjur* (Rapport 6893). Swedish Environmental Protection Agency.

Packer, C. (2023). *The lion: Behavior, ecology, and conservation of an iconic species.* Princeton University Press.

Parsons, A. W., Sandström, C., Capper, S., Faust, L., Kissui, B. M., Packer, C., & Jansson, I. (2025). The benefits of inclusive conservation for connectivity of lions across the Ngorongoro Conservation Area, Tanzania. *Conservation Science and Practice*, 7(3), Article e70001.

Pengwei, W., & Ji, Y. (2023). Tourists' willingness to pay conservation fees: The case of Hulunbuir Grassland, China. *Journal of Resources and Ecology*, 14(3), 656–666.

Persson, J., Rauset, G. R., & Chapron, G. (2015). Paying for an endangered predator leads to population recovery. *Conservation Letters*, 8(5), 345–350.

Petheram, L., & Campbell, B. M. (2010). Listening to locals on payments for environmental services. *Journal of Environmental Management*, 91(5), 1139–1149.

Prager, C. M., Varga, A., Olmsted, P., Ingram, J. C., Cattau, M., Freund, C., Wynn-Grant, R., & Naeem, S. (2016). An assessment of adherence to basic ecological principles by payments for ecosystem service projects. *Conservation Biology*, 30(4), 836–845.

Quinlan, R. J., Rumas, I., Naiskye, G., Quinlan, M., & Yoder, J. (2016). Searching for symbolic value of cattle: Tropical livestock units, market price, and cultural value of Maasai livestock. *Ethnobiology Letters*, 7(1), 76–86.

Ravenelle, J., & Nyhus, P. J. (2017). Global patterns and trends in human–wildlife conflict compensation. *Conservation Biology*, 31(6), 1247–1256.

Riggio, J., Jacobson, A., Dollar, L., Bauer, H., Becker, M., Dickman, A., Funston, P., Groom, R., Henschel, P., Iongh, H. H., Lichtenfeld, L., & Pimm, S. (2013). The size of savannah Africa: A lion's (*Panthera leo*) view. *Biodiversity and Conservation*, 22, 17–35.

Romañach, S. S., Lindsey, P. a., & Woodroffe, R. (2007). Determinants of attitudes toward predators in central Kenya and suggestions for increasing tolerance in livestock dominated landscapes. *Oryx*, 41(02), 185–195.

Salerno, J., Bailey, K., Gaughan, A. E., Stevens, F. R., Hilton, T., Cassidy, L., Drake, M. D., Pricope, N. G., & Hartter, J. (2020). Wildlife impacts and vulnerable livelihoods in a transfrontier conservation landscape. *Conservation Biology*, 34(4), 891–902.

Sgalitzer, H. A., Brownlee, M. T. J., Zajchowski, C., Bricker, K. S., & Powell, R. B. (2016). Modelling travellers' philanthropy: Tourists' motivations to donate at Sweetwater Chimpanzee Sanctuary. *Journal of Ecotourism*, 15(1), 1–20.

Sommerville, M. M., Milner-Gulland, E. J., & Jones, J. P. G. (2011). The challenge of monitoring biodiversity in payment for environmental service interventions. *Biological Conservation*, 144(12), 2832–2841.

The United Republic of Tanzania (URT), Ministry of Finance and Planning, Tanzania National Bureau of Statistics, President's Office - Finance and Planning, & Office of the Chief Government Statistician, Zanzibar. (2022). *The 2022 Population and Housing Census: Administrative Units Population Distribution Report.* https://www.nbs.go.tz/nbs/takwimu/Census2022/Administrative_units_Population_Distribution_Report_Tanzania_Mainland_volume1b.pdf

Thondhlana, G., Redpath, S. M., Vedeld, P. O., van Eeden, L., Pascual, U., Sherren, K., & Murata, C. (2020). Non-material costs of wildlife conservation to local people and their implications for conservation interventions. *Biological Conservation*, 246, Article 108578.

Wells, G., Fisher, J. A., Porras, I., Staddon, S., & Ryan, C. (2017). Rethinking monitoring in smallholder carbon payments for ecosystem service schemes: Devolve monitoring, understand accuracy and identify co-benefits. *Ecological Economics*, 139, 115–127.

Wunder, S. (2005). *Payments for environmental services: Some nuts and bolts.* Center for International Forestry Research.

Wunder, S., Brouwer, R., Engel, S., Ezzine-de-Blas, D., Muradian, R., Pascual, U., & Pinto, R. (2018). From principles to practice in paying for nature's services. *Nature Sustainability*, 1(3), 145–150.

Zabel, A., & Engel, S. (2010). Performance payments: A new strategy to conserve large carnivores in the tropics? *Ecological Economics*, 70(2), 405–412.

Zabel, A., & Holm-Müller, K. (2008). Conservation performance payments for carnivore conservation in Sweden. *Conservation Biology*, *22*(2), 247–251.

Zabel, A., & Roe, B. (2009). Optimal design of pro-conservation incentives. *Ecological Economics*, *69*, 126–134.

Zabel, A., Bostedt, G., & Engel, S. (2013). Performance payments for groups: The case of carnivore conservation in northern Sweden. *Environmental and Resource Economics*, *59*(4), 613–631.

SUPPORTING INFORMATION

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