



Deposited via The University of Leeds.

White Rose Research Online URL for this paper:

<https://eprints.whiterose.ac.uk/id/eprint/204385/>

Version: Accepted Version

Article:

Hamm, J., Holmes, G. and Martin-Ortega, J. (2024) The importance of equity in payments to encourage coexistence with large mammals. *Conservation Biology*, 38 (3). e14207.
ISSN: 0888-8892

<https://doi.org/10.1111/cobi.14207>

This is the peer reviewed version of the following article: Hamm, J., Holmes, G., & Martin-Ortega, J. (2023). The importance of equity in payments to encourage coexistence with large mammals. *Conservation Biology*, 00, 00–00. <https://doi.org/10.1111/cobi.14207>, which has been published in final form at <https://doi.org/10.1111/cobi.14207>. This article may be used for non-commercial purposes in accordance with Wiley Terms and Conditions for Use of Self-Archived Versions. This article may not be enhanced, enriched or otherwise transformed into a derivative work, without express permission from Wiley or by statutory rights under applicable legislation. Copyright notices must not be removed, obscured or modified. The article must be linked to Wiley's version of record on Wiley Online Library and any embedding, framing or otherwise making available the article or pages thereof by third parties from platforms, services and websites other than Wiley Online Library must be prohibited.

Reuse

Items deposited in White Rose Research Online are protected by copyright, with all rights reserved unless indicated otherwise. They may be downloaded and/or printed for private study, or other acts as permitted by national copyright laws. The publisher or other rights holders may allow further reproduction and re-use of the full text version. This is indicated by the licence information on the White Rose Research Online record for the item.

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

Equity matters in payments to encourage coexistence with large mammals

Abstract

Large mammals often impose significant costs such as livestock depredation or crop foraging on rural communities, and this can lead to the retaliatory killing of threatened wildlife populations. One conservation approach – payments to encourage coexistence (PEC) – aims to reduce these costs through financial mechanisms such as compensation, insurance, revenue-sharing, and conservation performance payments. Little is known about the equitability of PEC, however, despite its moral and instrumental importance, prevalence as a conservation approach, and the fact that other financial tools for conservation are often inequitable. Here, using examples from the literature, we first demonstrate the capability of PEC – as currently perceived and implemented – to be inequitable. We then provide three recommendations to improve the equitability of current and future schemes. These include the co-operative design of schemes that promote compensatory equity, the greater consideration of conservation performance payments, and changing the international model for funding PEC in order to reduce global coexistence inequalities. New and existing programmes must address issues of equitability across scales, to ensure that conservation efforts are not undermined by diminished social legitimacy.

Paying for coexistence

Large mammals are often considered charismatic, and attributed with significant existence value by many, particularly those who do not live alongside them (Macdonald, 2001; Dickman et al., 2011; Vasudev and Goswami, 2020; Vasudev et al., 2020). Such species, whether carnivorous or

herbivorous, also perform a highly influential role in maintaining biodiversity and in wider ecosystem dynamics, yet have seen severe reductions in both population and range (Ripple et al., 2014; Malhi et al., 2016). These declines are often ascribed, at least in part, to competition between large mammals and humans over space and resources (Nyhus, 2016; Van Eeden et al., 2018; Denninger Snyder and Rentsch, 2020).

Human-wildlife conflict is one aspect of human-wildlife relations (Dickman, 2010; Pooley et al., 2017). Understandings of it vary (Pooley et al., 2021), but its effects on both human communities and wildlife populations are well-documented (Thirgood et al., 2005; Bauer et al., 2022). People living alongside large mammals often face increased personal risk and fear, cultural losses, and negative effects on health (Jadhav and Barua, 2012; Jacobsen et al., 2021; Tan, 2021). They may also face economic losses through livestock predation and damage to crops and property (Dickman et al., 2011; Nyhus, 2016). Whilst indirect factors are also important (Dickman, 2010; Kansky and Knight, 2014; Jacobsen et al., 2021), these economic losses can result in antagonistic behaviours – such as the pre-emptive or retaliatory killing of threatened wildlife – being viewed more favourably (Ogada et al., 2003; Holmern et al., 2007; Romañach et al., 2007; Marchini and Macdonald, 2012; Karanth et al., 2013; Nyirenda et al., 2015).

There are various approaches that aim to reduce the economic costs associated with living alongside large mammals. These “payments to encourage coexistence” (PEC) are diverse, and include compensation, insurance, revenue-sharing initiatives, and conservation performance payments (Dickman et al., 2011: 13937). They attempt to rectify the “market failure” whereby the high global valuation of large mammals has failed to translate into effective local cost reduction (Macdonald, 2001; Nelson, 2009: 381). By offsetting some or all of the economic costs of human-wildlife conflict, PEC aim to encourage human-wildlife coexistence. Although the meaning and usefulness of the concept is plastic and contested (Fiasco and Massarella, 2022), human-wildlife coexistence is generally seen as a desirable, dynamic and locally-grounded state, in which human and wildlife populations persist in shared spaces, at an acceptable level of friction and cost to both (see Pooley, 2021).

Whilst the cost-efficiency of the different types of PEC has been debated (e.g. Bulte and Rondeau, 2005; Zabel et al., 2011; Skonhøft, 2017), an overriding focus on their economic efficiency may come at the detriment of other important factors, including nonmaterial values (Chan et al., 2012), broader ecosystem functioning (Palmer and Filoso, 2009), and social equity (Corbera, 2012; Corbera and Pascual, 2012; Pascual et al., 2014).

In this essay, we focus on the latter, because whilst the literature on the equitability of broader incentives for conservation is well-developed (e.g. Pascual et al., 2014; Calvet-Mir et al., 2015), little has been written in the context of PEC. Here, we interrogate the simplified discourse that suggests economic incentives such as PEC work well for both nature and people. We do so because left unchallenged, this conceptual “win-win” underplays trade-offs and risks ill-informed conservation which lacks legitimacy and reproduces local inequalities (Corbera, 2012: 615).

Conceptualising equity

Equity in conservation can be conceptualised in different ways. Here, we follow Crosman et al. (2022) in considering equity as what is fair and just, particularly for the less powerful. Importantly, we view equitability as a spectrum, and consider both positive and negative factors. Next, we briefly summarise the importance of equity in conservation from both a moral and instrumental viewpoint.

Equity as a moral imperative

Conservation tools cannot address all social wrongs, but it is imperative that the use of economic incentives does not exacerbate them (Adams et al., 2004; Tan, 2021). Despite this, evidence suggests that economic tools for conservation may struggle to deliver both equitable and efficient outcomes (Pascual et al., 2010; Pascual et al., 2014; Calvet-Mir et al., 2015). They can also deepen existing

inequalities through mechanisms such as elite capture, whereby wealthy or powerful groups benefit disproportionately at the cost of others (Dickman et al., 2011; Hayes et al., 2019).

Inequitable conservation risks the erosion of cultures and the marginalisation of vulnerable people (Holland and Roe, 2021). Some argue that equitable participation is not only a vital component of wellbeing (Prilleltensky, 2013), but a basic human right for those influenced by conservation actions (Dietsch et al., 2021).

Equity as an instrumental concern

Concerns over equitability can also come from an instrumental viewpoint. For example, communities are less likely to engage with conservation measures if they are unfairly burdened or excluded from their design and implementation (Martin et al., 2015; Vucetich et al., 2018). Inequity can fuel antagonism towards conservation entities and have negative consequences for both people and wildlife (Dietsch et al., 2021; Rakotonarivo et al., 2021a). Correspondingly, greater levels of social equity can make conservation interventions more effective (Rakotonarivo et al., 2021a) and aid the resolution of many conflicts over conservation, for example by increasing social engagement and collaboration, promoting unity within the community, and increasing trust between participants and conservation authorities (Young et al., 2016; Rakotonarivo et al., 2021b).

Using examples from the literature, we therefore explore the (in)equitability of PEC, before providing recommendations to inform a fairer and more legitimate conservation approach.

Dimensions of inequity in PEC

In some contexts, PEC – as currently conceived and implemented – may exacerbate social inequalities and even contribute towards the conflict they seek to address. These dimensions of inequity fall broadly into six themes – wealth, gender, land rights, location, legitimacy, and trustworthiness – which we discuss briefly in turn here.

Wealth

Firstly, engagement with PEC can be costly, and disproportionately so for those with lower incomes. For example, a majority of sheep owners in central Italy refused to engage with an insurance scheme for livestock lost to wolves, as they were first obliged to dispose of carcasses – an expensive requirement (Marino et al., 2016). Similarly, the €250 personal excess fee in a Finnish compensation scheme is a more significant barrier to engagement for poor reindeer herders than their wealthier counterparts, as it represents a larger proportion of their income (Heikkinen et al., 2011).

In some contexts, the requirement or expectation to pay bribes in order to “help officials arrive at expedient conclusions” is frequently noted as a similar obstacle (Madhusudan, 2003; Johnson et al., 2018: 315). Some schemes seem even more overtly inequitable with regards to wealth. One Kenyan compensation scheme reinforced existing social inequalities by excluding non-livestock owners from the fund, whilst still saddling them with community-wide obligations. These individuals were some of the poorest members of the community – with wealth measured primarily in terms of livestock ownership – and were underprivileged in terms of access to other possible forms of income generation; their exclusion from this PEC therefore compounded this inequality (Anyango-van Zwieten et al., 2015).

Gender

In many contexts, women are more vulnerable to predators, perceive them as more dangerous, and are less tolerant of them than men (Dickman et al., 2013; Harvey et al., 2017; van der Meer and Dullemont, 2021). Despite this, women are less likely to report conflict with wildlife to local authorities (Johnson et al., 2018), and female-headed households can struggle to access compensation without male support (Ogra and Badola, 2008; Ogra, 2009; Jadhav and Barua, 2012).

In many places, caring responsibilities mean that women are less able to perform conflict-minimising work or to travel great distances to file the required reports for compensation claims (Ogra and Badola, 2008; DeMotts and Hoon, 2012). Institutional biases and low self-confidence combine to further hinder women's participation in PEC (Ogra and Badola, 2008; Ogra, 2009; Kimanzu et al., 2021). Moreover, some schemes may not adequately represent women (Anyango-van Zwieten et al., 2015), or may even exclude them explicitly (Bandara and Tisdell, 2002).

Land rights

Proof of land rights is another common obstacle in PEC schemes. In India, a significant proportion of compensation for both crop and livestock losses goes unclaimed due to a lack of official land rights; the insistence on producing this proof is “without basis” and effectively functions to impede access to compensation for most households (Madhusudan, 2003: 473). Tenant farmers can also get a bad deal, with compensation instead paid to landowners (Ogra and Badola, 2008; Ogra, 2009). In other cases, they may be excluded from compensation altogether on the basis that they are only leaseholders, despite their eligibility under wider law (Bhattacharjee and Parthasarathy, 2013). Issues of land rights closely intertwine with those of wealth and gender; Ogra (2009) notes that tenant farmers on the periphery of Rajaji National Park tend to be women, and face greater difficulties when attempting to claim compensation due to a lack of proof of land rights or details of the sharecropping arrangement. The matter of land ownership is not only an issue for people who might wish to claim compensation, but also for the authorities responsible. In South Africa, multiple government departments have

unclear responsibilities for various species inside and outside of Kruger National Park (including a department specifically for the border fence). Additionally, the lands where most conflict occurs are under unclear ownership, as although they ought to have been officially returned to local communities according to the Communal Land Rights Act (No. 11 of 2004), this had not yet happened (Anthony et al., 2010). This type of bureaucratic complexity – stemming from ambiguous or contested land tenure – can seriously impede individuals’ engagement with PEC.

Location

As compensation payments often do not reimburse travel costs, claimants in remote regions incur higher transaction costs, sacrificing time and paid work to travel across isolated areas (Madhusudan, 2003; Jadhav and Barua, 2012; Sengupta et al., 2020). Furthermore, these locations often lack public transport infrastructure, and it is likely that this results in lower initial compensation claim rates (Pozo et al., 2021).

Similarly, individuals’ access to compensation may depend on their proximity to protected areas. For example, whilst crop-losses did not differ significantly between households inside and outside of the buffer zone around Kanha Tiger Reserve, India, those outside were less likely to claim and obtain compensation, and also received lower sums on average (Karanth et al., 2012). It may simply be that the governing authorities are reluctant to disburse funds in areas where charismatic megafauna (i.e. tigers) are absent (Miller et al., 2016).

Legitimacy

The perceived legitimacy of a conservation approach is likely to relate to its environmental success (Witter, 2021). As the following examples show, however, PEC schemes are sometimes seen as

illegitimate by potential participants due to different understandings at a very core level. In Arizona, USA, for instance, most livestock producers felt that compensation was simply a publicity stunt by environmental organisations (Vynne, 2009). In Italy, both insurance and compensation are perceived by some as illegitimate, with a significant minority of farmers not engaging with insurance as “a question of principle” (Marino et al., 2016: 233), believing it unjust that they should have to insure their livestock against damage from wolves, which they view as state property. Some opposed compensation of any type, on the grounds that it would legitimise wolf presence (Marino et al., 2016). Likewise, a majority of Botswanan farmers questioned by McNutt et al. (2017) believe that the government owns and benefits most from wildlife, yet does not adequately support those who incur the costs.

Trustworthiness

Trust is widely considered fundamental to conservation management and success (Dietsch et al., 2021). Trust – whether in institutions or in individuals – mediates perceptions of equitability (Nyaupane et al., 2009). Mistrust in PEC can be attributed to various factors including corruption (Ogra and Badola, 2008), procedural exclusion (Marino et al., 2016), uneven access to information (Anthony et al., 2010), perceived lack of political will (Vynne, 2009; Marino et al., 2016) or broken promises (Anthony, 2021). In one Finnish compensation scheme, reindeer herders must spend time attempting to find and prove livestock losses (Heikkinen et al., 2011). Their perspective is frequently ignored, despite their local ecological knowledge, and relations with hunters and environmentalists are characterised by mistrust (Heikkinen et al., 2011).

Recommendations

Given the diversity of PEC, the negative aspects highlighted here are unlikely to be exhaustive, but rather function as an illustration of the capability of PEC to be inequitable. Crucially, however, this is not an inherent characteristic; PEC can function as vehicles of social good, too. Using examples from the literature, we make three broad recommendations to improve the equitability of PEC. The first is to co-operatively design PEC with compensatory equity in mind. The second is for the greater consideration of conservation performance payments and the technologies to guide their implementation. Our third and final recommendation is to source PEC funding from the Global North in order to reduce global coexistence inequalities.

Compensatory and co-operative approaches

The equitability of PEC should be a principle consideration of scheme designers. By taking a more active role in ensuring social equity, PEC can increase community engagement, improve collaboration, and promote unity amongst participants – even when they are required to contribute financially (Rosen et al., 2012; Alexander et al., 2021). For example, an insurance scheme in Pakistan provides access to primary education for girls in participating villages (Rosen et al., 2012). This compensatory equity approach (Nyaupane et al., 2009) recognises the stark gender inequality in terms of access to, and quality of, education in the local context (Aslam, 2009; Khan et al., 2015). Factors such as gender therefore function not just as dimensions of inequity, but rather as complex elements which can be used to fulfil social goals.

Co-operative participation is also crucial, as it can help to increase trust between participants and the organisation or authority implementing it. This is the case in a conservation performance payment in northern Sweden, where Sami reindeer-herding villages are paid based on the number of lynx and wolverine reproductions on village lands. There, carnivore numbers are monitored co-operatively by the authorities and reindeer herders; this reduces mistrust between the groups, as people more readily accept estimates and data that they helped to co-produce (Persson et al., 2015).

Greater consideration of conservation performance payments

Conservation performance payments (CPPs) avoid the moral hazard associated with other PEC – where people may be incentivised to reduce livestock protection, in order to claim financial compensation – and are the only PEC which “directly incentivises” human-wildlife coexistence (Dickman et al., 2011: 13942). Some scholars argue that such payments are likely to be more efficient as “you get what you pay for” (Ferraro and Kiss, 2002: 1719), and they can frame conservationists and the people living alongside wildlife as equals, building trust through reciprocal obligation (Hussain, 2019: 83-84).

Furthermore, whilst ex-post compensation and insurance schemes – which comprise the vast majority of PEC (Ravenelle and Nyhus, 2017) – target livestock owners by default, some of the costs associated with living alongside large mammals, such as fear, are not felt solely by livestock owners (Jacobsen et al., 2021). Conversely, because CPPs can be paid to collectives, they may incorporate previously excluded or marginalised groups in a more equitable manner. This is particularly promising as it is known that some demographics, such as women, may value wildlife-derived benefits more than other groups (Keane et al., 2016), and once appropriately engaged, contribute towards more equitable conservation (Alexander et al., 2022). Indeed, a shift from compensation and insurance-based schemes towards CPPs has been widely recommended (Ravenelle and Nyhus, 2017).

It must be noted that whilst CPPs provide many opportunities to improve the equitability of PEC, they are not inherently equitable. As with all PEC, care must be taken to ensure that governance systems are suitably co-operative and well-adapted to the local context. In particular, caution must be taken to avoid elite capture, especially where votes on collective decision-making remain proportionate to livestock ownership, or where land rights are unclear (Zabel and Holm-Müller, 2008; Zabel et al., 2014).

This latter issue is important because well-delineated group boundaries are crucial in ensuring that payments go to those bearing the costs of coexisting with wildlife (Zabel and Holm-Müller, 2008). This can, however, be difficult to ensure in contexts where the target species is particularly wide-ranging. Fortunately, however, recent advances in technology may be able to overcome this obstacle. For example, telemetry data from radio-collared lions has recently been used to estimate the cost of lion presence across communal conservancies in Namibia (Heydinger et al., 2022). This approach would enable differentiated payments to be made which more accurately reflect the unequal and dynamic distribution of lions and their impacts across the landscape. In a similar vein, advances in environmental DNA (eDNA) sampling (Booth et al., 2023) and acoustic monitoring (Markova-Nenova et al., 2023) may provide another way in which species presence can be established and equitable payments guided.

Reducing global coexistence inequalities

The equitability of PEC is also an issue at the global level. Recognising the “coexistence inequality” whereby the costs of living alongside wildlife are disproportionately borne by rural people in the Global South (Macdonald, 2001; Jordan et al., 2020: 803; Brackowski et al., 2023), some argue that the costs of implementing PEC should be borne by the international community (Dickman et al., 2011).

The potential for the wider adoption of PEC, funded by the Global North, to reduce these broad-scale coexistence inequalities should therefore be explored further. Scholars have suggested that similar approaches could incorporate diverse funding streams such as conservation credits, donor grants, and state-based levies, which could include a substantial carbon tax (Dickman et al., 2011; Fletcher and Büscher, 2020). Such a model could potentially be less vulnerable to shocks such as the COVID-19 pandemic, but would face difficulties regarding scalability (Lindsey et al., 2020). Similarly, whilst this type of approach could form part of a transformative economic reconstruction (Sandbrook et al.,

2022) and help richer countries increase their relative conservation effort (Lindsey et al., 2017), there are concerns that such an approach would simply represent a continuation of a neoliberal paradigm and risk entrenching power imbalances and undermining conservation effectiveness (Corbera, 2012; Fletcher and Büscher, 2017; Kolinjivadi et al., 2019). The details of such a shift in both funding and framing are therefore crucial in determining its effectiveness and equitability.

Concluding remarks

Ensuring that conservation actions are equitable is not only a moral imperative, but an instrumental one. Despite this, it is evident that PEC can exacerbate as well as ameliorate social inequalities. It is imperative that schemes are developed in a participatory manner, as this can integrate issues of equity, governance, and norms in a way which has the best chance to achieve socially and ecologically sustainable outcomes (Amit and Jacobson, 2018). Scheme designers should consider how PEC affect pre-existing inequities (and vice versa), and how the impacts of PEC may vary across social groups and time (Crosman et al., 2022). There is a need for compensatory equity approaches in PEC, for the greater consideration of CPPs, and for global funding patterns to better reflect current global coexistence inequalities. These conclusions are summarised in Figure 1. Future research should further explore how the costs and benefits associated with living alongside wildlife influence people's behaviour. Additionally, little is known about the psychological and social mechanisms by which PEC influence different groups, and how this may relate to effectiveness and equitability. A failure to ensure the fairness of PEC at both local and global scales diminishes its legitimacy and jeopardises the sustainability of conservation efforts.

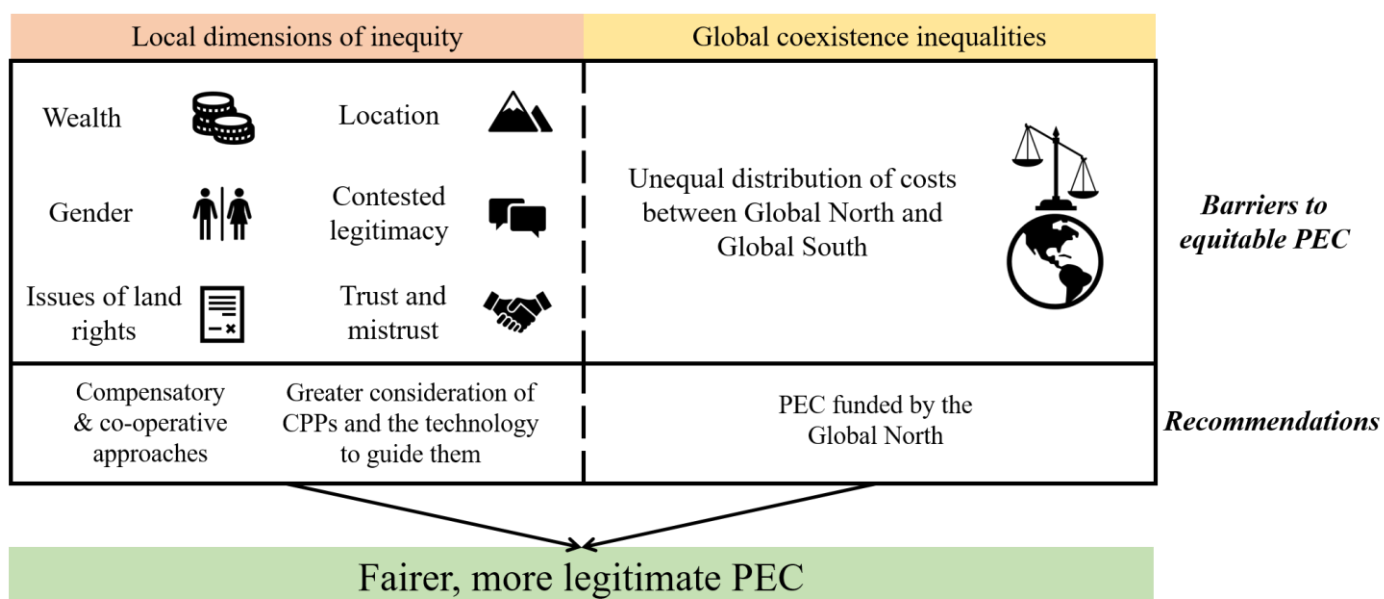


Figure 1. Payments to encourage coexistence (PEC) are often characterised by local and global inequities. To ensure their legitimacy, current and future schemes should adopt compensatory and co-operative approaches, give greater consideration to the potential of conservation performance payments (CPPs), and be funded in a manner which ameliorates global coexistence inequalities. This will help to promote the legitimacy of PEC, and perhaps conservation more widely.

References

- Adams, W.M., Aveling, R., Brockington, D., Dickson, B., Elliott, J., Hutton, J., Roe, D., Vira, B. and Wolmer, W. 2004. Biodiversity conservation and the eradication of poverty. *Science*. **306**:1146-1149.
- Alexander, J.S., Agvaantseren, B., Gongor, E., Mijiddorj, T.N., Piaopiao, T., Redpath, S., Young, J. and Mishra, C. 2021. Assessing the effectiveness of a community-based livestock insurance program. *Environmental Management*. **68**:87-99.

- Alexander, J.S., Bijoor, A., Gurmet, K., Murali, R., Mishra, C. and Suryawanshi, K.R. 2022. Engaging women brings conservation benefits to snow leopard landscapes. *Environmental Conservation*. **49**:180-186.
- Amit, R. and Jacobson, S.K. 2018. Participatory development of incentives to coexist with jaguars and pumas. *Conservation Biology*. **32**:938-948.
- Anthony, B.P., Scott, P. and Antypas, A. 2010. Sitting on the fence? Policies and practices in managing human-wildlife conflict in Limpopo Province, South Africa. *Conservation and Society*. **8**:225-240.
- Anthony, B.P. 2021. Paying for the past: the importance of fulfilling promises as a key component to resolving human–wildlife conflict. *Sustainability*, **13**:7407. <https://doi.org/10.3390/su13137407>.
- Anyango-van Zwieten, N., Van Der Duim, R. and Visseren-Hamakers, I.J. 2015. Compensating for livestock killed by lions: payment for environmental services as a policy arrangement. *Environmental Conservation*. **42**:363-372.
- Aslam, M. 2009. The relative effectiveness of government and private schools in Pakistan: are girls worse off? *Education Economics*. **17**:329-354.
- Bandara, R. and Tisdell, C. 2002. Asian elephants as agricultural pests: economics of control and compensation in Sri Lanka. *Natural Resources Journal*. **42**:491-519.
- Bauer, H., Dickman, A., Chapron, G., Oriol-Cotterill, A., Nicholson, S.K., Sillero-Zubiri, C., Hunter, L., Lindsey, P. and Macdonald, D.W. 2022. Threat analysis for more effective lion conservation. *Oryx*. **56**:108-115.
- Bhattacharjee, A. and Parthasarathy, N. 2013. Coexisting with large carnivores: a case study from Western Duars, India. *Human Dimensions of Wildlife*. **18**:20-31.
- Booth, H., Ramdlan, M.S., Hafizh, A., Wongsopatty, K., Mourato, S., Pienkowski, T., Adrinato, L. and Milner-Gulland, E. 2023. Designing locally-appropriate conservation incentives for small-scale fishers. *Biological Conservation*. **277**:109821. <https://doi.org/10.1016/j.biocon.2022.109821>.

- 341 Brackowski, A.R., O'Bryan, C.J., Lessmann, C., Rondinini, C., Crysell, A.P., Gilbert, S., Stringer,
342 M., Gibson, L., and Biggs, D. 2023. The unequal burden of human-wildlife conflict. *Communications*
343 *Biology*. **6**:182. <https://doi.org/10.1038/s42003-023-04493-y>.
- 344 Bulte, E.H. and Rondeau, D. 2005. Why compensating wildlife damages may be bad for conservation.
345 *The Journal of Wildlife Management*. **69**:14-19.
- 346 Calvet-Mir, L., Corbera, E., Martin, A., Fisher, J. and Gross-Camp, N. 2015. Payments for ecosystem
347 services in the tropics: a closer look at effectiveness and equity. *Current Opinion in Environmental*
348 *Sustainability*. **14**:150-162.
- 349 Chan, K.M., Guerry, A.D., Balvanera, P., Klain, S., Satterfield, T., Basurto, X., Bostrom, A.,
350 Chuenpagdee, R., Gould, R. and Halpern, B.S. 2012. Where are cultural and social in ecosystem
351 services? A framework for constructive engagement. *BioScience*. **62**:744-756.
- 352 Corbera, E. 2012. Problematizing REDD+ as an experiment in payments for ecosystem services.
353 *Current Opinion in Environmental Sustainability*. **4**:612-619.
- 354 Corbera, E. and Pascual, U. 2012. Ecosystem services: heed social goals. *Science*. **335**:655-656.
- 355 Crosman, K.M., Jurcevic, I., Van Holmes, C., Hall, C. C. and Allison, E. H. 2022. An equity lens on
356 behavioral science for conservation. *Conservation Letters*. **15**:e12885.
- 357 DeMotts, R. and Hoon, P. 2012. Whose elephants? Conserving, compensating, and competing in
358 northern Botswana. *Society & Natural Resources*. **25**:837-851.
- 359 Denninger Snyder, K., and Rentsch, D. 2020. Rethinking assessment of success of mitigation
360 strategies for elephant-induced crop damage. *Conservation Biology*. **34**:829-842.
- 361 Dickman, A.J. 2010. Complexities of conflict: the importance of considering social factors for
362 effectively resolving human–wildlife conflict. *Animal Conservation*. **13**:458-466.

- 363 Dickman, A.J., Macdonald, E.A. and Macdonald, D.W. 2011. A review of financial instruments to
364 pay for predator conservation and encourage human–carnivore coexistence. *Proceedings of the*
365 *National Academy of Sciences*. **108**:13937-13944.
- 366 Dickman, A.J., Marchini, S. and Manfredo, M. 2013. The human dimension in addressing conflict
367 with large carnivores. Pages 110-126 in Macdonald, D.W. and Willis, K.J. (eds.). *Key topics in*
368 *conservation biology 2*. John Wiley & Sons: Chichester, UK.
- 369 Dietsch, A.M., Wald, D.M., Stern, M.J. and Tully, B. 2021. An understanding of trust, identity, and
370 power can enhance equitable and resilient conservation partnerships and processes. *Conservation*
371 *Science and Practice*. **3**:e421.
- 372 Ferraro, P.J. and Kiss, A. 2002. Direct payments to conserve biodiversity. *Science*. **298**:1718-1719.
- 373 Fletcher, R. and Büscher, B. 2017. The PES conceit: revisiting the relationship between payments for
374 environmental services and neoliberal conservation. *Ecological Economics*. **132**:224-231.
- 375 Fletcher, R. and Büscher, B. 2020. Conservation basic income: A non-market mechanism to support
376 convivial conservation. *Biological Conservation*. **244**:108520.
377 <https://doi.org/10.1016/j.biocon.2020.108520>.
- 378 Harvey, R.G., Briggs-Gonzalez, V. and Mazzotti, F.J. 2017. Conservation payments in a social
379 context: determinants of tolerance and behavioural intentions towards wild cats in northern Belize.
380 *Oryx*. **51**:730-741.
- 381 Hayes, T., Grillos, T., Bremer, L.L., Murtinho, F. and Shapiro, E. 2019. Collective PES: More than
382 the sum of individual incentives. *Environmental Science & Policy*. **102**:1-8.
- 383 Heikkinen, H.I., Moilanen, O., Nuttall, M. and Sarkki, S. 2011. Managing predators, managing
384 reindeer: contested conceptions of predator policies in Finland's southeast reindeer herding area. *Polar*
385 *Record*. **47**:218-230.

- Heydinger, J., Diggle, R., Stuart-Hill, G., Dierkes, K. and Packer, C. 2022. Differentiated payments for ecosystem services based on estimated prey consumption by lions within communal conservancies in northwest Namibia. *Ecosystem Services*. **53**:101403. <https://doi.org/10.1016/j.ecoser.2021.101403>.
- Holland, E. and Roe, D. 2021. Practical guide helps negotiators put equity at the heart of the new global biodiversity framework. International Institute for Environment and Development. 2022. Available from: <https://www.iied.org/practical-guide-helps-negotiators-put-equity-heart-new-global-biodiversity-framework> (accessed May 2021).
- Holmern, T., Nyahongo, J. and Røskoft, E. 2007. Livestock loss caused by predators outside the Serengeti National Park, Tanzania. *Biological Conservation*. **135**:518-526.
- Hussain, S. 2019. The snow leopard and the goat: politics of conservation in the western Himalayas. University of Washington Press, Seattle.
- Jacobsen, K.S., Dickman, A.J., Macdonald, D.W., Mourato, S., Johnson, P., Sibanda, L. and Loveridge, A. 2021. The importance of tangible and intangible factors in human–carnivore coexistence. *Conservation Biology*. **35**:1233-1244.
- Jadhav, S. and Barua, M. 2012. The Elephant Vanishes: Impact of human–elephant conflict on people's wellbeing. *Health & Place*. **18**:1356-1365.
- Johnson, M.F., Karanth, K.K. and Weinthal, E. 2018. Compensation as a policy for mitigating human–wildlife conflict around four protected areas in Rajasthan, India. *Conservation and Society*. **16**:305-319.
- Jordan, N.R., Smith, B.P., Appleby, R.G., van Eeden, L.M. and Webster, H.S. 2020. Addressing inequality and intolerance in human–wildlife coexistence. *Conservation Biology*. **34**:803-810.
- Kansky, R., and Knight, A.T. 2014. Key factors driving attitudes towards large mammals in conflict with humans. *Biological Conservation*. **179**:93-105.

- 409 Karanth, K.K., Gopalaswamy, A.M., DeFries, R. and Ballal, N. 2012. Assessing patterns of human-
410 wildlife conflicts and compensation around a central Indian protected area. PLOS ONE. **7**.
411 <https://doi.org/10.1371/journal.pone.0050433>.
- 412 Karanth, K.K., Naughton-Treves, L., DeFries, R., and Gopalaswamy, A.M. 2013. Living with wildlife
413 and mitigating conflicts around three Indian protected areas. Environmental Management, **52**:1320-
414 1332.
- 415 Keane, A., Gurd, H., Kaelo, D., Said, M.Y., De Leeuw, J., Rowcliffe, J.M. and Homewood, K. 2016.
416 Gender differentiated preferences for a community-based conservation initiative. PLOS ONE. **11**.
417 <https://doi.org/10.1371/journal.pone.0050433>.
- 418 Khan, M., Rehman, S. and Rehman, C.A. 2015. Education and income inequality in Pakistan.
419 Management and Administrative Sciences Review. **4**:134-145.
- 420 Kimanzu, N., Schulte-Herbrüggen, B., Clendenning, J., Chiwona-Karlton, L., Krogseng, K. and
421 Petrokofsky, G. 2021. What is the evidence base linking gender with access to forests and use of
422 forest resources for food security in low-and middle-income countries? A systematic evidence map.
423 Forests. **12**. <https://doi.org/10.3390/f12081096>.
- 424 Kolinjivadi, V., Van Hecken, G., Almeida, D.V., Dupras, J. and Kosoy, N. 2019. Neoliberal
425 performatives and the ‘making’ of Payments for Ecosystem Services (PES). Progress in Human
426 Geography. **43**:3-25.
- 427 Lindsey, P.A., Chapron, G., Petracca, L.S., Burnham, D., Hayward, M.W., Henschel, P., Hinks, A.E.,
428 Garnett, S.T., Macdonald, D.W., Macdonald, E.A., Ripple, W.J., Zander, K., and Dickman, A. 2017.
429 Relative efforts of countries to conserve world’s megafauna. Global Ecology and Conservation.
430 **10**:243-252.
- 431 Lindsey, P., Allan, J., Brehony, P., Dickman, A., Robson, A., Begg, C., Bhammar, H., Blanken, L.,
432 Breuer, T. and Fitzgerald, K. 2020. Conserving Africa’s wildlife and wildlands through the COVID-
433 19 crisis and beyond. Nature Ecology & Evolution. **4**:1300-1310.

- 434 Macdonald, D.W. 2001. Postscript - carnivore conservation: science, compromise and tough choices.
435 Pages 524-538 in: Gittleman, J., et al. (eds.) *Carnivore Conservation*. Cambridge University Press,
436 Cambridge, UK.
- 437 Madhusudan, M. 2003. Living amidst large wildlife: livestock and crop depredation by large
438 mammals in the interior villages of Bhadra Tiger Reserve, South India. *Environmental management*.
439 **31**:466-475.
- 440 Malhi, Y., Doughty, C.E., Galetti, M., Smith, F.A., Svenning, J.C., and Terborgh, J.W. 2016.
441 Megafauna and ecosystem function from the Pleistocene to the Anthropocene. *Proceedings of the*
442 *National Academy of Sciences*. **113**:838-846.
- 443 Marchini, S., and Macdonald, D.W. 2012. Predicting ranchers' intention to kill jaguars: case studies in
444 Amazonia and Pantanal. *Biological Conservation*. **147**:213-221.
- 445 Marino, A., Braschi, C., Ricci, S., Salvatori, V. and Ciucci, P. 2016. Ex post and insurance-based
446 compensation fail to increase tolerance for wolves in semi-agricultural landscapes of central Italy.
447 *European Journal of Wildlife Research*. **62**:227-240.
- 448 Markova-Nenova, N., Engler, J.O., Cord, A.F., and Wätzold, F. 2023. A cost comparison analysis of
449 bird-monitoring techniques for result-based payments in agriculture. MPRA Paper No. 116311.
450 <https://mpra.ub.uni-muenchen.de/id/eprint/116311>.
- 451 Martin, A., Akol, A. and Gross-Camp, N. 2015. Towards an explicit justice framing of the social
452 impacts of conservation. *Conservation and Society*. **13**:166-178.
- 453 McNutt, J.W., Stein, A.B., McNutt, L.B. and Jordan, N.R. 2017. Living on the edge: characteristics of
454 human–wildlife conflict in a traditional livestock community in Botswana. *Wildlife Research*. **44**:546-
455 557.
- 456 Miller, J.R., Jhala, Y.V. and Jena, J. 2016. Livestock losses and hotspots of attack from tigers and
457 leopards in Kanha Tiger Reserve, Central India. *Regional Environmental Change*. **16**:17-29.

- 458 Nelson, F. 2009. Developing payments for ecosystem services approaches to carnivore conservation.
459 Human Dimensions of Wildlife. **14**:381-392.
- 460 Nyaupane, G.P., Graefe, A.R. and Burns, R.C. 2009. The role of equity, trust and information on user
461 fee acceptance in protected areas and other public lands: a structural model. Journal of Sustainable
462 Tourism. **17**:501-517.
- 463 Nyhus, P.J. 2016. Human–wildlife conflict and coexistence. Annual Review of Environment and
464 Resources. **41**:143-171.
- 465 Nyirenda, V.R., Lindsey, P.A., Phiri, E., Stevenson, I., Chomba, C., Namukonde, N., Myburgh, W.J.
466 and Reilly, B. K. 2015. Trends in illegal killing of African elephants (*Loxodonta africana*) in the
467 Luangwa and Zambezi ecosystems of Zambia. Environment and Natural Resources Research, **5**:24.
- 468 Ogada, M.O., Woodroffe, R., Ogue, N.O., and Frank, L.G. 2003. Limiting depredation by African
469 carnivores: the role of livestock husbandry. Conservation Biology. **17**:1521-1530.
- 470 Ogra, M. 2009. Attitudes toward resolution of human–wildlife conflict among forest-dependent
471 agriculturalists near Rajaji National Park, India. Human Ecology. **37**:161-177.
- 472 Ogra, M. and Badola, R. 2008. Compensating human–wildlife conflict in protected area communities:
473 ground-level perspectives from Uttarakhand, India. Human Ecology. **36**:717-729.
- 474 Palmer, M.A. and Filoso, S. 2009. Restoration of ecosystem services for environmental markets.
475 Science. **325**:575-576.
- 476 Pascual, U., Muradian, R., Rodríguez, L.C. and Duraipapp, A. 2010. Exploring the links between
477 equity and efficiency in payments for environmental services: A conceptual approach. Ecological
478 economics. **69**:1237-1244.
- 479 Pascual, U., Phelps, J., Garmendia, E., Brown, K., Corbera, E., Martin, A., Gomez-Baggethun, E. and
480 Muradian, R. 2014. Social equity matters in payments for ecosystem services. Bioscience. **64**:1027-
481 1036.

- 482 Persson, J., Rauset, G.R. and Chapron, G. 2015. Paying for an endangered predator leads to
483 population recovery. *Conservation Letters*. **8**:345-350.
- 484 Pooley, S., Barua, M., Beinart, W., Dickman, A., Holmes, G., Lorimer, J., Loveridge, A., Macdonald,
485 D., Marvin, G. and Redpath, S. 2017. An interdisciplinary review of current and future approaches to
486 improving human–predator relations. *Conservation Biology*. **31**:513-523.
- 487 Pooley, S., Bhatia, S., and Vasava, A. 2021. Rethinking the study of human–wildlife
488 coexistence. *Conservation Biology*, **35**: 784-793.
- 489 Pozo, R.A., LeFlore, E.G., Duthie, A.B., Bunnefeld, N., Jones, I.L., Minderman, J., Rakotonarivo,
490 O.S. and Cusack, J.J. 2021. A multispecies assessment of wildlife impacts on local community
491 livelihoods. *Conservation Biology*. **35**:297-306.
- 492 Prilleltensky, I. 2013. Wellness without fairness: The missing link in psychology. **43**:147-155.
- 493 Rakotonarivo, S.O., Bell, A., Abernethy, K., Minderman, J., Duthie, A., Redpath, S., Keane, A.,
494 Travers, H., Bourgeois, S. and Moukagni, L.-L. 2021a. The role of incentive-based instruments and
495 social equity in conservation conflict interventions. *Ecology and Society*. **26**.
496 <https://doi.org/10.5751/ES-12306-260208>.
- 497 Rakotonarivo, S.O., Jones, I.L., Bell, A., Duthie, A.B., Cusack, J., Minderman, J., Hogan, J.,
498 Hodgson, I. and Bunnefeld, N. 2021b. Experimental evidence for conservation conflict interventions:
499 The importance of financial payments, community trust and equity attitudes. *People and Nature*.
500 **3**:162-175.
- 501 Ravenelle, J. and Nyhus, P.J. 2017. Global patterns and trends in human–wildlife conflict
502 compensation. *Conservation Biology*. **31**:1247-1256.
- 503 Ripple, W.J., Estes, J.A., Beschta, R.L., Wilmers, C.C., Ritchie, E.G., Hebblewhite, M., Berger, J.,
504 Elmhagen, B., Letnic, M. and Nelson, M.P. 2014. Status and ecological effects of the world’s largest
505 carnivores. *Science*. **343**. <http://dx.doi.org/10.1126/science.1241484>.

- 506 Romañach, S.S., Lindsey, P.A., and Woodroffe, R. 2007. Determinants of attitudes towards predators
507 in central Kenya and suggestions for increasing tolerance in livestock dominated
508 landscapes. *Oryx*. **41**:185-195.
- 509 Rosen, T., Hussain, S., Mohammad, G., Jackson, R., Janecka, J.E. and Michel, S. 2012. Reconciling
510 sustainable development of mountain communities with large carnivore conservation. *Mountain
511 Research and Development*. **32**:286-293.
- 512 Sandbrook, C., Gómez-Baggethun, E. and Adams, W.M. 2022. Biodiversity conservation in a post-
513 COVID-19 economy. *Oryx*. **56**:277-283.
- 514 Sengupta, A., Binoy, V. and Radhakrishna, S. 2020. Human-Elephant Conflict in Kerala, India: a
515 Rapid Appraisal Using Compensation Records. *Human Ecology*. **48**:101-109.
- 516 Skonhoft, A. 2017. The silence of the lambs: Payment for carnivore conservation and livestock
517 farming under strategic behavior. *Environmental and Resource Economics*. **67**:905-923.
- 518 Tan, K.C. 2021. Just conservation: The question of justice in global wildlife conservation. *Philosophy
519 Compass*. **16**. <https://doi.org/10.1111/phc3.12720>.
- 520 Thirgood, S., Woodroffe, R. and Rabinowitz, A. 2005. The impact of human–wildlife conflict on
521 human lives and livelihoods. Pages 13-26 in S. Thirgood, R. Woodroffe and A. Rabinowitz (eds.)
522 *People and wildlife, conflict or co-existence?* Cambridge University Press, Cambridge, UK.
- 523 van der Meer, E. and Dullemont, H. 2021. Human-carnivore coexistence: Factors influencing
524 stakeholder attitudes towards large carnivores and conservation in Zimbabwe. *Environmental
525 Conservation*. **48**:48-57.
- 526 Van Eeden, L.M., Crowther, M.S., Dickman, C.R., Macdonald, D.W., Ripple, W.J., Ritchie, E.G. and
527 Newsome, T.M. 2018. Managing conflict between large carnivores and livestock. *Conservation
528 Biology*. **32**:26-34.
- 529 Vasudev, D., and Goswami, V.R. 2020. A Bayesian hierarchical approach to quantifying stakeholder
530 attitudes toward conservation in the presence of reporting error. *Conservation Biology*, **34**:515-526.

- 531 Vasudev, D., Goswami, V.R., Hait, P., Sharma, P., Joshi, B., Karpate, Y., and Prasad, P.K. 2020.
 532 Conservation opportunities and challenges emerge from assessing nuanced stakeholder attitudes
 533 towards the Asian elephant in tea estates of Assam, Northeast India. *Global Ecology and*
 534 *Conservation*. **22**:e00936. <https://doi.org/10.1016/j.gecco.2020.e00936>.
- 535 Vucetich, J.A., Burnham, D., Macdonald, E.A., Bruskotter, J.T., Marchini, S., Zimmermann, A. and
 536 Macdonald, D.W. 2018. Just conservation: What is it and should we pursue it? *Biological*
 537 *Conservation*. **221**:23-33.
- 538 Vynne, S.J. 2009. Livestock compensation for the Mexican gray wolf: improving tolerance or
 539 increasing tension? *Human Dimensions of Wildlife*. **14**:456-457.
- 540 Witter, R. 2021. Why militarized conservation may be counter-productive: illegal wildlife hunting as
 541 defiance. *Journal of Political Ecology*. **28**:175-192.
- 542 Young, J.C., Searle, K., Butler, A., Simmons, P., Watt, A.D. and Jordan, A. 2016. The role of trust in
 543 the resolution of conservation conflicts. *Biological Conservation*. **195**:196-202.
- 544 Zabel, A., Bostedt, G. and Engel, S. 2014. Performance payments for groups: the case of carnivore
 545 conservation in Northern Sweden. *Environmental and Resource Economics*. **59**:613-631.
- 546 Zabel, A. and Holm-Müller, K. 2008. Conservation performance payments for carnivore conservation
 547 in Sweden. *Conservation Biology*. **22**:247-251.
- 548 Zabel, A., Pittel, K., Bostedt, G. and Engel, S. 2011. Comparing conventional and new policy
 549 approaches for carnivore conservation: theoretical results and application to tiger conservation.
 550 *Environmental and Resource Economics*. **48**:287-301.