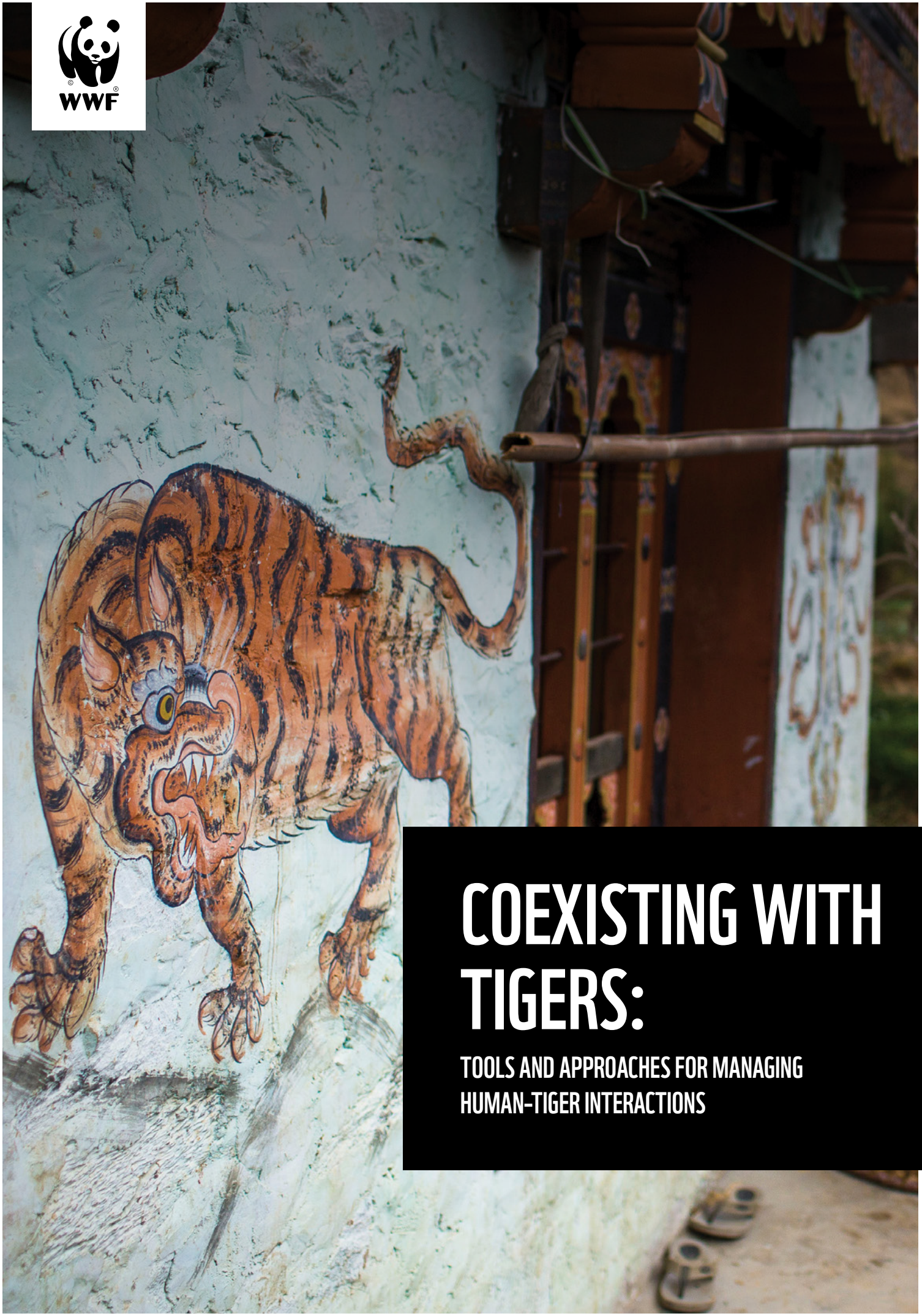

COEXISTING WITH TIGERS:

TOOLS AND APPROACHES FOR MANAGING HUMAN-TIGER INTERACTIONS

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CONTENTS

PART 1: DECIDING HOW TO MANAGE HUMAN-TIGER INTERACTIONS FOR COEXISTENCE

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This report aims to enhance the ability of conservation practitioners to promote human-tiger coexistence in places where both live in close proximity. It first provides guidance on how practitioners can collaborate with the Indigenous Peoples and local communities who live with tigers (*Panthera tigris*) to decide which issues and interventions to prioritize. It then summarizes a suite of interventions that can help understand, prevent, respond to, mitigate, monitor, and govern human-tiger interactions. Each intervention summary includes an assessment of that intervention's estimated effectiveness, required resources, possible trade-offs, and associated monitoring tools, along with a description of real-world cases in which the intervention has been applied. With these resources, conservation practitioners will be better equipped to navigate the road from conflict to coexistence and create a world in which people and tigers can thrive together.

The need for facilitating and maintaining coexistence with tigers has never been greater. Driven by policies aimed at accelerating economic growth, changes in global land cover and climate have altered the distribution of Earth's natural resources and exacerbated the extent to which human and wildlife activities overlap temporally and spatially[1,2]. For tigers, these changes mean that they more frequently come into contact with people whose lives and livelihoods are vulnerable to the dangers posed by tigers. Further, the costs and burdens of this increased overlap are felt disproportionately by people in rural landscapes[3], where livelihoods are vulnerable to human-wildlife conflict, and livelihood vulnerability puts people at further risk of conflict[4]. Such a situation threatens to erode people's tolerance for tigers and their conservation.

The challenges of human-tiger interactions have grown partly due to the successes of other tiger conservation efforts. The recorded number of wild tigers is now higher than it has been in decades. Efforts to conserve tigers have also yielded substantial carbon sequestration benefits[5]. And all the while, people are finding novel ways to not only tolerate living near tigers, but to mutually benefit from their presence[6]. To do so, conservationists working to manage human-wildlife conflict are breaking disciplinary boundaries[7,8], integrating diverse forms of knowledge, and advancing social justice in and through their work[9]. This report aims to compile many of the ways that people are doing this and to make those interventions readily understandable and accessible. It does so with the hope that further sharing of the successes and challenges faced by conservationists working across tiger conservation landscapes can promote learning and adaptation elsewhere and realize diverse forms of human-tiger coexistence.

In doing so, this report draws from the WWF's C2C: Conflict to Coexistence Approach (C2C)[10]. C2C is a generalized, structured approach and methodology for understanding human-wildlife interactions and promoting coexistence. While this report does not require prior knowledge of C2C, its framing has been influenced by it. One secondary goal of this report is to complement C2C by exemplifying how its general approach can be tailored to one species. Resources for C2C can be found here, and some reference will be made to them throughout this report.

This report is structured as follows. First, it introduces the conflict and coexistence spectrums as a way of emphasizing that neither human-tiger conflict nor coexistence are fixed points, but that they are fluid, dynamic relationships that will look different in different places and at different times. Then, the report describes outcomes and associated attributes that fall along the spectrums and can be monitored as practitioners implement their interventions. These outcomes and attributes draw largely from the C2C approach. With this framing in mind, the report next outlines one activity that can be used to prioritize which outcomes, attributes, and associated interventions practitioners may want to focus on, with a clear emphasis on co-design and collaborative decision-making with affected Indigenous Peoples and local communities. The second half of the report provides summaries of available interventions that could promote human-tiger coexistence, with details on their effectiveness, required resources, real-world examples, and other notes. With these resources, tiger conservation practitioners will be well suited to work with the Indigenous Peoples and local communities living with tigers to ensure an equitable and sustainable future for all.

CONFLICT AND COEXISTENCE SPECTRUMS

Neither human-tiger conflict nor coexistence are stable states. Each is dynamic [11] and exists along a spectrum [12]. This dynamism means that, at any point, a situation may move within either the conflict or coexistence spectrum, or between them. Because of this dynamism, there is not an 'ultimate' level of coexistence that, once achieved, means practitioners are done with their work. Coexistence is a relationship between humans and tigers that requires constant adaptive collaborative management. Realistically, sharing landscapes with large and dangerous wildlife, like tigers, will always involve some risk, regardless of how well the system is managed. Thus, even if severe conflict is not present in a landscape, practitioners must still monitor and manage human-tiger interactions to make sure that a dynamic coexistence is maintained. Further, coexistence does not mean that conflict events will never occur. Rather, a relationship of coexistence occurs when there are management strategies and structures in place that work for all people and wildlife involved in the event that negative interactions do take place.

The conflict and coexistence spectrums are depicted in Figure 1. Both of the spectrums are defined by the extent of risk and tolerance people have for wildlife. They are connected to each other by management effectiveness. That is, if human-wildlife interactions are effectively managed, a given situation may move from the conflict to the coexistence spectrum. If a situation is not managed effectively, it may move from the coexistence to the conflict spectrum. The two spectrums are distinct because each is

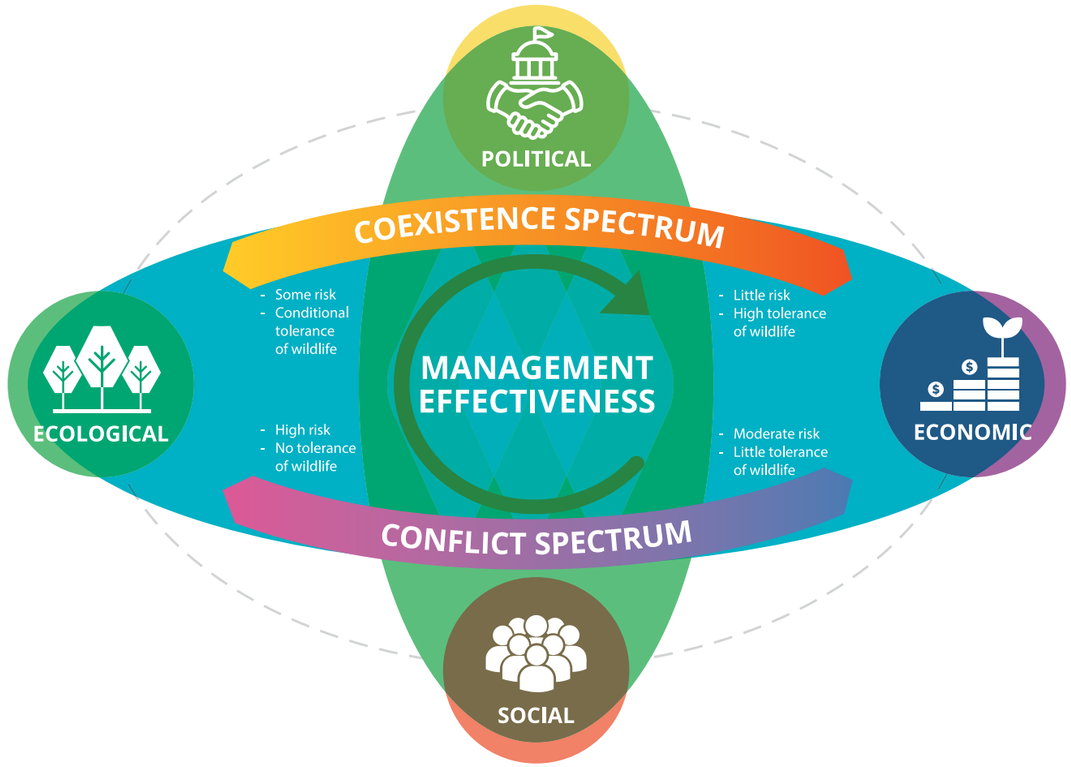

Figure 1: The conflict and coexistence spectrums, each spectrum is defined by levels of risk and tolerance, and they are connected by management effectiveness. On the coexistence spectrum, management actions directed at one outcome are likely to feedback and increase the chances of success for other management actions. Conversely, on the conflict spectrum, management actions directed at one outcome are likely to decrease the chances of success for other management outcomes. These spectrums and their relationships occur within distinct ecological, political, economic, and social contexts, meaning that conflict and coexistence will look different in different places.

defined by distinct feedbacks. In the coexistence spectrum, a management action that results in a positive result for one or more attributes makes it more likely that further management actions will also have a positive result. For example, in the Sundarbans, women who are widowed by tiger attacks on their husbands face significant indirect and direct costs, including stigma and loss of income. However, with the help of NGO assistance, some have been able to adopt different livelihood strategies and become self-reliant, making them more resilient to future conflict [13]. Conversely, in the conflict spectrum, a management action that has a negative result makes it more likely that further management actions will also have a negative result. For example, some conservation interventions aim to increase people's access to cities and markets, so that they rely less on the same natural resources as wildlife. However, one study from Mozambique found that villagers with greater road access had greater livelihood vulnerability to human-wildlife conflict, as resources in their proximity depleted more quickly because more people had access to them [14]. This meant that people had to go further for resources, which increased their exposure to wildlife conflict, which in turn made their livelihoods more vulnerable. Thus, management effectiveness is the key distinction between the conflict and coexistence spectrums, as it largely determines whether interventions will equitably support or undermine safe, sustainable, and human-wildlife interactions.

The two spectrums and the relationship between them take place within distinct social, economic, political, and ecological contexts. Because these contexts vary so highly across tiger landscapes, conflict and coexistence may take vastly different forms in different places. Differing ecological contexts may mean that appropriate management interventions look dissimilar for, as an example, wide ranging Amur tigers living in the sparsely populated Russian and Chinese Far East and areas with high human and tiger density, like central Maharashtra, India. Social contexts may mean conflict and coexistence look very different even within the same area, such as the Sundarbans, where the motives for killing tigers differ substantially between villagers, poachers, hunters, trappers, and pirates [15]. Economic context is particularly important in shaping the extent to which people's livelihoods are vulnerable to tiger conflict, such as in the Western Terai Arc landscape, where declining forest productivity and uncompensated livestock depredations led a majority of pastoralists to prefer resettlement [15]. Finally, the political context of human-tiger conflict plays an important role in enabling and constraining conflict management, such as when people's preferences for different management interventions are shaped by their struggle to implement labor and indigenous rights legislation [16]. The influence of these varying contexts on conflict and coexistence means that a deep understanding of the history of each site and the factors shaping current human-tiger relations is necessary to successfully achieving coexistence. For this reason, the first steps in the C2C Methodology are screening the context by researching the history and wider socio-political context to understand interactions and analyzing stakeholders. These steps are not covered in this report, but are in the C2C Step-by-step guide. Whether using this guide or not, a deep understanding of the contextual factors shaping human-tiger interactions will be necessary for knowing what forms conflict and coexistence can and do take in a given site and what management interventions may be appropriate.

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OUTCOMES TO MONITOR ACROSS THE CONFLICT AND COEXISTENCE SPECTRUMS

Along these spectrums are four outcomes that can be measured across several attributes. The outcomes are the same as those in the C2C Approach: (1) People, (2) Livelihoods & Assets, (3) Wildlife, and (4) Habitat. Each of these outcomes contains several attributes that can be monitored to better understand where any one case of human-tiger interactions falls along the spectrums and what interventions may be appropriate. These attributes also make it possible to determine whether any one management intervention was effective, if they are measured before and after its implementation. This section describes these different outcomes and their attributes.

Outcomes are interconnected. While these outcomes are represented as separate categories, they are deeply interconnected. Any intervention to improve attributes of one outcome may have an effect on attributes of another outcome. For example, practitioners and community members may collaboratively decide that livestock enclosures or fences are the best way to protect people's livelihoods from tiger depredation. However, extensive fencing can also result in habitat fragmentation and barriers to landscape connectivity, which makes it more difficult for wild animals to traverse a landscape. For this reason, in addition to monitoring the rate of livestock depredations before and after the construction of fences, it would be important for practitioners and community members to also monitor habitat connectivity. Because of the interconnectedness of these four outcomes, each intervention summary in Part 2 includes a description of possible trade-offs, so that any unintended consequences of an intervention can be anticipated and mitigated while the intervention is being implemented.


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OUTCOME 1: PEOPLE

The first outcome of the conflict and coexistence spectrums concerns people's ability and willingness to live alongside tigers. There are four attributes within this outcome that can be monitored to assess where along the spectrums any particular case falls within this outcome. The four attributes are: (1) Psychological vulnerability and resilience, (2) Tolerance of tigers, (3) Risk of injury or death to people, and (4) Governance.

Attribute 1.1: Psychological vulnerability and resilience

When tigers cause injury to, or kill, people or livestock, there can be lasting psychological effects. Post-traumatic stress has been documented in survivors and their families, and persistent stress due either to fear or the increased economic vulnerability can affect those who are not direct survivors. When people are psychologically vulnerable to tiger conflict, they are less likely to recover quickly and return to their regular state of mind. When people are psychologically resilient to tiger conflict they are able to either recover or readily access the resources they need to recover. Sometimes, such as when tigers leave severe physical injuries to people, psychological recovery may be needed in addition to physical recovery. Psychological vulnerability and resilience are under-explored and under-treated aspects of human-wildlife conflict generally, as they are often 'hidden' impacts. Collaboration with psychological and medical professionals is especially key to promoting psychological resilience.

Attribute 1.2: Tolerance of tigers

Tolerance is an attitudinal variable that can manifest in positive or negative behaviors toward tigers and their conservation. When people are intolerant of living in close proximity to tigers, they may retaliate after a conflict, such as through poisoning bait animals, or actively working against tiger conservation efforts. When people are tolerant of living in close proximity to tigers, they are more likely to support and cooperate with conservation efforts, furthering the feedback on the coexistence spectrum. Tolerance can be conditional in some cases, such as when people tolerate living with tigers because doing so brings tourism income. But this conditional tolerance can easily turn back to intolerance, such as when that additional income goes away due to some policy change or restriction on tourist activity. Other times, tolerance can increase alongside people's ability to adapt to the psychological and physical risks posed by tigers.

Attribute 1.3: Risk of injury or death to people

When people and tigers share landscapes, there will always be some risk of physical injury to people from tigers. It is important to remember that coexistence does not require the complete absence of such risks. Rather, coexistence requires that management systems be in place to effectively and equitably reduce the risk of tigers injuring or killing people. Managing these risks is often a question of adaptability and constraints to the when and where people use the landscape. For example, tigers are most active during the early morning and late evening. If people can avoid going to areas frequented by tigers during these times, they may reduce their risk of injury or death. Facilitating such adaptation may mean, for example, that installing toilets in people's houses so they can avoid using the forest at these times could enhance their adaptive capacity. Conversely, if people travel certain paths at certain times to perform wage labor jobs, they may be unable to change when they pass through areas with higher likelihoods of encountering tigers[17]. Additionally, having management systems and interventions in place for when tigers are seeking new home ranges or otherwise straying from their established territories will also help to reduce the risk of injury or death to people.

Attribute 1.4: Governance

Governance refers to the regulatory processes, mechanisms, and organizations through which people try to influence, in this case, environmental outcomes[18]. How conservation interventions are governed has a significant effect on whether they are equitable and effective. Ineffective governance, such as that mired by corruption and mismanagement, can not only worsen environmental outcomes, it can cause harm to people and alienate them from further conservation action. Effective governance, on the other hand, can build trust in conservation initiatives and ensure that there are clear decision-making structures in place even when unanticipated problems arise. A key indicator of whether governance is effective and equitable is whether people comply with wildlife and conservation policies [19]. When people see these policies as against their norms or interests, or otherwise as unacceptable, they can actively resist them, such as when people move back into forest villages after being relocated. Often, but not always, changing governance processes to enhance people's ability to have a say about the policies that will affect them lead to greater compliance [20]. Less often, greater enforcement of existing policies may be necessary.

OUTCOME 2: LIVELIHOODS AND ASSETS

The second outcome of the conflict and coexistence spectrums concerns people's livelihoods and the extent to which they are secured against the presence of wildlife. This outcome can be measured by one attribute to assess where along the spectrums any particular case falls, economic vulnerability and resilience.

Attribute 2.1: Economic vulnerability and resilience

Similar to psychological vulnerability and resilience, economic vulnerability and resilience describes the extent to which people can recover economically after a tiger injures or kills a person or livestock. If the person injured or killed was the main income-earner in the family, it may be considerably difficult for the other family members to adapt and find new sources of income. As they try to adapt, other 'hidden' costs may be incurred, such as loss of school time for children, reduced health due to increased physical labor, lack of sleep and stress, and further financial burden due to medical expenses, all of which can be unevenly distributed across genders. If their livelihoods depend on forest resources, this could mean that they spend more time in the forest, furthering their risk for additional injury or death. Conversely, livelihoods can greatly benefit from the presence of tigers. By controlling the population of wild herbivores and omnivores, tigers can aid farmers by reducing crop losses [21]. Under certain conditions, tiger presence can also generate further income from tourism revenue, programs providing monetary incentives to people based on wildlife presence in their area, and direct employment in conservation activities. Diverse, non-market based livelihoods in which people have control of their means of living are often the most resilient to conflict.

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OUTCOME 3: WILDLIFE

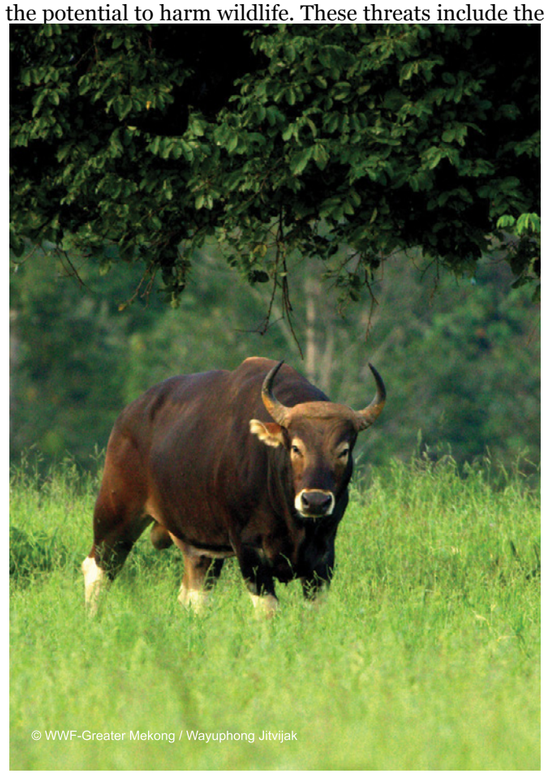
The third outcome of the conflict and coexistence spectrums concerns the extent to which wildlife thrive alongside human presence. There are two attributes associated with this outcome: (1) Population dynamics and (2) Risk of injury or death to wildlife.

Attribute 3.1: Population dynamics

The long-term persistence, and in some places growth, of tiger populations is key to their recovery in Asia. Monitoring how interventions affect tiger populations is key to understanding where on the conflict or coexistence spectrums any given site is. Further, the long-term persistence of tiger populations depends on their ability to disperse both in and out of a given site so that they can breed with other populations, thus securing a sustainable metapopulation. Achieving robust metapopulation dynamics may also necessitate implementing interventions to establish better habitat connectivity, so that tigers can easily disperse across landscapes[22]. Additionally, robust tiger populations depend on robust prey species populations, so that tigers have enough food to eat without relying on livestock. Thus, while monitoring raw numbers of tigers is important to understanding their population dynamics, measuring other habitat attributes will also be important to understand why any change in tiger population is occurring.

Attribute 3.2: Risk of injury or death to wildlife

Apart from direct negative interactions with people that can harm wildlife, there are distinct threats that hold the potential to harm wildlife. These threats include the presence of snares and other poaching equipment, as well as a normative culture of retaliatory killing of tigers [23]. The presence of these threats is often monitored using patrols or local intelligence networks. Often, snares will indirectly threaten tigers by catching their prey and reducing available wild food. The culture of retaliatory killing can also be influenced by economic incentives, which decrease the livelihood need for catching prey species, or local champions, such as wildlife guardians, which can help shift social norms in a community.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OUTCOME 4: HABITAT

The fourth and final outcome of the conflict and coexistence spectrums relates to the extent to which habitat is suitable to maintain viable populations of tigers and their prey. There are two attributes associated with this outcome: (1) habitat connectivity and (2) habitat quality.

Attribute 4.1: Habitat connectivity

Habitat connectivity at a large scale is crucial for individual tigers to disperse between populations. At a smaller scale, it is also important to ensure that there are large enough patches to support prey populations. Often tigers occupy spaces with mixed land covers, including forest, agriculture, and grassland. Ensuring that these habitats are linked to allow for easy movement across the landscape is important for the long-term persistence of tiger populations. In particular, linear infrastructure, such as roads and railway lines, present considerable barriers to wildlife movement. Land cover conversion, typically due to development, also presents a significant barrier. Typically, interventions to enhance habitat connectivity are large-scale and include long-term land use planning, wildlife overpasses and underpasses, and habitat restoration.

Attribute 4.2: Habitat quality

In addition to the connectivity of habitat, the quality of that habitat is equally important to supporting long-term tiger population persistence. The extent to which habitats support adequate prey populations is often an important way to measure quality, as prey populations often predict tiger populations [24]. Habitats can degrade when they are overgrazed or overharvested, such that prey species do not have adequate foliage upon which to forage.

DECIDING WHAT CONFLICT AND COEXISTENCE OUTCOMES AND ATTRIBUTES TO ADDRESS: A COLLABORATIVE DECISION-MAKING PROCESS

Deciding which outcomes and attributes are most important to address, and therefore which interventions to implement, is a process that requires both collaboration with affected communities and relevant rights-holders and other actors, and thorough knowledge of human-tiger interactions [25]. This section outlines a collaborative decision-making activity, called the nominal group technique, that enables such decision-making. This activity can be done with small groups of community members and involves discussing and ranking different attributes to decide which are most important to address. It is a useful activity because it allows for group discussion and anonymous input within a transparent, democratic process. Nominal group technique is not the only activity through which to collaboratively decide which interventions to implement. However, it is an effective, relatively simple, and low-cost way of doing so. For further information on this activity, see the overview by Huge and Mukherjee (2018) [26]. Below are the main steps to conduct a nominal group technique exercise with a small group.

Working within the C2C Methodology, this activity is particularly suited as a way to complete Step 4, "Co-designing the HWC Management Strategy." This step requires that duty-bearers and rights-holders come together to decide how to manage human-wildlife interactions. Importantly, this activity would greatly benefit from the context-screening, stakeholder analysis, and C2C assessment conducted in the first three steps of the C2C Methodology, and the resulting knowledge of which C2C Elements and Outcomes are important to which stakeholders. If the C2C assessment suggests that certain Elements and/or Outcomes should be prioritized, some interventions that do not apply to those could be left out of the activity.

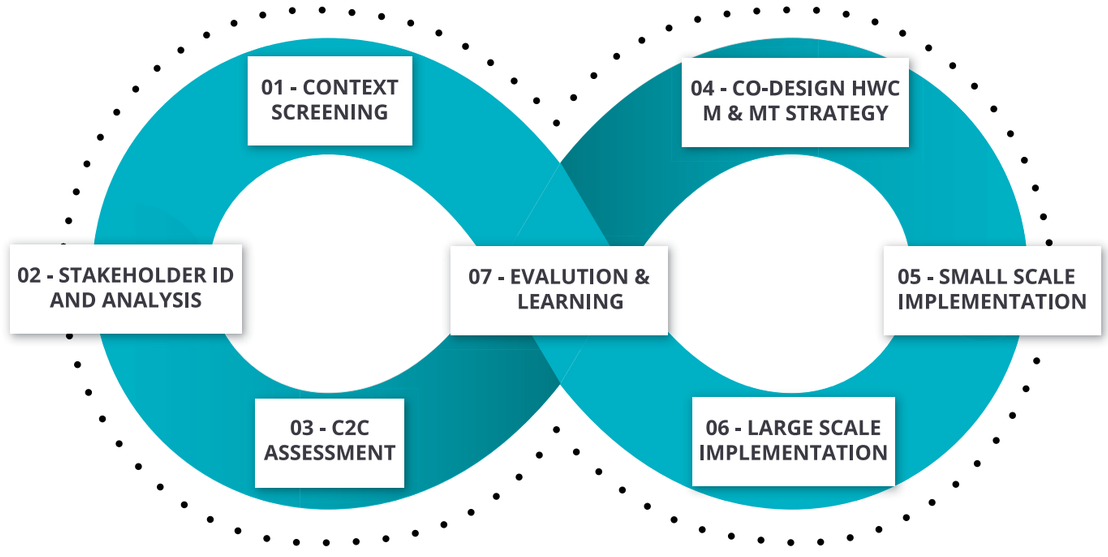

Figure 2: C2C Methodology. The collaborative decision-making process described below can be used during Step 4

STEP 1: DEFINE PURPOSE

Through the nominal group technique, participants should decide what attributes of human-tiger interactions they are most interested in addressing, and what interventions they think are the best to do so. These goals, however, imply that human-tiger interactions are important to them and that they want to improve some attributes of those interactions. This implication may not always be true. Community members may feel like crop damage by wild boar (*Sus scrofa*), for example, is a more pressing issue. In such an event, it will be important to find ways to address their concerns, even if they do not directly relate to tiger conservation. This does not exclude the possibility of addressing both human-tiger interactions and communities' concerns. But addressing communities' concerns is important because it may help to build trust and may facilitate future tiger projects. For this reason, completing the first three steps of the C2C Methodology are important, as they will bring these issues to light.

STEP 2: SELECT PARTICIPANTS

Participants should be selected in a similar manner to any focus group activity, with anywhere from 4-20 people participating in any one group. If a C2C assessment has been conducted prior to this activity, the stakeholders identified therein may be helpful in selecting participants for this activity. The participants should be knowledgeable about human-tiger interactions, have a similar social position to each other, and reflect a diversity of opinions. Ideally, there should be negligible hierarchical differences among the members of any group, as this helps to make the participants feel comfortable sharing their thoughts about sensitive topics with each other [27]. For example, the activity can be done once with a group of all women, once with farm laborers, and once with government officials. Achieving this kind of sample may require repeating the activity for several different groups. Four to six focus groups tend to be enough to discover most relevant themes on a topic [28]. The stakeholder analysis from the C2C Methodology will be important to knowing how participants should be divided between focus groups.

STEP 3: IDENTIFY LOCATION

The activity should take place at a neutral place and time. For example, a schoolhouse on the weekend is often ideal. Conversely, a government office building may make people uncomfortable. As with the participant selection, selecting the location should be done in such a way as to ensure that it does not dissuade participants from attending or participating to the fullest.

STEP 4: PREPARE MATERIALS

The nominal group technique requires few resources, the most important of which are listed here:

- An experienced facilitator
- A black board, projector, or chart paper that can be visible to all participants, or
- Paper with human-tiger conflict issues listed and space for additional issues to be added (template in Appendix 1a) for all participants
- Pens or pencils for all participants
- Ranking sheets for all participants (template in Appendix 1a)
- A computer with R statistical software or internet access for quickly analyzing participants' rankings (templates in Appendix 1b). Rankings can also be analyzed by hand, but this tends to take longer.

STEP 5: DISCUSS FREE, PRIOR, AND INFORMED CONSENT

Free, prior, and informed consent (FPIC) is a process that should accompany any conservation initiative involving people. Typically, conservation organizations, donors, and research institutions have their own requirements for what must be included in an FPIC process. For the context of the nominal group technique activity, at a basic level, an FPIC process should involve providing full and detailed information to eligible participants of what the activity will entail before it begins, how the information collected will be used, stored, made accessible and by whom, any precautions to protect participants' identity, and then a free opportunity for possible participants to either agree or disagree to participate with no penalty.

It should be noted though that FPIC is a necessary process but may not be a sufficient one to ensure that the activity proceeds equitably and democratically [29]. Often, Indigenous Peoples and local communities have their own consent and approval processes through which conservation practitioners should work. In cases where FPIC is conducted in lieu of these other processes, the FPIC process can undermine Indigenous people's sovereignty [30]. Additionally, if FPIC is not administered in a fair and representative way, similar to the selection of participants described above, it can further undermine the goals of equity and social justice [31]. Because of these complexities, fully understanding the context and conducting an analysis of all relevant rights-holders and stakeholders, such as through the first three steps of the C2C framework, is crucial to ensuring this activity and the project in total proceed in an appropriate and equitable way.

STEP 6: SHARE AND GENERATE IDEAS

Once the participants are gathered and the purpose of the activity is explained, the list of attributes related to human-tiger interactions should be presented. They could be presented either as a list at the front of the group, such as on a black board, projector, or chart paper, or they could be provided to each participant individually on paper (Template in Appendix 1a). In the event that one or more of the participants has difficulty reading, some identifiable symbol should accompany each attribute or an assistant should help those who need it. The initial list of attributes should mirror those listed above, and be written out as sentences such as those here:

- People in this area generally cannot financially withstand or recover from a tiger attack on a family member or livestock.
- People in this area generally cannot emotionally and mentally withstand or recover from a tiger attack on a family member or livestock.
- People do not tolerate living near tigers.
- People are frequently injured or killed by tigers in this area.
- People generally disobey laws about using forest resources and interacting with tigers.
- The people who manage tigers and their habitat are generally not effective at doing so.
- The way in which tigers and their habitat are managed is generally unfair and/or harmful to people and their livelihoods.
- The population of tigers in this area is quickly reducing.
- The population of wild prey for tigers in this area is quickly reducing.
- Tigers are frequently injured or killed in this area.
- There are few large areas of forest around here.
- There is not enough suitable vegetation for tiger prey species to survive in this area.

These sentences are written to emphasize their negative dimension because the participants will later be asked to rank what they see as the most pressing attribute affecting their communities. After going over the list, participants should be given time to write down any other attributes that they think are missing and should be added to the list. The facilitator should then ask each participant who wanted to add an attribute to do so. These should be added one attribute per participant per time until all new attributes are exhausted, with all new ideas added *verbatim* to the list.

STEP 7: DISCUSS

Once all potential attributes are listed, participants should be encouraged to ask clarifying questions, so that each participant fully understands the meaning of each attribute. This is not the time for participants to debate which attribute is most important. That discussion will come later. The facilitator should restrict discussion at this time only to those questions that seek to clarify why an attribute is listed or what it means.

STEP 8: RANKING

The facilitator should now instruct the participants to anonymously rank the attributes by importance. A template ranking sheet is provided in Appendix 1a. First, the organizers will need to decide how many attributes they can address with the resources and time available to them. They should then instruct the participants to rank that number of most important attributes. For example, if the organizers can address three attributes, the participants should be instructed to rank their top three attributes, with 1 being ranked the most important attribute to address, 2 the second most important, and so on. The participants should be given enough time to complete the ranking and be allowed privacy to rank anonymously. After they have ranked the attributes and submitted their anonymous rankings to the facilitator, there should be a 30-minute break, which the organizers can use to analyze the responses using the R code or the online resource provided in Appendix 1b.

The suggested method for analyzing the rankings is proportional ranked choice voting [32], though the facilitator and organizers are welcome to use any method they prefer. Proportional ranked choice voting leads to the fairest and most representative outcomes of ranking activities, which in this case means that the attributes to be addressed will best match those that the participants' find important. For instance, simply picking the three most frequently voted attributes could marginalize one group of people for whom those attributes do not apply and whose perspectives will not be reflected in the ensuing results. Appendix 1b has been provided because the tabulation of rankings for proportional ranked choice voting is somewhat complicated. The number of attributes that the organizers decide they are able to address sets the threshold for ranking the attributes. For example, if the organizers can only address one attribute, any attribute will need to be ranked as most important by 50% + 1 of the participants. If they can address two attributes, each attribute will need to be ranked as most important by 33.3% + 1 participants. If they can address three attributes, each attribute will need to be ranked as most important by 25% + 1 participants, and so forth. Any votes above the threshold get allocated to participants' next highest ranked attribute. If no attribute meets the threshold, the attribute which the fewest participants ranked as their most important attribute is eliminated, and their second ranked votes are then considered.

Hypothetical example:

The organizers have enough resources to address three human-tiger interaction attributes, and there are 20 participants providing their rankings. Therefore, any attribute needs 25% + 1, or 6 votes, to be chosen as an attribute that will be addressed. Initially, each participant's top ranked attribute is counted. Thirty-five percent of participants, or 7 people, ranked 'Economic vulnerability' as their most important attribute, but no other attribute crossed the 25% + 1 threshold. This means that 'Economic vulnerability' will definitely be chosen as an attribute to address. 'Economic vulnerability' had one surplus vote. Therefore, one participant who ranked 'Economic vulnerability' highest will be randomly selected to have their second highest ranked attribute count toward the next attribute to be selected. If that randomly selected participant ranked 'Habitat connectivity' as the second most important attribute, 'Habitat connectivity' will get one more vote, and then the rankings will be recounted. Initially, five people had ranked habitat connectivity as their most important attribute, but this did not cross the 25% + 1 threshold. Now though, with one more vote having been allocated to it, it does cross the threshold and 'Economic vulnerability' and 'Habitat connectivity' have been selected as attributes to address. To select the third attribute, the rankings are counted again, but no attribute crosses the 25% + 1 threshold. Therefore, the attribute which the fewest participants ranked as the most important, 'Danger to wildlife' is eliminated. The one person who ranked it as most important has their vote distributed to their next highest choice, 'Governance'. This reallocation puts 'Governance' across the threshold and it is selected as the last attribute to address.

STEP 9: DISCUSS AND RANK VOTE AGAIN

After the rankings have been analyzed, the facilitator should reconvene the participants and describe the results to them. The facilitator should then ask the participants to openly discuss and interpret the results, with particular attention to why the highest ranked attribute or attributes were selected to be addressed. At the end of this discussion, by simple majority, the facilitator should ask participants if they want to repeat the ranking, or if they are satisfied with the attributes selected. If the majority would like to rank the attributes again, the facilitator should help them do so by repeating the appropriate steps above. If not, the attribute or attributes to address have been decided.

In the event that multiple focus groups were conducted with different segments of the population (as described in 'Select Participants' above), it is possible that different groups will have selected different attributes to address. The best way to deal with this discrepancy would be to analyze all rankings from all focus groups together, and use proportional ranked choice voting to select the attributes to address. In this case, the results may not be able to be reported at each focus group, but may need to be reported back to the members after all focus groups are finished. Alternatively, the organizers may choose the highest ranked attribute from each focus group. Either way, the process for deciding which attributes to address should be transparent from the beginning and clearly communicated to participants.

STEP 10: CHOOSING INTERVENTIONS

Once the attribute or attributes to address have been decided by the group, the next step is to decide what interventions to implement in order to address those issues (see 'Intervention Summaries'). This decision can be made collaboratively by repeating the nominal group technique, but ranking interventions rather than attributes, or it can be made by the practitioners based on their knowledge of the interventions and what is described later in this report. If this decision is made collaboratively, participants should be given appropriate interventions to rank. In this case, practitioners may need to contribute to the discussion to suggest related interventions. For example, if participants select livestock depredation compensation as the intervention they want to implement, practitioners could recommend also implementing fencing or livestock enclosures as a way to prevent livestock depredations from happening in the first place and mitigate the need for compensation programs. Similarly, if the participants select fencing and livestock enclosures as the intervention they would like to implement, but habitat in the area is already fragmented, the practitioners may want to inform the participants that further fencing could exacerbate such fragmentation. However, if the resources and time available to practitioners is limited, this may negate the need for a collaborative decision process, as it may only be possible to implement one or a few interventions. In such a scenario, practitioners will need to be open, honest, and clear with those they are working about the constraints under which the practitioners are working. If there are interventions that Indigenous people and local communities are keen to implement but that the practitioner does not have sufficient capacity to offer, it may be useful to identify other partners who can support such implementation and supplement existing capacity.

CONCLUSION

This first part of the report has presented the conflict and coexistence spectrums, their outcomes and attributes, and one possible method for deciding upon which attributes to focus. The next part of the report summarizes interventions that may affect one or more of these attributes and how to monitor their effects along the conflict and coexistence spectrums. It is important to remember though that these outcomes and attributes are not exhaustive and that they privilege what has been discussed in existing scientific literature. The Indigenous Peoples and local communities living with tigers may have other ways of defining and measuring coexistence that are not comparable with those outlined here [33]. Because of this, practitioners will have to be open to new ideas and worldviews and work to weave them together with scientific perspectives. The same is true of monitoring indicators, as discussed below in the monitoring subsection.

Further, it is especially important to acknowledge that Indigenous Peoples and local communities are not homogenous groups [34]. As with any group, inequalities exist between and within them, including differences in gender, status, caste, class, land tenure, ability, sexuality, and ethnicity. These differences lead to differential exposures to risks from wildlife [35], necessitating that management efforts account for this unequal burden. Thus, while attempting to facilitate movement towards human-tiger coexistence, it will be crucial to examine inter- and intra-group variability in the outcomes and attributes of the spectrums. Failing to do so could risk alienating certain subgroups from management efforts, reinforcing inequality, and hindering progress along the spectrums. Conversely, sufficient attention to these differences could mean that justice and equity are bolstered through the management of human-tiger interactions [36]. Each of the interventions summarized in the next part have the potential to either reinforce or reduce inequality. Therefore, ensuring that the right interventions are chosen to address the rights issues for the right people is crucial. The activity described above can help to do that. But, just as managing human-tiger interactions requires constant adaptation, so will consideration of the process used to engage with Indigenous Peoples and local communities about their interactions with tigers.

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PART 2: INTERVENTION SUMMARIES

29 INTERVENTIONS AND 9 MONITORING TOOLS

This part summarizes 29 interventions and 9 monitoring tools that practitioners can use when managing human-tiger interactions. The intervention summaries include brief descriptions of the intervention, a real example of their use in conservation, their required resources, evidence of effectiveness, relevant monitoring tools, related interventions, and other notes and further resources. The monitoring tool summaries include brief descriptions of the tools, their strengths and limitations, what outcomes and attributes they can help measure, their software and compatibility and availability, data privacy summary, organizational support, and how they can be used to measure progress on the coexistence and conflict spectrums. The purpose of these summaries is not to provide readers with all the information they would need to successfully implement the interventions. Rather, it is to help them choose which interventions are likely to be the most appropriate for their given context and then to provide further resources through which readers can learn how best to implement them. Further reviews of the effectiveness of interventions for managing human-felid interactions can be found in Holland et al. (2018) [37] and Khorozyan and Waltert (2021) [38]. Additionally, reviews that are not specific to felids, but to human-carnivore interactions include Eklund et al. (2017) [39] and van Eeden et al. (2017) [40].

Evidence used to assess effectiveness. Only relatively robust evidence has been used to assess intervention effectiveness. That is, only studies that have statistically estimated the impact of an intervention on one or more attributes through, at least, a before-after design, and ideally, with control and treatment groups, have been considered[41]. Additionally, only studies of human-felid interactions have been considered, as interactions with, and interventions for, species of other families likely differ too much from human-tiger interactions to be applicable. Strictly cross-sectional studies and studies of people's perceptions of an intervention have not been considered as evidence of effectiveness, as they are unable to estimate effectiveness in an accurate and reliable way. However, because these types of studies can reveal important aspects of an intervention that may not have been intended by the implementers or that may illuminate some other contextual issue, they have been summarized in the 'OTHER NOTES' field of the intervention summaries. Note that a systematic review and meta-analysis was not conducted and the summaries provided here are not meant to be comprehensive. The 'EFFECTIVENESS' field only includes studies with robust designs meant to estimate impact. Where no such studies could be found, the evidence of effectiveness is marked as "Unknown". Where evidence quality is listed as 'Weak' only studies with a temporal aspect were found. Where evidence quality is listed as 'Moderate' studies included both a temporal aspect and a control group. Where evidence quality is listed as 'Strong', studies included a temporal aspect, a control group, and randomization between the treatment and control groups.

It is important to note that the interventions summarized here may have undetected effects on other attributes that were not tested. For example, one study estimated the effect of education and outreach on poaching [42]. However, education and outreach may affect tolerance as well, though this relationship was not studied. Because no intervention has been tested everywhere with every attribute, the reader will need to use some knowledge of their specific context when deciding what attributes may be affected by what interventions. To aid in this decision-making, the 'EFFECTIVENESS' field also includes contextual information about where the study was conducted, including with what species, livelihoods, and country.

Also note that the 'EFFECTIVENESS' field includes a brief note about that intervention's estimated benefit from www.conservationevidence.com. ConservationEvidence is an online database, based at the University of Cambridge, UK. For any intervention, ConservationEvidence convenes an expert panel to review the scientific literature on how it affects its intended outcome. Based on that panel review, each intervention receives a rating. These ratings have been included in the 'EFFECTIVENESS' field. For more information on the methods of ConservationEvidence, see *What Works in Conservation* [43].

Intervention effectiveness will vary for reintroduced tiger populations. It is important to note that the effectiveness of the interventions summarized below will differ when implemented among reintroduced populations of tigers. This difference in effectiveness is due both to tiger ecology and changes among people. Tigers prefer different habitat types, including those nearer to human settlements, when they are exploring new landscapes as compared to when they have established home ranges [44]. In particular, the quality of habitat in the reintroduced landscape significantly affects tigers' levels of stress [45] and they can range widely before establishing home ranges more similar to those of previous tiger populations [44]. Tigers without home ranges are more likely to be involved in conflict than those otherwise [46]. Similarly, the people living in those landscapes may have adjusted to living without tigers, and the reintroduced tigers could impact their lives and livelihoods in different ways than they had before [47]. For recommendations on how to consider the human dimensions when facilitating reintroduction, see Consorte-McCrea et al. (2022) [48].

C2C Elements. The intervention summaries also indicate to which C2C Elements they are relevant. With this field, if, after completing the C2C assessment, any Element stands out more than the others as in need of attention, then all interventions within that Element can be easily compared. Below are brief descriptions of the C2C Elements.

The first element of the C2C Approach is Understanding Interactions. The C2C Methodology includes several steps to understand human-wildlife interactions in a given site, including context screening, stakeholder identification and analysis, and the C2C assessment. Understanding these interactions is critical to deciding on which outcomes and attributes to focus, what interventions to prioritize, and with whom to engage. The interventions categorized as Understanding Interactions differ from others because they are not meant to directly affect human-tiger interactions. Rather, they are activities designed to provide further information that could be critical to understanding what attributes are most important for a given context, and that will enable more effective implementation of other interventions. Because of this unique character, the effectiveness of these interventions is not summarized and there are no monitoring tools suggested to measure their effectiveness.

The second element of the C2C Approach is Monitoring. Monitoring of the outcomes and attributes is necessary to understand whether any intervention is having an effect, intended or otherwise, on the conflict and coexistence spectrums. Ideally, monitoring data will be collected before and after the implementation of any intervention, both within the implementation area and outside of it (statistically speaking, randomizing where interventions are implemented is also ideal for estimating their effects. But randomization is rarely feasible). This kind of before-and-after, treatment-control measurement is the best way to measure impact; that is, to know whether any change is happening in the implementation area, and whether that change is due to the intervention itself, or some external factor.

The third element in the C2C Approach is Prevention. Preventing human-tiger conflicts in the first place is one of the best ways to promote coexistence in shared landscapes. Accordingly, there are more preventative interventions than for any other C2C Element. Additionally, compared to interventions for other Elements, the preventative interventions assessed here have good evidence of effectiveness at achieving their goals, though they vary substantially in required resources.

The fourth element in the C2C Approach is Response. Responding to human-wildlife conflict after it occurs is particularly important to ensuring that the damages of such conflict, both for people's lives and livelihoods, are minimized. Note that two Response interventions, cognitive behavioral therapy and eye movement desensitization and reprocessing, are the only interventions summarized in this report that are designed to enhance people's psychological resilience to conflict. They are also interventions in which conservation practitioners are likely not equipped to implement themselves. Rather, they require a certified mental health professional to work with people who have been directly impacted by conflict. These two interventions have not been tested in human-wildlife conflict situations, and thus their effectiveness in such contexts is unknown. But they have been effective for treating psychological vulnerability in other contexts, and effort has been made to find examples as similar as possible to human-wildlife conflict situations.

The fifth element in the C2C Approach is Mitigation. Mitigation interventions are designed to reduce the impact of human-wildlife conflict after it has occurred. One mitigation intervention, livelihood diversification (which is also preventative), is divided into three separate interventions, all of which aim to provide people with a source of income that does not stem from their use of local natural resources. Note that one mitigation intervention,

removal of individual animals involved in conflict, is the least effective intervention summarized in this report and may lead to further conflict.

The sixth and final element in the C2C Approach is Policy and Governance. Policy and governance play important enabling and constraining roles on the context within which human-wildlife interaction management takes place and the effectiveness of conservation interventions [49–51]. Often, the fora in which policy and governance change happens is physically removed from the sites of human-wildlife interactions being managed, and involves different stakeholders and rights-holders whose priorities may not be managing those interactions. These differences make interventions to promote policy change that would indirectly affect human-wildlife interactions quite different than those to directly manage it. The intervention summary for conservation finance mechanisms is different from the others. It provides narrative descriptions of different finance mechanisms and is meant to provide readers with a quick overview of options available to them. Robust evaluations of these mechanisms do not exist. Therefore, policy-makers and practitioners will have to decide based on their knowledge of the context within which they work what mechanisms might be most effective at financing human-wildlife interaction management. There is also a narrative section at the end of the intervention summaries describing how policy advocacy works. Similarly to finance mechanisms, policy advocacy lacks robust evaluations of specific advocacy strategies. Thus, specific interventions to achieve policy change are not described. Rather, this section provides a framework within which to understand policy advocacy, and practitioners are recommended to collaborate with their organization's policy teams on understanding what policies are needed in their areas and how to effectively advocate for them.

INTERVENTIONS BY OUTCOME

Outcome	Attribute	Resources required	Intervention (Effectiveness: grey = unknown, orange = likely harmful, yellow = likely beneficial, green = beneficial)	Time from plan to implement	Level of impact	Page
People	Psychological vulnerability and resilience	Moderate	Cognitive behavioral therapy	Weeks	Individual	27
			Eye movement desensitization and reprocessing	Weeks	Individual	36
	Tolerance	Moderate	Wildlife Guardians	Years	Group	56
		High	Predator alert systems	Years	Group	50
	Risk of injury or death to people	Low	Rapid response teams	Months	Group	54
		High	Removal of animals involved in conflict	Months	Group	55
			Predator alert systems	Years	Group	50
	Governance	Moderate-high	Good governance principles	Years	Group, region	37
		Moderate	Revenue-sharing	Years	Group	43
Economic vulnerability and resilience		Low	Guard dogs	Months	Individual	38
			Artificial deterrents	Months	Individual	26
		Low-moderate	Insurance	Years	Group, region	40
		Moderate	Wildlife guardians	Years	Group	56
			Livestock enclosures and fencing	Months	Individual	47
			Revenue-sharing	Years	Group	43
		Moderate-high	Design principles	Years	Group, region	33
			Compensation	Years	Group, region	28

Economic vulnerability and resilience		High	Prey augmentation	Months	Group, region	52
			Payments for Ecosystem Services	Years	Group, region	44
			Predator alert systems	Years	Group	50
			Conditional and unconditional cash transfers	Years	Group, region	46
Wildlife	Population	High	Prey augmentation	Months	Group, region	52
	Risk of injury or death to wildlife	Low	Rapid response teams	Months	Group	54
		Low-moderate	Education and outreach campaigns	Months	Group	35
		Low-moderate	Insurance	Years	Group, region	40
		Moderate	Wildlife guardians	Years	Group	56
		Moderate-high	Compensation	Years	Group, region	28
		High	Overpasses and underpasses	Years	Region	48
			Anti-poaching patrols	Months	Group, region	25
Habitat	Connectivity/ Quality	Moderate-high	Design principles	Years	Group, region	33
			Good governance principles	Years	Group, region	37
		High	Overpasses and Underpasses (connectivity only)	Years	Region	48
			Conditional and unconditional cash transfers	Years	Group, region	46
			Payments for ecosystem services	Years	Group, region	44

While they may play important roles in enabling the effectiveness of other interventions or in understanding human-tiger interactions, the following interventions are not linked directly to an outcome, and thus do not appear in the table above: Conservation Finance Mechanisms (pg. 30), Land Use Planning and Management (pg. 41), Predation Risk Maps (pg. 49), and Prey Biomass Assessments (pg. 53).

INTERVENTIONS

ANTI-POACHING PATROLS

C2C Elements: Prevention

DESCRIPTION

Anti-poaching patrols are interventions designed to prevent and deter the illegal killing of wildlife for consumption or sale. In the case of tigers and their prey, poachers are often hired through organized networks, travel to tiger landscapes, set snares to entrap wildlife, kill them, skin and process the valuable body parts, and then transport them for sale. Anti-poaching patrols aim to catch poachers in tiger landscapes, detect and disable snares, and recover wildlife body parts. They do this by patrolling (either by foot, vehicle, or drone) tiger landscapes, reporting the detection of poacher signs, and either capturing or working with law enforcement to capture poachers. Patrol staff can either be hired locally or externally, and receive training in the detection of poacher signs and the analysis of poaching detection data.

RESOURCES REQUIRED

- High
- Funds to employ patrol staff long-term
- Funds to equip patrol staff
- Funds for a trainer and materials to train patrol staff
- Funds for an analyst and law enforcement liaison

EXAMPLE

Working with the National Park authority, Flora and Fauna (FF) established five anti-poaching units in Kerinci Seblat National Park, Indonesia [52]. FF provided strategic guidance and liaised with neighboring communities, while the National Park authority provided operational field command. The patrol teams were authorized to make arrests of poachers. When on foot, patrol teams focused on entry points and interior trails, and they alternated trails to avoid becoming predictable. Groups of four would track their route with GPS and compasses, and record poaching signs, such as snares, and other environmental threats, like illegal logging. Patrol teams were assisted by 60 people from the neighboring villages, who would report information on poaching activity to them. Upon verifying the information, patrol teams would rapidly mobilize in that area. Informants were given a small reward for their information. Between 2000 and 2010, 642 foot patrols led to the removal of 4,433 snares, 122 of which were set for tigers specifically. Areas that were more frequently patrolled in the preceding year had fewer snares detected in subsequent years. Patrols that were conducted based on information reports were 40% more likely to result in snare detection than routine patrols.

EFFECTIVENESS

OUTCOME: Wildlife
ATTRIBUTE: Risk of injury or death to wildlife
EFFECT: Significantly reduced
Evidence quality: Weak
 # Studies: 1 [52,53]
Cat species: Tiger and non-cat species
Livelihoods: Farming, pastoralism
Countries: Indonesia, Tanzania, Zambia
ConservationEvidence.com summary: Likely beneficial

ATTRIBUTE: Population dynamics
EFFECT: Qualified (prey populations significantly increased, tiger population decreased)
Evidence quality: Weak
 # Studies: 1 [54]
Cat species: Tiger
Livelihoods: Farming, subsistence hunting and foraging
Countries: Laos
ConservationEvidence.com summary: Not assessed

OTHER NOTES	MONITORING TOOLS
• **Trade-offs:** Anti-poaching patrols may affect psychological vulnerability and risk of injury to people. Anti-poaching patrols are often given some degree of enforcement authority. There are many past examples of this authority being abused, as those conducting patrols physically harm people they believe to be poachers. In such cases, the long-term success of conservation interventions may be compromised, as people grow wary of whether conservationists value their well-being. • The personal, social, and economic situation of those who kill wildlife for sale in markets is often neglected in the rhetoric of anti-poaching. That is, it is often assumed that 'poachers' are all bad and beyond redemption, and therefore it is unnecessary to understand their perspectives or the factors influencing their decision to poach [55]. Often these factors include persistent inequality, for which anti-poaching patrols do little to resolve, and may exacerbate, in the long-term. Such neglect, paired with militarized poaching patrols, has resulted in the violation of human rights in the past and the reinforcement of factors that increased poaching in the first place [56,57]. • Anti-poaching patrols have a high opportunity cost. That is, because they require significant resources, they prevent such resources from being used for other purposes. Education and outreach intervention require significantly fewer resources, and have similar effectiveness in reducing poaching [53].	**Attribute**: Risk of injury or death to wildlife; Population dynamics • SMART • EarthRanger
FURTHER RESOURCES	**RELATED INTERVENTIONS**
	Education and outreach

ARTIFICIAL DETERRENTS

C2C Elements: Prevention

DESCRIPTION	RESOURCES REQUIRED
Artificial deterrents are interventions designed to prevent livestock depredation by using different sensory methods to make predators uncomfortable when they approach livestock. Visual deterrents can include flashing lights and scarecrows. Acoustic deterrents can include recorded human, animal, or mechanical sounds and firecrackers. These deterrents are placed near or on livestock enclosures, and can either be turned on when a predator is known to be near (either by visual confirmation or by camera trap or other sensor), or can be set to a timer.	• Low • Funds to purchase and install deterrents • Funds for maintenance of deterrents, including labor cost

EXAMPLE	EFFECTIVENESS
Between 2018 and 2019, researchers worked with community members in Uttarakhand, India, to determine the effectiveness of fox lights at deterring livestock depredation by leopards.[58] Fox lights are solar-powered lights that automatically flicker three differently colored lights at random time intervals during the night to mimic local community member activity. Fox lights were installed in 16 villages, and the rate of livestock depredations in those villages was compared with that in 17 control villages, in which no fox lights were installed. Leopard presence was confirmed by regular trail walks and reports from village members. The research was done in collaboration with community members, who attended workshops on predator deterrents, helped to decide where to install the fox lights, and to monitor their functioning during the study. While leopard presence was similar between the villages with lights and those without, livestock depredations were nearly 50% lower in the villages with fox lights.	**OUTCOME:** Livelihoods & Assets **ATTRIBUTE:** Economic vulnerability (Livestock depredation) **EFFECT**: Significantly reduced **Evidence quality:** Moderate **# Studies:** 1 [58] **Cat species:** Leopard **Livelihoods**: Livestock farming, agriculture **Countries**: India **ConservationEvidence.com summary:** Not assessed
OTHER NOTES	**MONITORING TOOLS**
Trade-offs: There are no known trade-offs of using artificial deterrents on other outcomes or attributes. While artificial deterrents are widely used across the globe to prevent livestock depredations, their evaluation, particularly in tiger landscapes, is highly limited.	**Attribute**: Economic vulnerability and resilience (Livestock Depredations) • SMART • EarthRanger
FURTHER RESOURCES	**RELATED INTERVENTIONS**
ENCOSH Predator Deterrent Light systems https://encosh.org/en/simplified_initiatives/predator-deterrent-light-systems/	• Livestock enclosures and fences • Guard dogs

COGNITIVE BEHAVIORAL THERAPY

C2C Elements: Response, Mitigation

DESCRIPTION	RESOURCES REQUIRED
Cognitive behavioral therapy (CBT) is an intervention designed to treat post-traumatic stress disorder (PTSD) in people who themselves or whose family members have suffered tiger conflict. CBT is based on the principles that psychological problems are due in part to faulty thinking and unhelpful behaviors, and that people can learn better ways of coping with their symptoms. CBT helps people to do that by recognizing when they are thinking and acting in unhelpful ways and learning new skills to deal with difficult situations. There are no records of CBT being used to address psychological vulnerability stemming from wildlife conflict, but it has been very effective for treating post-traumatic stress stemming from other events.	• Low-moderate • Funds for a certified professional to conduct therapy

EXAMPLE	EFFECTIVENESS
Motor vehicle accidents bear some resemblance to wildlife attacks, in that they often happen during routine daily activities and can cause serious bodily injury. Researchers wanted to estimate the effectiveness of cognitive behavioral therapy for treating PTSD in victims of motor vehicle accidents [59]. To do so, they randomly assigned 42 such victims either to a waitlist or to 8-12 weekly sessions of CBT. CBT was conducted by a certified clinician and included writing a personal accident account and reading it aloud, imagining the worst moments of the traumatic event, and stepwise exposure to anxiety-related traffic situations. Those who received CBT displayed significantly fewer PTSD symptoms both immediately after treatment and at a 3-month follow-up. Several systematic reviews and meta-analyses have further supported this effect, though CBT is not always successful at treating PTSD [60–63].	**OUTCOME**: People **ATTRIBUTE**: Psychological vulnerability and resilience **EFFECT**: Unknown **Evidence quality:** NA **# Studies:** NA **Cat species:** NA **Livelihoods**: NA **Countries**: NA **ConservationEvidence.com summary:** Not assessed
OTHER NOTES	**MONITORING TOOLS**
• **Trade-offs:** There are no known trade-offs between CBT and other attributes and outcomes. • CBT can also be effective among children experiencing PTSD, especially when administered within a school setting [64].	**Attribute**: Psychological vulnerability and resilience • Household Surveys • Social Impact Focus Groups • Wildlife Tolerance Model
FURTHER RESOURCES	**RELATED INTERVENTIONS**
• American Psychological Association resources for CBT • What is Cognitive Behavioral Therapy? • Cognitive Behavioral Therapy and PTSD	• Eye Movement Desensitization and Reprocessing

COMPENSATION

C2C Elements: Response, Mitigation

DESCRIPTION	RESOURCES REQUIRED
Compensation is an intervention designed to reduce the financial burden of wildlife conflict for those who have experienced it and to improve tolerance of their living with wildlife. When livestock or people are attacked by wildlife, claims are filed by affected individuals to the relevant authorities, often detailing where and when the attack happened and what the damages were. Based on existing policy and assessment of the claim, affected individuals are paid an amount of money to compensate for their loss.	• Moderate-High • Continual funds needed to pay near market-value of killed livestock or compensate for the death of family members • Funds for administration costs

EXAMPLE	EFFECTIVENESS
In the buffer zone of Nepal's Chitwan National Park, farmers often enter forested areas to collect fuelwood and graze livestock. Doing so places both themselves and their livestock at risk from tigers. In 1998, Nepal began financially compensating people for injuries and deaths to people and livestock resulting from such encounters, with more formal guidelines for conservation entering force in 2009. The purpose of these payments was to reduce people's economic hardship and their animosity toward wildlife. Between 2007 and 2014, USD 93,618 was paid in compensation, 65% for human deaths, 5.7% for human injuries, and 29.3% for livestock killings. The payments for human deaths were each equivalent to 1.5 years' income. Those for human injuries covered, on average, 63.6% of full expenses, and payments for livestock loss covered 46.7% of the full value of the depredated livestock. Because there was no before-after study design to assess the effectiveness of these payments at reducing livelihood vulnerability, it is impossible to understand their full contributions to doing so. However, those analyzing these data suggested that the efficacy of the compensation payments was questionable, and recommended simplifying the claim procedure, controlling bureaucratic corruption and misconduct, and revising the compensation payment rates [65].	**OUTCOME**: Wildlife **ATTRIBUTE**: Risk of injury or death to wildlife (retaliatory killings) **EFFECT**: Significantly reduced **Evidence quality:** Moderate **# Studies**: 2 [66,67] **Cat species:** Lion **Livelihoods**: Pastoralist **Countries**: Kenya **ConservationEvidence.com summary:** Likely beneficial **OUTCOME**: Livelihoods & Assets **ATTRIBUTE**: Livelihood vulnerability and resilience **EFFECT**: Unknown **Evidence quality:** Weak **# Studies:** 1 [65] **Cat species:** Tiger **Livelihoods**: Farming **Countries**: Nepal **ConservationEvidence.com summary:** Not assessed
OTHER NOTES	**MONITORING TOOLS**
• **Trade-offs:** Depending on how compensation payments are administered, they can negatively affect governance effectiveness and equity. Compensation programs that are locally controlled are more likely to run efficiently and less likely to be subject to bribery. • A global review study [68] suggested three ways to improve wildlife conflict compensation programs: (1) requiring claimants to employ damage prevention practices, such as fencing or improved husbandry, (2) modifying compensation payments to be outcome or performance based, and (3) adjusting programs so that payments happen more quickly. • Often, processing compensation payments is slow. To overcome this slowness, a program called Wild Seve was established in Karnataka, India. Wild Seve assists people affected by conflict to file and monitor their claims and receive payment [69]. • Several studies have demonstrated inequality in who is able to access compensation payments, with access shaped by wealth, gender, and social capital, among others [70,71]. These studies recommend co-designing payment programs, adding tourist visitors' fees to compensation funds [72] and increasing funding for them from the Global North to reduce global inequities.	**Attribute**: Risk of injury or death to wildlife • SMART • Earth Ranger **Attribute**: Livelihood vulnerability and resilience • Household surveys • Social impact focus groups

FURTHER RESOURCES	RELATED INTERVENTIONS
WWF Tigers Alive Initiative, Lessons Learned from Global Compensation and Insurance Schemes	• Insurance • Livelihood diversification

CONSERVATION FINANCE MECHANISMS (C2C ELEMENTS: POLICY AND GOVERNANCE)

Conservation finance mechanisms are instruments designed to maintain continual funding for conservation interventions, including those to manage human-wildlife interactions. In contrast to other interventions summarized here, the scientific literature does not provide evidence for their effectiveness. This lack of evidence is likely because policies are often uniformly implemented, meaning that there are few control cases with which to compare. In lieu of summaries like those for the other interventions above, this section presents narrative descriptions of conservation finance mechanisms and how they have been applied in the past, but does not suggest whether one might be more effective than others. Additionally, in contrast to the other intervention summaries, this section does not deal exclusively with big cat conservation, both because there are not enough relevant case studies and because conservation finance mechanisms largely function independently of species ecology.

However, this independence from species ecology represents an important risk inherent in many market-based financial mechanisms: that they are unable to reflect and accommodate the complexity of human-wildlife interactions. Their necessary uniformity means that careful design of these mechanisms is needed to ensure that (1) all rights-holders and stakeholders are continually engaged and informed about how mechanisms work, (2) their incentives do not drive the simplification of conservation efforts, and (3) financial benefits flow equitably to communities, ensuring that those most affected receive the most benefit [73].

Carbon Credits

Carbon credits are a financing mechanism through which corporations or other organizations reduce their carbon footprint by buying credits in a voluntary or regulated market, which are sold by governments, organizations, or other third-parties doing work that sequesters carbon. One carbon credit is equivalent to one ton of carbon dioxide or equivalent greenhouse gas. Sometimes, the work being done to sequester carbon can also benefit biodiversity conservation. For example, in Latin America, 44 REDD+ (Reducing Emissions from Deforestation and Forest Degradation) projects occurred within jaguar (*Panthera onca*) habitat. The activities conducted to enhance carbon sequestration also had the potential to benefit jaguar conservation, including hunting restrictions, patrols, and habitat conservation. However, none of the projects had monitoring programs robust enough to estimate changes in jaguar occupancy during the project timeline [74]. However, because carbon credits have been critiqued for their questionable effectiveness and inequity, some recommend using them as transitional tools toward larger, justice-oriented conservation financing [75].

Conservation trust funds

Conservation trust funds are financial mechanisms that provide grants for conservation projects, with funding coming from a variety of sources, including sinking funds and endowments. The annual investment return of the trust fund is used to finance conservation interventions for the grantee. The best known example of a conservation trust fund is the Global Conservation Fund administered by Conservation International (CI) [76]. With a $100 million grant from the Gordon and Betty Moore Foundation, CI uses the Global Conservation Fund to invest in their own projects and those of other organizations around protected areas. Much of the funding is used to design and establish endowments that act as further conservation trust funds for individual protected areas. With these endowments, protected area funding increases by an amount equal to the annual investment return of the conservation trust fund. In addition to protected areas, the Global Conservation Fund has been used to fund Indigenous Peoples and community conservation territories and areas and privately-managed nature reserves.

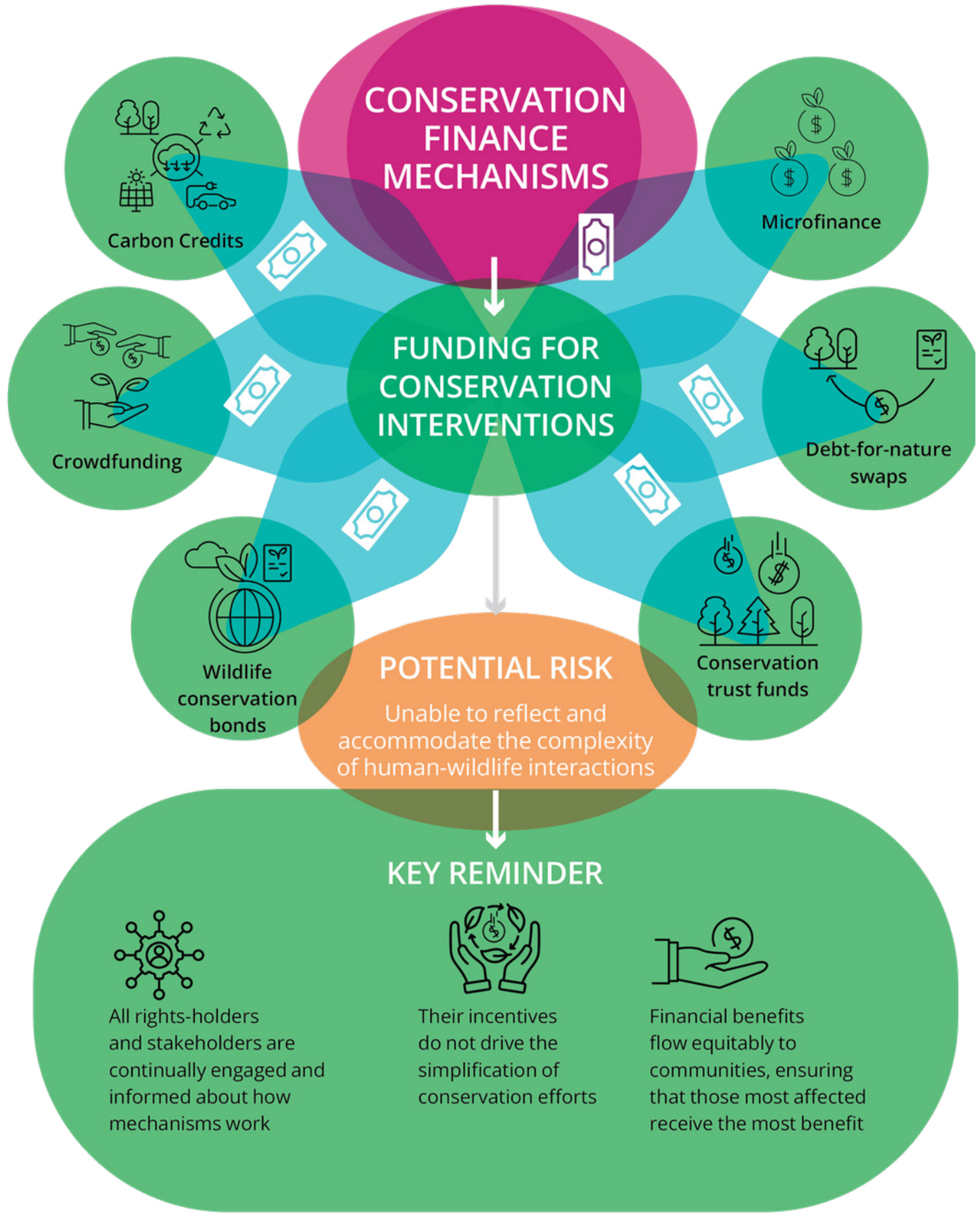

Figure 3: Conservation finance mechanisms that could support the management of human-tiger interactions.
Note: These 6 interventions are not an exhaustive list of nature financing mechanisms but some examples

Crowdfunding

Crowdfunding is a financial mechanism in which donations are sought from individuals, organizations, or companies. Crowdfunding can occur directly between a conservation organization and donors, or indirectly through an online crowdfunding website. Use of a crowdfunding website can be attractive because it reduces the transaction costs both for the donor and the organization. Among crowdfunded projects, those for species conservation, and mammals in particular, are by far the most common, and funds often flow directly from the Global North to projects in the Global South [77].

Debt-for-nature swaps

Debt-for-nature swaps are financial mechanisms through which NGOs or crediting governments purchase some amount of a debtor country's debt and the debtor country allocates the funds they would have used to repay the debt to conservation activities. Ideally, debt-for-nature swaps allow debtor countries to reduce their debt while also enhancing their conservation activities. The debt purchased can be either commercial, in which case it is typically bought by non-governmental organizations, or public, in which case it is typically bought by creditor countries. Historically, debt-for-nature swaps have suffered from several shortcomings that largely stem from their design and the scale at which they are implemented. These shortcomings include failing to (1) deliver additional resources to debtor country budgets, (2) deliver additional resources to conservation activities, (3) reduce debt burden, (4) align with government policy, and (5) align with government systems [78].

Microfinance

Microfinance is a financial mechanism through which a revolving fund is established to provide small loans for conservation-friendly economic activities, with the loan interest payments used to fund conservation interventions. For example, in 2013 Fauna & Flora International provided seed funding to Villages Savings and Loan Associations to establish a microfinance program for private forest owners to engage in conservation-friendly agriculture and conservation activities [79]. Loans were given with an annual interest rate of 20%, with 12% going to the maintenance of the microfinance program and 8% going to chimpanzee conservation. Within 9 years, 450 forest owners had accessed microcredits and USD 1,900 raised for chimpanzee conservation, which covered 40% of the wildlife patrol costs.

Wildlife conservat ion bonds

Wildlife conservation bonds are outcome-based mechanisms that allow investors to invest in the conservation of a single species. The invested money goes toward the management of protected areas and conservation activities related to the concerned species. If that species' population achieves a benchmark growth rate over a defined timeframe, investors are repaid their investment plus a success payment higher than what the interest of that investment would have been. If the concerned species population does not grow at the benchmark rate, investors are repaid at a lower payment. The bonds depend on independent organizations to calculate species population numbers and a conservation organization to verify them. The first such bond was issued in 2022 for the conservation of the black rhinoceros (*Diceros bicornis*) in Kenya and South Africa. The World Bank will repay investors their principal investment and the Global Environmental Facility will pay the success payment. Rhino population numbers will be verified by the Zoological Society of London. A full account of the development of the Rhino Bond can be found in Medina and Scales (2024) [80]. Similar bonds can be issued for other environmental outcomes, such as forest conservation and carbon sequestration [81].


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DESIGN PRINCIPLES

C2C Elements: Policy and Governance	
DESCRIPTION	**RESOURCES REQUIRED**
Design principles are a set of eight empirically-derived criteria, which, when in place, can facilitate the long-term sustainability of common-pool resource management, those resources that are not privately owned but also not openly available to everyone [82]. The eight principles are: 1. Clearly defined geographical boundaries for the resource and who has rights use it 2. Congruence between the resource management rules and local conditions, including restrictions on when, where, and how people use the resources and the amount they are able to extract 3. Collective choice arrangements, such that people affected by the rules can participate in modifying them 4. Monitoring of resource use is done actively and monitors are accountable to those they monitor 5. Sanctions for violating the management rules are graduated, such that the penalty increases with the seriousness of the offense 6. Conflict resolution mechanisms exist that allow rapid access to low-cost arenas to resolve conflicts 7. The rights to organize are recognized by external government authorities. 8. Multiple, nested layers of enterprises governing the above principles. The effectiveness of these design principles at promoting sustainable use of natural resources is well-supported empirically [83] and are often assessed in contexts where governance responsibilities have been devolved or decentralized to the local or community level, for example, Anthony et al. (2010) [84].	• Moderate-High • Funds for policy engagement • Extensive facilitation needed to draft and implement new governance rules

EXAMPLE	EFFECTIVENESS
In 1996, India passed a law called Panchayat Extension to Rural Areas Act (PESA). This law devolved governance and management responsibility for local resources in areas with high populations of Scheduled Tribes to their local elected bodies, and mandated that those bodies be composed of a majority of people from Scheduled Tribes. Though not created with the design principles in mind, PESA embodied many of them, including, at least, clearly defined boundaries, collective choice arrangements, monitoring, graduated sanctions, conflict resolution mechanisms, recognized rights to organize, and nested enterprises. Evidence from large-scale time-series remote sensing data suggests that the implementation of PESA led to a 3% increase in tree canopy cover per year, as well as a reduction in deforestation, relative to areas outside of Scheduled Areas [85]. The authors of this study suggest that these habitat benefits derived from the increase of political power for Scheduled Tribes, which allowed them to thwart timber, mining, and industrial interests and pursue their own collection and sale of non-timber forest products. Particularly in central India, Scheduled Areas heavily overlap with the distribution of tiger and leopard populations.	**OUTCOME:** Livelihoods & Assets **ATTRIBUTE:** Economic vulnerability **EFFECT:** Somewhat reduced **Evidence quality:** Moderate **# Studies:** 3 [85–87] **Cat species:** Tiger, leopard **Livelihoods:** Farming, pastoralism **Countries:** India, Malawi, Nepal, Uganda **ConservationEvidence.com summary:** Not assessed **OUTCOME:** Habitat **ATTRIBUTE:** Habitat Quality and Connectivity **EFFECT:** Significantly increased **Evidence quality:** Strong **# Studies:** 3 [86,88,89] **Cat species:** Tiger, leopard, jaguar **Livelihoods:** Farming **Countries:** Brazil, India, Nepal, Peru **ConservationEvidence.com summary:** Not assessed
OTHER NOTES	**MONITORING TOOLS**
Trade-offs: There are no known trade-offs between governance based on the design principles and other attributes or outcomes. The effect of design principles on governance is not assessed here. In this case design principles are governance, and including it as both an intervention and an outcome would be circular. However, the Elinor monitoring tool can help track the implementation of design principles and whether they are in force on the ground.	**Attribute:** Governance • Elinor **Attribute:** Habitat Quality/ Connectivity • Collect Earth Online • ForestWatcher • Remap
FURTHER RESOURCES	**RELATED INTERVENTIONS**
	Good Governance Principles

EDUCATION AND OUTREACH CAMPAIGNS

C2C Elements: Prevention

DESCRIPTION	RESOURCES REQUIRED
Education and outreach campaigns are interventions designed to provide their audience with the information and/or skills needed to live safely with wildlife. These campaigns can be conducted through various forms of media, or via a series of in-person workshops. Ideally, the design of these interventions is informed by educational and behavioral theory to maximize their effectiveness. The subject of these campaigns can also vary widely from anti-poaching to reaction training to livelihood changes and skills for deterring wildlife.	• Low-Moderate • Funds needed to hire facilitators • Funds needed for workshop materials, venue, and food
EXAMPLE	**EFFECTIVENESS**
Between 2008 and 2011, WWF-Thailand and the Thai Department of National Parks, Wildlife, and Plant Conservation sought to reduce poaching in and around Kuiburi National Park, Thailand[42]. To do so, they conducted 116 outreach events focused on local leaders, farmers, and school children aiming to change social norms around poaching to make people less tolerant of it. They designed their workshops around six principles of behavior change from social psychology: (1) they established trust through face-to-face meetings in which they were open about their goals, (2) they justified their aims by telling people about the importance of the national park and how poaching affects its wildlife, (3) they motivated people by informing people about the benefits of a healthy environment, (4) they appealed to people's ethics by speaking of the moral responsibility to help other species and related a Buddhist parable on that theme, (5) they proposed feasible actions that people could take, including informing others about the state of wildlife in the park, reconsidering hunting or eating wildlife, and refusing poachers' access to the park and anonymously informing authorities, and (6) they instilled confidence by sharing how other communities had successfully overcome environmental degradation. They monitored the effect of their workshops by estimating poaching events and focal species populations using sign-based occupancy surveys and camera traps. Poaching events declined four-fold after their workshops, with several sites dropping to zero immediately after. This decline was uncorrelated with anti-poaching patrol effort, suggesting that the workshops significantly reduced poaching in the area.	**OUTCOME**: Wildlife **ATTRIBUTE**: Risk of injury or death to wildlife (Poaching) **EFFECT**: Significantly reduced **Evidence quality:** Weak **# Studies:** 1 [42,53] **Cat species:** Tiger **Livelihoods**: Pineapple farming **Countries**: Thailand **ConservationEvidence.com summary:** Not available
OTHER NOTES	**MONITORING TOOLS**
Trade-offs: There are no known trade-offs between education and outreach campaigns and other attributes or outcomes. Environmental education has also been implemented with school children, where it has been shown to increase their environmental knowledge, knowledge of safe behavior, and some environmental attitudes [90].	**Attribute**: Risk of injury or death to wildlife • SMART • Earth Ranger
FURTHER RESOURCES	**RELATED INTERVENTIONS**
For information on designing environmental education and outreach materials, see the North American Association for Environmental Education's Guidelines for Excellence: Environmental Education Materials.	

EYE MOVEMENT DESENSITIZATION AND REPROCESSING

C2C Elements: Response, Mitigation

DESCRIPTION

Eye movement desensitization and reprocessing (EMDR) is an intervention designed to treat post-traumatic stress disorder (PTSD) in people who themselves or whose family members have suffered conflict. EMDR is based on the principle that a person's working memory has limited capacity. In EMDR, the patient is asked to focus on the traumatic event while following a therapist's finger back and forth with their eyes. As the patient tries to do both at once, the limited capacity of working memory results in the traumatic event's vividness and intensity being reduced and relegated to the long-term memory. This leads to a less emotional reaction upon future activation of that memory. There are no records of EMDR being used to overcome psychological vulnerability stemming from wildlife conflict, but it has been very effective for treating PTSD stemming from other events.

RESOURCES REQUIRED

- Low-moderate
- Funds for a certified professional to conduct therapy

EXAMPLE

Researchers wanted to test the effectiveness of EMDR at treating PTSD symptoms stemming from a variety of events, including physical and sexual assault, life-threatening injury, traffic accident, earthquake, and witnessing the death of a loved one [91]. To do so, 67 participants were randomly selected for EMDR or for a standard treatment. Their PTSD symptoms were assessed before and after treatment, as well as at 3- and 6-month follow-ups. At all points after treatment, those who received EMDR displayed significantly fewer PTSD symptoms than the control group. These results have been further supported by additional systematic reviews and meta-analyses [92,93].

EFFECTIVENESS

OUTCOME: People

ATTRIBUTE: Psychological vulnerability and resilience

EFFECT: Unknown

Evidence quality: NA

 # Studies: NA

Cat species: NA

Livelihoods: NA

Countries: NA

ConservationEvidence.com summary: Not available

OTHER NOTES

Trade-offs: There are no known trade-offs between EMDR and other attributes and outcomes.

EMDR can also be effective among children experiencing PTSD, especially when administered within a school setting [64].

MONITORING TOOLS

Attribute: Psychological vulnerability and resilience

- Household Surveys
- Social Impact Focus Groups
- Wildlife Tolerance Model

FURTHER RESOURCES

- American Psychological Association resources for EMDR
- What is EMDR?
- Eye Movement Desensitization and Reprocessing and PTSD

RELATED INTERVENTIONS

Cognitive Behavioral Therapy

GOOD GOVERNANCE PRINCIPLES

C2C Elements: Policy and Governance

DESCRIPTION

Good governance principles are criteria derived from political theory, experience, and public social values about the proper way to govern natural resources. While there is no definitive list of good governance principles, they commonly include [94,95]:

- Be forward-looking, adaptive and respond to people's needs
- Seek and incorporate multiple and diverse perspectives
- Apply social and ecological science, citizens' knowledge, and trust administrators' judgment
- Produce multiple, sustainable benefits for all involved
- Ensure that administrators are responsible for maintaining resources and allocating their benefits
- Be publicly accessible and transparent
- Administrators are publicly accountable
- People should be informed and engaged in decision making
- Who has rights to make decisions is clearly defined
- Administrators work with nongovernmental entities
- Facilitate collaboration and coordination across ecological, jurisdictional, and ownership boundaries

RESOURCES REQUIRED

- Moderate-High
- Funds for policy engagement
- Extensive facilitation needed to draft and implement new governance rules

EXAMPLE

In Bong County, Liberia, deforestation occurs because elites derive benefits from agribusiness and logging operations and are not accountable to their constituencies. Researchers wanted to know if promoting more informed and inclusive decision-making mitigated those causes and reduced deforestation [96]. Out of 120 communities, they randomly selected half. In those communities, they recruited four literate individuals to become citizen forest monitors. The monitors received training in how to record forest activities and arrange meetings to present their findings to their communities over the next year. Compared to communities who did not have citizen monitors, those that did reported significantly more checks on elite manipulation and accountability, and more information and inclusion in forest governance. However, there was no change in deforestation rates as a result of the citizen monitors.

EFFECTIVENESS

OUTCOME: People

ATTRIBUTE: Governance

EFFECT: Significantly enhanced

Evidence quality: Strong

 # Studies: 1 [96]

Cat species: Leopard

Livelihoods: Farming, pastoralism

Countries: Liberia

ConservationEvidence.com summary: Not assessed

OUTCOME: Habitat

ATTRIBUTE: Habitat Quality and Connectivity

EFFECT: None detected

Evidence quality: Strong

 # Studies: 1

Cat species: Leopard

Livelihoods: Farming

Countries: Liberia

ConservationEvidence.com summary: Not assessed

OTHER NOTES	MONITORING TOOLS
Trade-offs: There are no known trade-offs between governance based on good governance principles and other attributes or outcomes While the effect of design principles on governance was not assessed above, here the effect of good governance on governance is. It is assessed largely because the study described in the example tested the effect of one good governance principle, informed and inclusive decision-making, on another, accountability. The Elinor monitoring tool can help track the implementation of Good Governance Principles on the ground.	**Attribute:** Governance • Elinor **Attribute:** Habitat Connectivity/ Quality • Collect Earth Online • ForestWatcher • Remap
FURTHER RESOURCES	**RELATED INTERVENTIONS**
	Design Principles

GUARD DOGS

C2C Elements: Prevention

DESCRIPTION	RESOURCES REQUIRED
Guard dogs are interventions designed to prevent predators from killing livestock using dogs that are trained to protect livestock herds by chasing, scaring, or otherwise deterring predators from attacking. Dogs are often trained for this purpose and raised with the herds they will protect. When dogs detect predators approaching their herds, they will bark, snarl, and chase predators away.	• Low • Funds to breed and train dogs • Funds to provide follow-up veterinary services for dogs
EXAMPLE	**EFFECTIVENESS**
In Namibia, the Cheetah Conservation Fund breeds Anatolian shepherd dogs to protect commercial and subsistence farmers' livestock from predators[97]. All dogs are raised with livestock and placed with their herds at eight weeks of age. Between 2009-2010, they interviewed farmers to whom they had given such dogs to understand their effectiveness at reducing depredations. Compared to the year prior to receiving the dogs, farmers reported significantly fewer depredations by jackal (*Lupulella*), cheetah (*Acinonyx jubatus*), caracal (*Caracal caracal*), and baboon (*Papio*). But the dogs had no reported effect on depredations by leopards. All farmers reported ceasing the killing of cheetahs and leopards. However, more jackals were killed by farmers and dogs after the guard dogs were introduced. Further, one dog killed a cheetah, one a baboon, and one a jackal and caracal. The researchers conclude that guard dogs should be trained in how to respond to both target and non-target species, and that the dog's size relative to the target species should be considered when choosing breeds.	**OUTCOME:** Livelihoods & Assets **ATTRIBUTE:** Economic vulnerability (Livestock depredation) **EFFECT:** Somewhat reduced, depending on species and husbandry practices **Evidence quality:** Weak **# Studies:** 2 [97,98] **Cat species:** Cheetah, leopard, caracal **Livelihoods:** Subsistence and commercial livestock farming **Countries:** Namibia, Iran **ConservationEvidence.com summary:** Beneficial

OTHER NOTES	MONITORING TOOLS
Trade-offs*:* Without proper training, guard dogs can prey upon species that tigers or other predators may depend upon, as in the example above. This circumstance creates a trade-off between livelihood vulnerability and resilience and risk of injury or death to wildlife. While untrained companion dogs often accompany people traversing tiger landscapes, they are often untrained and there are few evaluations of the effectiveness of untrained companion dogs at reducing livestock depredations. Livestock guardian dogs are extensively used to prevent depredations by wild canids and bears, where evidence suggests they may be more effective than against big cats.	**Attribute:** Economic vulnerability and resilience (Livestock Depredation) • SMART • Earth Ranger
FURTHER RESOURCES	**RELATED INTERVENTIONS**
Cheetah Conservation Fund Livestock Guarding Dog Program https://cheetah.org/canada/about-us/what-we-support/livestock-guarding-dogs-program/	Artificial deterrents

INSURANCE

C2C Elements: Response, Mitigation

DESCRIPTION	RESOURCES REQUIRED
Community-based insurance is a variant of compensation payments. Rather than compensation money coming from governments, people pay into a locally-administered insurance program, which can be supplemented with tourism revenue or government contributions. When a paying participant incurs damage from wildlife, their compensation money comes from the insurance program, rather than the government.	• Low-Moderate • Funds for administration costs

EXAMPLE	EFFECTIVENESS
Mongolia's Tost Tosonbumba Nature Reserve is home to an estimated 12-19 snow leopards (*Panthera uncia*) and about 85 semi-nomadic households, each with about 210 head of livestock, including goats, sheep, camels, and horses. In 2009, the Snow Leopard Conservation Foundation and Snow Leopard Trust began supporting a community-based livestock insurance program [99]. They jointly drafted the program regulations and guidelines with livestock-owning households, and the financial resources were provided by herder premiums and contributions from external sources. A committee of local herders was organized to manage the insurance fund. Their duties included setting the premium amounts (based on livestock holdings), collecting premiums, managing accounts, maintaining the insurance register, and verifying livestock deaths and causes. Program participants also received bi-annual information on herding practices, pasture management, and conservation issues via in-person meetings. By 2018, 55 households were participating in the insurance program and the fund was receiving $4,733 USD annually from these participants, about twice what it received from external sources. Over the same period, relative to non-participants, those who paid into the insurance program reported more disapproval of retaliatory killings than non-participants, and their livestock losses to snow leopards decreased relative to non-participants. Accordingly, yearly insurance claims also decreased. 100% of reported losses were compensated in all years, and all insurance claims were paid within the given year.	**OUTCOME:** Livelihoods & Assets **ATTRIBUTE:** Economic vulnerability (livestock depredation, monetary loss) **EFFECT:** Significantly reduced **Evidence quality:** Moderate **# Studies:** 1 [99] **Cat species:** Snow leopard **Livelihoods:** Pastoralism **Countries:** Mongolia **ConservationEvidence.com summary:** Not assessed **OUTCOME:** Wildlife **ATTRIBUTE:** Risk of injury or death to wildlife (retaliatory killings) **EFFECT:** Significantly reduced **Evidence quality:** Moderate **# Studies:** 1 [99] **Cat species:** Snow leopard **Livelihoods:** Pastoralist **Countries:** Mongolia **ConservationEvidence.com summary:** Likely beneficial

OTHER NOTES	MONITORING TOOLS
Trade-offs*:* Depending on how insurance programs are administered, they can negatively affect governance effectiveness and equity. Insurance programs that are locally controlled are more likely to run efficiently and less likely to be subject to bribery.	**Attribute:** Livelihood vulnerability and resilience • Household surveys • Social impact focus groups **Attribute:** Risk of injury or death to wildlife • SMART • Earth Ranger
FURTHER RESOURCES	**RELATED INTERVENTIONS**
	• Compensation • Livelihood diversification

LAND USE PLANNING AND MANAGEMENT

C2C Elements: Understanding Interactions, Prevention

DESCRIPTION	RESOURCES REQUIRED
Land use planning and management is an intervention designed to enable more efficient and effective use of space for conservation. Planning is often based on a mix of ecological variables, like wildlife presence and habitat cover, and socio-economic variables, like people's income, vulnerability, or tolerance. With spatially-explicit data on these variables, it is possible to plan where and with whom to implement management interventions in order to maximize impact per funding spent. Land use planning and management is not an intervention by itself that will lead to measurable changes in outcomes. For this reason, its effectiveness is not assessed here. However, it will likely enable other interventions that are designed based on land use planning to be more effective than they would be otherwise.	• Moderate • Resources are needed to collect and analyze data necessary for land use planning and then to turn those data into management plans

EXAMPLE	EFFECTIVENESS
Nearly half of the Pench Tiger Reserve buffer zone, in central India, is private agricultural land. To ensure that tigers have adequate habitat for dispersal and to support a prey base, researchers wanted to understand where to prioritize an incentive-based agroforestry initiative to enhance habitat connectivity [100]. To do so, they combined camera trap data on likely habitat use by tigers, leopards (*Panthera pardus*), dholes (*Cuon alpinus*), and sloth bears (*Melursus ursinus*), with social data from a survey of farmers on their willingness to accept the initiative, and economic data on the likely cost of the program given farmers' willingness. Their approach yielded spatially-explicit maps of where the initiative could be implemented in the most cost effective way to increase habitat connectivity. It also uncovered important reasons for why certain areas were prioritized, including a negative association with tourism and a positive association with habitat cover.	Not applicable

OTHER NOTES	MONITORING TOOLS
Trade-offs: There are no known trade-offs between land use planning and management and other attributes. However, land use planning can lead conservation initiatives to overlook certain dynamics when they were not included in the planning assessment.	Not applicable
FURTHER RESOURCES	**RELATED INTERVENTIONS**
An example of land use planning related to tiger conservation in Sumatra suggests that mapping tiger habitat and ecosystem services can lead to greater forest cover, sediment retention, and carbon sequestration gains than current government plans [101].	• Predation risk maps • Prey biomass assessment

LIVELIHOOD DIVERSIFICATION

Livelihood diversification is an intervention designed to mitigate economic vulnerability and increase resilience to damages caused by wildlife by making people less reliant on one vulnerable livelihood strategy. By having multiple livelihood strategies, people can rely on other strategies when one is damaged by wildlife, therefore mitigating their overall vulnerability and increasing their economic resilience. For example, in the Greater Maasai Mara Ecosystem, Kenya, people who engage in a combination of livestock breeding, crop planting and off-farm activities, such as tourism, tend to have greater incomes than those who engage in only one or two such strategies [102]. Within livelihood diversificat ion, there are many proposed sub-interventions. Below, each is treated separately, though a summary of many interventions can be found in Dickman et al. (2011) [103]. Note that there have been very few evaluations of livelihood diversification interventions within the context of human-wildlife interactions. Thus, the interventions described below focus more on Livelihoods & Assets and Habitat outcomes. This limited evidence hinders any conclusions about whether people who have diversified their livelihoods are actually more resilient to conflict. But there is indirect evidence for this relationship given their effects on income and habitat.

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LIVELIHOOD DIVERSIFICATION 1: REVENUE-SHARING

C2C Elements: Prevention, Mitigation

DESCRIPTION	RESOURCES REQUIRED
Revenue-sharing is an intervention designed to reduce people's dependence on local forest resources by sharing revenues from tourism or other profit-generating activities associated with living near wildlife. Most often, revenue-sharing is associated with the distribution of profits to those living in and around protected areas. Note that while wildlife and ecotourism are some of the most common forms of benefit sharing, there is a noticeable lack of robust studies on whether they reduce livelihood vulnerability or even affect people's incomes.	Moderate Funds to manage the distribution of revenue from tourism or other wildlife-related profit-generating activities.
EXAMPLE	**EFFECTIVENESS**
Using temporal data on the establishment of protected areas in Costa Rica and census data between 1973 and 2000, researchers aimed to determine the mechanisms through which protected areas affect poverty alleviation, including changes in ecotourism, infrastructure, and ecosystem services [104]. They found that two-thirds of poverty reductions over that time were attributable to opportunities from ecotourism, as estimated by the establishment of nearby park entrances, with no evidence for the other mechanisms.	**OUTCOME:** People **ATTRIBUTE:** Governance **EFFECT:** Significantly increased **Evidence quality:** Weak **# Studies:** 1 [105] **Cat species:** Tiger **Livelihoods:** Farming, ecotourism **Countries:** Laos **ConservationEvidence.com summary:** Not assessed **OUTCOME:** Livelihoods & Assets **ATTRIBUTE:** Economic vulnerability **EFFECT:** Significantly reduced **Evidence quality:** Moderate **# Studies:** 3 [104–106] **Cat species:** Leopard, lion, jaguar, tiger **Livelihoods:** Farming, ecotourism **Countries:** Colombia, Peru, Bolivia, Nepal, sub-Saharan Africa, Indonesia, Bangladesh, Thailand, Laos **ConservationEvidence.com summary:** Not assessed
OTHER NOTES	**MONITORING TOOLS**
Trade-offs: There are no known trade-offs between revenue-sharing and other attributes or outcomes Note that there are very few robust studies on the impact of revenue-sharing on people's economic vulnerability. The study from Costa Rica cited here examines only poverty and proximity to parks with tourism, assuming that this proximity approximates a measure of income from ecotourism opportunities. The study from Laos has no control group, so it is unclear whether changes in income are due to the project or to some other external factor.	**Attribute:** Economic vulnerability and resilience • Household surveys • Social impact focus groups **Attribute:** Governance • Elinor

FURTHER RESOURCES	RELATED INTERVENTIONS
	• Payments for ecosystem services • Conditional and unconditional cash transfers

LIVELIHOOD DIVERSIFICATION 2: PAYMENT FOR ECOSYSTEM SERVICES

C2C Elements: Prevention, Mitigation

DESCRIPTION	RESOURCES REQUIRED
Payments for ecosystem services (PES) are interventions designed to mitigate people's use of local natural resources by substituting that use for cash payments [107]. The idea behind PES is that if people are receiving cash in hand, they will have no need to use local natural resources and will rather protect that natural resource to ensure that the payments continue. PES are the most common form of financial instrument used in conservation globally, with applications ranging to watershed restoration, carbon sequestration, and forest conservation. Payments can be calculated in several ways, including by estimating the amount of money it would take to artificially perform the same "services" as nature, such as water purification, carbon sequestration, and soil fertilization, or via survey experiments about how much money people would require to stop using natural resources. Upon verification that these ecosystem services are still being provided by nature, payments are made to the people who would have otherwise been using the natural resources that provide those services. One proposed variant of PES is a wildlife premium [108]. This premium is designed to protect large terrestrial vertebrates by embedding additional payments within PES programs depending on the recovery and maintenance of threatened fauna.	• High • Continual payments, often of a large sum over a large area • Funds to administer and monitor the payments and verification

EXAMPLE	EFFECTIVENESS
Between 2011 and 2013, researchers partnering with the Chimpanzee Sanctuary and Wildlife Conservation Trust in Uganda tested whether giving private forest owners $28, or 70,000 Ugandan shillings per hectare of forest each year reduced the amount that they cleared their forests [109]. This payment amount was calculated to equal that which forest owners may earn by selling their timber. Forest owners were randomized to either receive the payments or not, and tree cover was assessed via satellite imagery. After the two years, they found that deforestation among those who received payments was only half that of those who had not received payments, indicating that the payments significantly reduced deforestation. They also found no evidence that those who received payment began deforesting other, further forests.	**OUTCOME:** Livelihoods & Assets **ATTRIBUTE:** Economic vulnerability and resilience **EFFECT:** Unclear **Evidence quality:** Strong **# Studies:** 3 [110] **Cat species:** Leopard, jaguar **Livelihoods:** Farming, timber and non-timber forest produce **Countries:** China, Costa Rica, Mexico **ConservationEvidence.com summary:** Not assessed **OUTCOME:** Habitat **ATTRIBUTE:** Habitat Quality/ and Connectivity **EFFECT:** Significantly improved **Evidence quality:** Strong **# Studies:** 16 [110] **Cat species:** Leopard, jaguar **Livelihoods:** Farming, timber and non-timber forest produce **Countries:** Brazil, China, Colombia, Costa Rica, Mexico, Uganda **ConservationEvidence.com summary:** Not assessed

OTHER NOTES	MONITORING TOOLS
Trade-offs: There are no known trade-offs between payments for ecosystem services and other attributes or outcomes. While payments for ecosystem services can be environmentally effective, their equity is often called into question, as the procedures for how money is dispersed and its distribution are often uneven and prone to elite capture [111]. Payments for ecosystem services are most often designed in the Global North and implemented in the Global South, with little consideration given towards how to design the programs collaboratively and to reflect local contexts, including gender, power, and non-monetary values toward nature [112]. Some PES schemes attempt to pay people for change in wildlife populations. However, these are largely untested and anecdotal evidence suggests that they face similar challenges as other PES programs, including monitoring methods, governance, and the equitability of payments [113].	**Attribute:** Livelihood vulnerability and resilience • Household surveys • Social impact focus groups **Attribute:** Habitat Quality and Connectivity • Collect Earth Online • ForestWatcher • Remap

FURTHER RESOURCES	RELATED INTERVENTIONS
United Nations Framework Convention on Climate Change page on REDD+, their flagship PES program	Revenue-sharing Conditional and unconditional cash transfers

LIVELIHOOD DIVERSIFICATION 3: CONDITIONAL AND UNCONDITIONAL CASH TRANSFERS

C2C Elements: Prevention, Mitigation

DESCRIPTION

Cash transfers are interventions designed to increase people's economic resilience and reduce their dependence on local natural resources by providing them with regular cash payments [114]. Payments that are conditional usually require recipients to send their children to school and/or attend regular health checkups. Payments that are unconditional are simply given to families in the program area. The intervention is based on poverty-alleviation cash-transfer programs, which are the most equitable financial instrument to alleviate poverty. Green cash transfers (known as conservation basic income [115], when they are unconditional) target the feedback loop between environmental degradation and poverty, under the assumption that alleviating poverty will provide environmental gains[116].

RESOURCES REQUIRED

- High
- About $5.50/person/day, plus administrative fees [117].

EXAMPLE

In 2000 the Colombian government launched *Familias en Acción*, a conditional cash transfer poverty eradication program. Using time-series data comparing households who received payment and those who did not, one study found that families who received payments bought more land- and energy-intensive goods [118]. However, local deforestation rates were lower in program areas than outside of them. The study suggests that, when households have access to markets, cash transfers reduce their dependency on local resources. This finding is corroborated by studies conducted on similar programs in other countries. However, this finding also means that, where people do not have reliable market access, cash transfers result in short term environmental harm, as money is used to fund infrastructure to increase market access.

EFFECTIVENESS

OUTCOME: Livelihoods & Assets

ATTRIBUTE: Economic vulnerability

EFFECT: Significantly reduced

Evidence quality: Strong

 # Studies: 5 [118–122]

Cat species: Leopard, jaguar, tiger

Livelihoods: Farming

Countries: Brazil, Colombia, Indonesia, Mexico, Sierra Leone

ConservationEvidence.com summary: Not assessed

OUTCOME: Habitat

ATTRIBUTE: Habitat Quality and Connectivity

EFFECT: Qualified impact (significantly improved when market access exists, significantly worsened when market access does not exist)

Evidence quality: Strong

 # Studies: 5 [118–122]

Cat species: Leopard, jaguar, tiger

Livelihoods: Farming

Countries: Brazil, Colombia, Indonesia, Mexico, Sierra Leone

ConservationEvidence.com summary: Not assessed

OTHER NOTES

Trade-offs: Where market access does not readily exist, cash transfers can result in short-term harm to habitats as people use their new money to gain access to markets.

Note that cash transfers have not been used specifically to manage human-wildlife interactions. However, they have been implemented in landscapes where conflict occurs.

Cash transfers have been more extensively studied in the context of household resilience to climate change. For a review on that topic, see Agrawal et al. (2020) [123].

MONITORING TOOLS

Attribute: Economic vulnerability and resilience

- Household surveys
- Social impact focus groups

Attribute: Habitat Quality and Connectivity

- Collect Earth Online
- ForestWatcher
- Remap

FURTHER RESOURCES

World Bank on how to design cash transfer programs:

https://blogs.worldbank.org/en/developmenttalk/how-should-we-design-cash-transfer-programs

RELATED INTERVENTIONS

- Revenue-sharing
- Payments for ecosystem services

LIVESTOCK ENCLOSURES AND FENCES

C2C Elements: Prevention

DESCRIPTION

Livestock enclosures and fences are interventions designed to create physical barriers that prevent predators from being able to prey upon livestock. Often, enclosures are used as a place for livestock to remain while they are not being grazed. Sometimes, the fences enclose a larger space where livestock can graze without risk of encountering predators. Enclosures and fences can also be electrified or reinforced so they are more likely to deter predators, and can be accompanied by artificial deterrents.

RESOURCES REQUIRED

- Moderate
- Funds for construction materials
- Funds for staff to design and install enclosures/fences
- Funds for maintaining enclosures/fences

EXAMPLE

Between 2014 and 2016, researchers worked in the Tost Mountains of Mongolia to test the effectiveness of tall fences around night-time corrals at reducing livestock depredation by snow leopards [124]. They built 2 meter high fences with an electric wire at the top. Before building fences, farmers reported a mean loss of 3.9 sheep and goats during winter nights, when livestock were kept in corrals. After the fences were built, losses reduced to 0. Losses remained constant during the summer and when livestock were not night-time corralled, suggesting the reduced livestock losses were specifically due to the fences.

EFFECTIVENESS

OUTCOME: Livelihoods & Assets

ATTRIBUTE: Economic vulnerability (Livestock depredation)

EFFECT: Significantly reduced

Evidence quality: Moderate

 # Studies: 68 [38,124–127]

Cat species: Tiger, all big cat species, and non-cat species

Livelihoods: Farming, pastoralism

Countries: Many Asian countries, all Africa, Colombia

ConservationEvidence.com summary: Likely beneficial

OTHER NOTES	MONITORING TOOLS
Trade-offs: Enclosures and fences can create a trade-off with habitat connectivity. Sometimes, the extent of the fences can be so great that wildlife movement is constrained [128]. This has happened in the Greater Masai Mara Ecosystem, Kenya,[129] where property fences have greatly reduced habitat connectivity and the ability of migrating animals to traverse the landscape. While livestock enclosures and fences are widely used to protect livestock in tiger landscapes, very few case studies have actually evaluated their effectiveness in such contexts.	**Attribute:** Economic vulnerability (Livestock depredation) • SMART • EarthRanger
FURTHER RESOURCES	**RELATED INTERVENTIONS**
	Artificial deterrents Guard dogs

OVERPASSES AND UNDERPASSES (WILDLIFE CROSSINGS)

C2C Elements: Prevention

DESCRIPTION	RESOURCES REQUIRED
Wildlife overpasses and underpasses, also known as crossing structures, are interventions designed to prevent the risk of injury or death to wildlife from collisions with vehicles while crossing linear infrastructure, like roads and railways, by building structures over or under such infrastructure that allow animals to cross safely. Overpasses and underpasses can be designed in many different ways, including with or without vegetation, and be of different sizes to accommodate different species. There are no systematic evaluations of the effectiveness of overpasses and underpasses on reducing collisions with wildlife [130], but there are numerous studies documenting their use by multiple species, including in tiger landscapes [131].	• High • Funds needed to plan, design, construct, and maintain large-scale infrastructure.
EXAMPLE	**EFFECTIVENESS**
National Highway 44 runs through Pench Tiger Reserve in central India and includes 16 underpasses. Using camera traps placed on and around the underpasses, researchers assessed the species richness and behavior of animals crossing the structures [131]. They found the tigers and dholes preferred using overpasses that were closer to the protected area, while small mammals and ungulates preferred those with proximal vegetation. Importantly, they found that the movement rate for most animals was similar when crossing the structures and when in adjacent habitat, suggesting that overpasses did not significantly alter their stress or alertness.	**OUTCOME:** Wildlife **ATTRIBUTE:** Risk of injury or death to wildlife (collision) **EFFECT:** Unknown **OUTCOME:** Habitat **ATTRIBUTE:** Habitat connectivity **EFFECT:** Unknown **Evidence quality:** None **# Studies:** 0 **Cat species:** NA **Livelihoods:** NA **Countries:** NA **ConservationEvidence.com summary:** Not available

OTHER NOTES	MONITORING TOOLS
Trade-offs*:* There are no known trade-offs between wildlife overpasses and underpasses and other attributes or outcomes.	**Attribute:** Risk of injury or death to wildlife • SMART • EarthRanger
FURTHER RESOURCES	**RELATED INTERVENTIONS**
For design specifications of overpasses and underpasses used in the United States, see the US Federal Highway Administration's Wildlife Crossing Structure Handbook: Design and Evaluation in North America	Land use planning

PREDATION RISK MAPS

C2C Elements: Understanding Interactions, Prevention

DESCRIPTION	RESOURCES REQUIRED
Predation risk maps are interventions designed to prevent attacks on people or livestock by visualizing where on the landscape such attacks are most likely to occur and by avoiding, or taking certain management measures in, those areas. Predation risk maps are often produced using records of previous attacks, but can also be based on camera trapping data of tiger, prey, and human activity. Note that there have been no systematic attempts to evaluate the effectiveness of predation risk maps at preventing human-wildlife conflict. Predation risk maps largely enable the spatial prioritization of other interventions and thus their effect is indirect. See the discussion in Miller (2015) [132] for examples of how predation risk maps have been used to influence intervention and/or policy design.	• Low-Moderate • Depending on the data source, funds will be needed either to access conflict records, or to conduct camera trapping • Funds for data analysis and mapping
EXAMPLE	**EFFECTIVENESS**
In Northeast China, researchers wanted to be able to predict the occurrence of Amur tigers and their depredations on livestock [133]. They collected data on livestock depredations from the regional government and deployed camera traps to measure tiger occurrence. They found that tiger occurrence was best predicted by prey availability and that prey were more common further from human settlements. However, livestock depredations happened closer to human settlements, suggesting that when tigers stray from their normal range and find fewer prey species, they will prey on livestock. With these results, they recommended that regulations on human activity should correspond to risk zones, that cattle management should improve to avoid times and places when tigers are most active, and that prey populations should be augmented through reintroduction, supplemental feeding, and the clearing of snares.	Not applicable
OTHER NOTES	**MONITORING TOOLS**
Trade-offs: There are no known trade-offs between predation risk mapping and other attributes or outcomes.	Not applicable
FURTHER RESOURCES	**RELATED INTERVENTIONS**
See the ESRI ArcMap Tutorial on creating a heatmap, which are often used to visualize predation risk spatially https://doc.arcgis.com/en/insights/latest/create/heat-maps.htm	• Land use planning and management • Prey biomass assessment

PREDATOR ALERT SYSTEMS

C2C Elements: Prevention

DESCRIPTION	RESOURCES REQUIRED
Predator alert systems are interventions designed to notify people of a nearby approaching predator. Approaching predators are typically identified through one or a combination of the of the following methods: (1) a radio/GPS collared animal moves crosses a geofence, an invisible border surrounding a settlement, (2) an animal is photographed and identified by an AI-assisted camera trap near to a settlement, or (3) hired spotters scan areas around a settlement. After being identified, an automated message is sent either to everyone in the relevant community urging them to avoid the area where the animal was identified, or to a subset of trained response teams who take further action to reduce the likelihood of direct encounters with the animal.	• High • Funds and expertise to purchase and operate in the long-term either radio/GPS collars, AI-assisted camera traps, or trained spotters • Funds to hire a permanent project manager to ensure the system operates correctly
EXAMPLE	**EFFECTIVENESS**
Working with the state forest departments, researchers deployed 12 AI-assisted camera traps in the Kanha-Pench corridor of central India, and 7 in Dudhwa Tiger Reserve, northern India.[134] All were placed along forest trails or roads within 1 kilometer of the forest-agriculture edge. Researchers and officials were alerted via email or push notification within 30-42 seconds of the camera traps being triggered and the AI classifying the image as containing a tiger. After officials reviewed the images, they would message village heads if they noted anything of particular concern about the approaching animal. The sample size was too small to determine whether there was any significant reduction in human-tiger interactions. Other studies with lions have shown increased tolerance, reduced livestock losses, and fewer negative interactions.	**OUTCOME:** People **ATTRIBUTE:** Tolerance **EFFECT:** Significantly increased **ATTRIBUTE:** Risk of injury or death to people **EFFECT:** Significantly reduced **OUTCOME:** Livelihoods & Assets **ATTRIBUTE:** Economic vulnerability **EFFECT:** Significantly reduced **Evidence quality:** Moderate **# Studies:** 3 [134–136] **Cat species:** Tiger, lion, and non-cat species **Livelihoods:** Farming, pastoralism **Countries:** India, Botswana **ConservationEvidence.com summary:** Insufficient data

OTHER NOTES	MONITORING TOOLS
Trade-offs: Depending on how such a system is implemented, it may reduce or increase trust in external organizations and psychological vulnerability. AI-assisted camera traps and hired spotters may make people feel like they are under surveillance. To mitigate this feeling, all studies that have used such systems have also implemented educational programs and/or co-designed the intervention with the affected communities.	**Attribute:** Tolerance • Household surveys • Social impact focus groups • Wildlife Tolerance Model **Attribute:** Risk of injury or death to people • Household surveys • Social impact focus groups • SMART • EarthRanger **Attribute:** Economic vulnerability and resilience • Household surveys • Social impact focus groups
FURTHER RESOURCES	**RELATED INTERVENTIONS**
Global Conservation TrailGuard AI-assisted camera trap: https://globalconservation.org/trailguard-ai	• Wildlife Guardians • Education and outreach


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PREY AUGMENTATION

C2C Elements: Prevention

DESCRIPTION	RESOURCES REQUIRED
Prey augmentation is an intervention designed to increase the population of prey species so that tigers will rely less on livestock for food, thereby reducing both economic costs to owners and the risk of harmful encounters between humans and tigers. It has long been established that prey abundance can predict tiger densities [24] and that livestock can make up a significant proportion of tigers' diets [137]. Thus, the guiding idea behind this intervention is that if there are more readily available wild prey species, tigers will substitute them for livestock in their diets, thereby reducing conflict events. However, this intervention has not been systematically tested in tiger landscapes.	• High • Funds for sourcing and relocating potentially large numbers of prey species, including veterinarian, transportation, and logistical costs
EXAMPLE	**EFFECTIVENESS**
To reduce puma (*Puma concolor*) and jaguar cattle depredation on a ranch in Sonora, Mexico, researchers sought to increase wild prey populations by translocating peccaries (*Pecari tajacu*) and establishing feeding stations for white-tailed deer (*Odocoileus virginianus*) in and around the ranch [138]. In a before-after design, they used scat samples to estimate diet and camera traps to estimate relative prey abundance. Compared to the eight-month period before prey augmentation, they noted significant increases in puma and jaguar preferences for wild prey, a reduction of 65% in the percentage of livestock remains in scat, a significant increase in relative prey abundance of deer, and no change in the relative abundance of peccaries. However, the lack of change in relative peccary abundance was partly due to the fact that puma and jaguar preference for peccaries increased significantly, meaning that they were eating more peccaries than earlier.	**OUTCOME:** Livelihoods & Assets **ATTRIBUTE:** Economic vulnerability (livestock depredation) **EFFECT:** Significantly reduced **OUTCOME:** Wildlife **ATTRIBUTE:** Population (prey) **EFFECT:** Significantly increased **Evidence quality:** Weak **# Studies:** 1 [138] **Cat species:** Puma, jaguar **Livelihoods:** Cattle ranching **Countries:** Mexico **ConservationEvidence.com summary:** Insufficient data
OTHER NOTES	**MONITORING TOOLS**
Trade-offs: There are no known trade-offs between prey augmentation and other attributes along the conflict and coexistence spectrums. Prey augmentation has been conducted, but not thoroughly evaluated in tiger landscapes. See WWF-Malaysia's call to give prey augmentation more attention.	**Attribute:** Economic vulnerability (livestock depredation) • Household surveys • SMART • EarthRanger **Attribute:** Population dynamics (prey) • SMART • EarthRanger
FURTHER RESOURCES	**RELATED INTERVENTIONS**
	Prey biomass assessment

PREY BIOMASS ASSESSMENT

C2C Elements: Understanding Interactions

DESCRIPTION	RESOURCES REQUIRED
Prey biomass assessments are interventions designed to understand how many tigers a landscape can support based on the available prey there. As such, they are not interventions designed to have a direct effect on tiger or prey populations, but can provide needed information to plan other interventions that might be suitable. Prey biomass assessments are typically done by measuring prey species abundance, either through camera trapping or transect surveys, and then calculating how many tigers could be supported by those prey species, using established models of tiger feeding needs.	• Moderate • Funds needed to train staff in how to conduct biomass surveys • Funds needed for survey equipment
EXAMPLE	**EFFECTIVENESS**
In the early 2000s, it was unknown whether Amur tigers existed in the eastern Wanda Mountains, China. To estimate how many tigers the landscape could support, researchers conducted line transect surveys to measure the density and abundance of three key tiger prey species: roe deer, red deer, and wild boar [139]. Using established models of the mass of each prey species and how much biomass tigers need to eat, they estimated that prey biomass was far below what was needed to support a healthy population of tigers. Further, between 2002 and 2008, the researchers found that these prey species declined by 40-45%, largely due to poaching.	Not applicable
OTHER NOTES	**MONITORING TOOLS**
Trade-offs: There are no known trade-offs between prey biomass assessments and other attributes or outcomes.	Not applicable
FURTHER RESOURCES	**RELATED INTERVENTIONS**
	• Land use planning and management • Predation risk maps • Prey augmentation

RAPID RESPONSE TEAMS

C2C Elements: Response

DESCRIPTION	RESOURCES REQUIRED
Rapid response teams are interventions designed to respond to situations in which tigers have moved within close proximity to areas of human activity by organizing and training a group of people who know how to respond properly to protect people and their livelihoods and chase away animals. Similar to Wildlife Guardians, the response teams will alert people to nearby approaching predators, instruct people on how to react, conduct crowd control, and attempt to deter the animal from approaching any further. Note that no systematic attempts to evaluate rapid response teams were found, and thus their effectiveness is unknown.	• Low • Funds to train volunteer groups
EXAMPLE	**EFFECTIVENESS**
In the Bangladeshi Sundarbans, where human-tiger conflict is relatively frequent, the NGO WildTeam organized volunteer groups called Village Tiger Response Teams (VTRTs) [140]. They trained groups of villagers in how to respond when a tiger approached a village. VTRTs are available via a 24-hour hotline. When a tiger nears a village, VTRTs are called to manage crowds to prevent them from harassing or killing the tiger, and they try to drive the tiger away with firecrackers or other deterrents. They also call the local Forest Department to come and assist with safely trapping the tiger and releasing it elsewhere. VTRT members are not paid any compensation, but derive some status and prestige from their peers for being part of the group. As of 2018, 49 teams totaling 340 people cover 80% of border villages in four Sundarban ranges.	**OUTCOME:** People **ATTRIBUTE:** Risk of injury or death to people **EFFECT:** Unknown **OUTCOME:** Wildlife **ATTRIBUTE:** Risk of injury or death to wildlife **EFFECT:** Unknown **Evidence quality:** NA **# Studies:** NA **Cat species:** NA **Livelihoods:** NA **Countries:** NA **ConservationEvidence.com summary:** Not assessed
OTHER NOTES	**MONITORING TOOLS**
Trade-offs: There are no known trade-offs between rapid response teams and other attributes or outcomes.	**Attribute:** Risk of injury or death to people/wildlife • SMART • Earth Ranger
FURTHER RESOURCES	**RELATED INTERVENTIONS**
Equator Initiative Page for WildTeam's Village Tiger Response Team: https://www.equatorinitiative.org/2020/04/24/solution10986/	Wildlife Guardians

REMOVAL OF INDIVIDUAL ANIMALS INVOLVED IN CONFLICT

C2C Elements: Mitigation

DESCRIPTION	RESOURCES REQUIRED
Removing individual animals involved in conflict is an intervention designed to mitigate further harm to people or wildlife after conflict has occurred by separating the two, ideally permanently. Removal often involves baiting and capturing and/or tranquilizing the concerned animal and safely moving it either to another, further habitat or keeping it in captivity. Often, this intervention assumes either that there are simply too many people and wildlife living in close proximity, or that certain individual animals are injured or sick and thus attack people or livestock because they are unable to survive on wild prey. Removal can be effective when animals are kept in captivity, but this intervention is particularly ineffective when animals are moved to other habitats.	• High • Estimated at $3,756 per individual animal [141].
EXAMPLE	**EFFECTIVENESS**
Between 2001 and 2003, the Junnar Forest Division in Maharashtra, India, began a translocation campaign to move leopards that had attacked people to forests about 40 km away. During this period, they removed 29 leopards. Prior to the translocation campaign, between 1993 and 2001, leopard attacks on humans happened about 4 times per year, on average. After the campaign began, leopards attacked 17 people per year, on average. The program was stopped in 2003. Researchers analyzing these data found that attacks were less likely the further a leopard was moved, that attacks were more likely to be lethal when more leopards had been moved to the same area, and attacks were more likely where leopards from multiple locations had been moved [142].	**OUTCOME:** People **ATTRIBUTE:** Risk of injury or death to people **EFFECT:** Significantly increased **Evidence quality:** Weak **# Studies:** 13 [141–143] **Cat species:** Jaguar, leopard, lion, puma, tiger **Livelihoods:** Farming, pastoralism, urban employment **Countries:** India, North America, sub-Saharan Africa **ConservationEvidence.com summary:** Likely harmful
OTHER NOTES	**MONITORING TOOLS**
Trade-offs: There are no known trade-offs between the removal of individual animals involved in conflict and other attributes or outcomes. Massei et al. (2010) [144] highlight several problems facing translocations as a conflict mitigation tool, including animal mortality due to stress, extreme dispersal after translocation, malnutrition, dehydration, and decreased immunocompetence. They recommend that if translocations are to take place, animals should first be put in acclimatization pens and given food and shelter and later health monitoring after release into the wild.	**Attribute:** Risk of injury or death to people • SMART • Earth Ranger
FURTHER RESOURCES	**RELATED INTERVENTIONS**

WILDLIFE GUARDIANS

C2C Elements: Prevention, Response

DESCRIPTION

Wildlife guardians is an intervention designed to decrease livestock depredations and retaliatory killings of predators, and increase tolerance of living near wildlife. To do so, leaders from the affected communities are hired to perform three roles. First, upon hearing of a proposed attempt to retaliate against predators, they try to dissuade their peers by emphasizing potential tourism revenue, possible arrest, and, in some cases, exclusion from compensation programs. Second, to reduce livestock depredations, they help reinforce livestock enclosures, retrieve lost livestock, and inform their peers about nearby predator movement. Third, they help monitor predator movement using traditional and telemetry/camera trap methods.

RESOURCES REQUIRED

- Moderate
- Funds to employ leaders long-term
- Funds for staff and materials to train leaders in literacy and animal movement data collection
- Funds for associated monitoring equipment
- Possible associated compensation funds
- Administrative funds

EXAMPLE

In three communities of northwest Zimbabwe, conservationists developed the Long Shields Community Guardian program to reduce livestock depredations by lions (*Panthera leo*) and associated retaliatory killings [145]. They recruited 14 farmers, selected in consultation with leaders among the local community, who all had previous experience chasing away lions, were literate, lived locally, and were respected by their peers. These farmers were trained in lion tracking, radio/GPS telemetry, and herding and livestock enclosure fortification. Twenty-one lions from 9 nearby prides were fitted with radio/GPS collars, which recorded locations every 2 hours. When a collar recorded a point within 3km of a settlement, the Community Guardians would send a mobile message to their peers alerting them of the presence, and then attempt to deter the lions from approaching further by chasing them while blowing horns. Compared to before the program's implementation, the livestock losses significantly reduced in two of the three communities and increased in the third. Retaliatory killings reduced by 41% overall.

EFFECTIVENESS

OUTCOME: People

ATTRIBUTE: Tolerance

EFFECT: Significantly increased

OUTCOME: Livelihoods & Assets

ATTRIBUTE: Economic vulnerability (livestock depredations)

EFFECT: Somewhat reduced

OUTCOME: Wildlife

ATTRIBUTE: Risk of injury or death to wildlife (retaliatory killings)
EFFECT: Significantly reduced

Evidence quality: Moderate

 # Studies: 3 [67,145,146]

Cat species: African lion

Livelihoods: Pastoralists, farmers

Countries: Kenya, Zimbabwe

ConservationEvidence.com summary: Not available

OTHER NOTES

Trade-offs: There are no known trade-offs between Wildlife Guardians interventions and other attributes along the conflict and coexistence spectrums.

Wildlife Guardian interventions have not been tested in tiger landscapes, and thus their suitability there is currently unknown. They have primarily been implemented in sub-Saharan Africa to reduce livestock depredation by lions and associated retaliatory killings. Retaliatory killings of tigers are often not solely due to the need for retribution, but due to a combination of risk perceptions, perceived failings of authorities to deal with livestock depredations, and perceived personal rewards, such as status and money [14,23].

The Wildlife Guardian interventions that have been tested were preceded by exploratory research aimed at understanding correlates of livestock depredation and retaliatory killings [147,148]. Such research is especially important for understanding whether Wildlife Guardians is an appropriate intervention for any given site.

Behavior change disclaimer: Wildlife Guardians interventions are effectively behavior change interventions. As with most behavior change programs, Wildlife Guardians is guided by the assumptions that local behavior is a primary threat to the species of interest and that it is appropriate for outside conservationists to change that behavior. Many times, one or both of these assumptions do not hold true [149,150]. Thus, when deciding whether to implement a Wildlife Guardians intervention, careful consultation with the affected Indigenous People and local communities must be done to ensure that the factors influencing their behavior are accounted for and that they give their consent for the program to be implemented [151].

MONITORING TOOLS

Attribute: Tolerance

Wildlife Tolerance Model

Attribute: Economic vulnerability and resilience (livestock depredations)

- SMART
- EarthRanger
- Household Surveys

Attribute: Risk of injury or death to wildlife (retaliatory killings)

- SMART
- EarthRanger

FURTHER RESOURCES

Lion Guardians website: www.lionguardians.org

FAO/IUCN Long Shields Community Guardians case study: https://openknowledge.fao.org/server/api/core/bitstreams/9c799fb9-afec-4305-ab90-eae87ab9644e/content

RELATED INTERVENTIONS

- Predator alert systems
- Rapid response teams

MONITORING TOOLS

Information in monitoring tool summaries. Rather than interventions, this section on monitoring summarizes nine monitoring tools that can be used to track changes in the attributes and outcomes along the conflict and coexistence spectrums over time. These tools are all freely available from different organizations and publications. The monitoring tool summaries include descriptions of the tools, what outcomes and attributes they measure, their strengths and limitations, with what software platform they work, their availability, a brief description of their data privacy and ownership policies, and a list of the organizations that support them. Some, but not all, of the tools are supported by dedicated online platforms. Similarly, some tools include specific indicators to measure, while others only provide a platform within which to measure indicators collaboratively chosen by the practitioner team and the affected Indigenous People and local communities.

Determining whether an attribute or site is on the coexistence or conflict spectrums. Importantly, the monitoring tool summaries also provide guidance on how the tools can be used to identify where a given attribute is on the conflict or coexistence spectrums. The basic method for doing so is similar across each monitoring tool: Baseline data are collected, those data are used to identify attributes that need addressing, an intervention is planned and implemented to address those attributes, and further monitoring is conducted after implementation. If that attribute and others show improvement after the intervention, it is likely that the attribute is on the coexistence spectrum. If that attribute and others show deterioration, it is likely that the attribute is on the conflict spectrum. Remember that the coexistence and conflict spectrums are defined by feedbacks. If an improvement in one attribute makes it more likely that other attributes will show improvement after an intervention, then that site is on the coexistence spectrum. Conversely, if a deterioration in one attribute makes it more likely that other attributes will deteriorate after an intervention, then that site is on the conflict spectrum.

Participatory monitoring. All the tools summarized below can be implemented in a participatory way that weaves scientific, indigenous, and local knowledge together. Doing so is important for respecting and maintaining Indigenous Peoples' and local communities' rights to their own knowledge. But further, the weaving of different types of knowledge through collaborative and participatory processes can lead to improvements in data quality and quantity [152], and collaboratively-produced knowledge is more often used in environmental decision-making than knowledge generated otherwise [153]. In some cases, such as the Wildlife Guardians intervention summarized above, participatory monitoring can itself be an intervention to promote tolerance to wildlife presence. However, participatory monitoring is not a panacea for evaluating and learning from past efforts. The development and selection of indicators to monitor entails navigating questions of identity and positionality, scale, socio-ecological complexity, and social norms [154]. Community monitors can also face personal risks in contexts where monitoring puts them in danger or at risk of political persecution [155]. For further resources on participatory monitoring, see Sigouin et al. (2025) [156]. For examples of participatory big cat monitoring, see Dolrenry et al. (2016) [152] for lions (*Panthera leo*) in Kenya, Lavariega et al. (2020) [157] for jaguars in Mexico, and Dickman et al. (2025) [158] for community camera trapping.

Note that this section does not cover the technical aspects of designing and conducting an effective monitoring program. Sampling strategies, data collection frequency, and data analysis, among others, will vary by the project goals and the monitoring tools being used. Most of the monitoring tools summarized here include guidance and/or tutorials on these technical details. Broad overviews of monitoring designs and approaches can also be found in the published literature [159–162].

Monitoring tools that apply to People and Livelihoods & Assets attributes are presented first (Elinor, Household Surveys, Social Impact Focus Groups, Wildlife Tolerance Model), followed by those that apply to Wildlife attributes (EarthRanger, SMART), and Habitat attributes (Collect Earth Online, ForestWatcher, Remap). None of these monitoring tools can measure all attributes described in this roadmap, and many are complementary. Thus, the choice of which monitoring tool to use should be driven by need, applicability, and available expertise.

ELINOR

C2C Elements: Monitoring

DESCRIPTION	OUTCOMES AND ATTRIBUTES
Elinor (www.elinordata.org) [94] is a monitoring tool designed to help gather, store, share, and use governance and management data for any conservation area. The tool includes an assessment of 35 questions grouped into 10 attributes. These questions are based on environmental governance theory and practitioner experience. The questions can be answered either through focus groups with relevant rights-holders and stakeholders, or through a desk-based assessment by a knowledgeable person. The tool allows users to store and visualize these data, as well as share them with other Elinor users, if desired. Based on data collected, Elinor gives scores that help users assess which dimensions of governance and management they may need to focus on. Elinor is part of the Social Monitoring and Evaluation Toolkit, developed by WWF-US.	**Outcome:** People **Attribute:** Governance
STRENGTHS	**PLATFORM**
Available in seven languages (English, French, Spanish, Portuguese, Kiswahili, Bahasa Indonesia, Malagasy) • Works offline • Simple interface • Creates automated reports • Training videos and materials available on website	• Mobile • None • Desktop • Any web browser
LIMITATIONS	**AVAILABILITY**
• Only assesses governance and management attributes • No dedicated mobile application	• www.elinordata.org • Open-source • Free
DATA OWNERSHIP AND PRIVACY	**ORGANIZATIONAL SUPPORT**
Data are user-owned and protected	WWF-US
MONITORING ALONG THE COEXISTENCE AND CONFLICT SPECTRUMS	
Elinor includes a custom scoring system that can be used to identify where along the coexistence and conflict spectrums a given site may lie. Each assessment question is scored 0-3, each attribute is scored 0-10, and each overall assessment is scored 0-100, all with the higher numbers indicating a better score. To identify whether a given site is on either the conflict or coexistence spectrum, first conduct one Elinor assessment. Using the results of that assessment, identify what attributes of governance and management require attention and then plan and implement an intervention to address them. Then conduct another Elinor assessment. If the target attributes showed improvement and other attributes of governance and management stayed the same or also showed improvement, it is likely that governance is on the coexistence spectrum. Conversely, if the target attributes stayed the same or declined and other attributes did the same, it is likely that governance is on the conflict spectrum.	

HOUSEHOLD SURVEYS

C2C Elements: Monitoring	
DESCRIPTION	**OUTCOMES AND ATTRIBUTES**
Household Surveys (HSs) refers to a specific survey instrument developed by WWF-US as part of their Social Monitoring and Evaluation Toolkit. HSs do not have an accompanying digital platform, but there is a guide on how to administer them, including sampling and how questions can be mixed and matched to measure specific attributes. The HSs measure diverse indicators, including social and economic well-being, education, livelihood diversification, social and financial capital, perceived impacts of conservation interventions, and perceived ecosystem condition.	**Outcome:** People **Attribute:** Psychological vulnerability and resilience; Risk of injury or death to people; Governance **Outcome:** Livelihoods & Assets **Attribute:** Economic vulnerability and resilience
STRENGTHS	**PLATFORM**
• Captures a diverse array of social indicators • Allows tracking of indicators over time • Facilitates comparison between households or other areas that are using the same HSs	No digital platform, though extensive how-to guide is available
LIMITATIONS	**AVAILABILITY**
• Requires time and effort to implement • Can neglect differences within households	Contact WWF Global Science for access Free
DATA OWNERSHIP AND PRIVACY	**ORGANIZATIONAL SUPPORT**
Data are user-owned and protected	WWF-US
MONITORING ALONG THE COEXISTENCE AND CONFLICT SPECTRUMS	
Household Surveys include methods to calculate indices for various attributes, including livelihood vulnerability, governance, and others. These indices are scored 0-10, with 10 being best and 0 being worst (they can be found in the Appendix of this linked document). To identify whether a given site is on either the conflict or coexistence spectrum, first administer one Household Survey. Using the results of that survey, calculate the appropriate indices and then plan and implement an intervention to address any identified shortcomings. Then conduct another survey and again calculate the appropriate indices. If the target attributes showed improvement and other attributes from the survey stayed the same or also showed improvement, it is likely that these attributes are on the coexistence spectrum. Conversely, if the target attributes stayed the same or declined and other attributes did the same, it is likely that these attributes are on the conflict spectrum.	

SOCIAL IMPACT FOCUS GROUPS

C2C Elements: Monitoring	
DESCRIPTION	**OUTCOMES AND ATTRIBUTES**
Social Impact Focus Groups (SIFGs) are monitoring tools designed to elicit ways in which conservation interventions may be affecting people that are not captured by other social monitoring tools, such as people's perceptions of the impact of conservation activities, their experience with projects, and how they think they could be improved. SIFGs do not have an accompanying digital platform, but a guide on how to run them is available from WWF-US, as part of their Social Monitoring and Evaluation Toolkit. The guide details how to select participants, how to run the focus groups, and what questions to ask. SIFGs are best used in combination with other social monitoring tools because they may not allow practitioners to track monitoring indicators overtime, but are the best way to understand emerging issues that are not covered by other tools.	**Outcome:** People **Attribute:** Psychological vulnerability and resilience; Tolerance; Risk of injury or death to people; Governance **Outcome:** Livelihoods & Assets **Attribute:** Economic vulnerability and resilience
STRENGTHS	**PLATFORM**
• Provides data that may not be captured by other monitoring tools, particularly emergent issues with planned or ongoing conservation interventions. • Relatively rapid, low-cost data collection.	No digital platform, though extensive how-to guide is available
LIMITATIONS	**AVAILABILITY**
• Requires trained facilitators/moderators. • Not reliable for tracking the same indicators over time.	Contact WWF Global Science for access Free
DATA OWNERSHIP AND PRIVACY	**ORGANIZATIONAL SUPPORT**
Data are user-owned and protected	WWF-US
MONITORING ALONG THE COEXISTENCE AND CONFLICT SPECTRUMS	
Social Impact Focus Groups do not provide quantitative data that enable measuring progress along the coexistence or conflict spectrums. However, they will be especially useful for understanding the results of other monitoring tools. For instance, if EarthRanger is indicating a high rate of negative wildlife encounters, social impact focus groups could be used to understand why those rates are so high, what is and is not working with particular interventions, and what other interventions could be useful. Social impact focus groups are unique among other monitoring tools in their ability to explain the reasons behind other quantitative results.	

WILDLIFE TOLERANCE MODEL

C2C Elements: Monitoring

DESCRIPTION	OUTCOMES AND ATTRIBUTES
The Wildlife Tolerance Model [163] is a framework and accompanying survey to identify drivers of people's tolerance for living with potentially harmful wildlife. It consists of three main components: (1) socio-demographics, (2) an inner model that measures 11 variables related to people's values, norms, emotions, and interest in wildlife, and (3) an outer model that measures people's experience, exposure, and meaningful events with wildlife, as well as monetary and non-monetary costs and benefits of living near wildlife. The survey is typically done in-person and requires large sample sizes to adequately assess drivers of tolerance.	**Outcome:** People **Attribute:** Psychological vulnerability and resilience; Tolerance; Risk of injury or death to people; Governance **Outcome:** Livelihoods & Assets **Attribute:** Economic vulnerability and resilience
STRENGTHS	**PLATFORM**
• Extensive survey measures many attributes and relates them to people's tolerance of wildlife • Peer-reviewed and tested in several places	No digital platform. Survey is done in-person
LIMITATIONS	**AVAILABILITY**
• No training materials or platform • Time and effort intensive • Only available in English • No organizational support	Available in the supporting information for Kansky et al. (2021) [164] Free
DATA OWNERSHIP AND PRIVACY	**ORGANIZATIONAL SUPPORT**
Data are user-owned and protected	None
MONITORING ALONG THE COEXISTENCE AND CONFLICT SPECTRUMS	
The Wildlife Tolerance Model (WTM) includes several indicators to measure each attribute, but its strength lies in how it connects these indicators to tolerance. To identify whether a given site is on the conflict or coexistence spectrum, first administer one WTM survey. Using the results of that survey, analyze how those indicators relate to tolerance, following examples in the cited papers and then plan and implement an intervention to address any indicators negatively associated with tolerance. Then conduct another WTM survey and again perform the same analysis. If the target indicators showed improvement and other attributes from the survey stayed the same or also showed improvement, it is likely that these attributes are on the coexistence spectrum. Conversely, if the target attributes stayed the same or declined and other attributes did the same, it is likely that these attributes are on the conflict spectrum. If the resources or expertise do not exist to perform the analysis, the raw results from each indicator can be used to identify possible issues to address and where on the spectrums the given area may lie.	

EARTHRANGER

C2C Elements: Monitoring

DESCRIPTION	OUTCOMES AND ATTRIBUTES
EarthRanger (www.earthranger.com) [165] is a web and mobile application that integrates observations, such as animal tracks or poaching events, with vector spatial data (point and polygon). It can integrate and analyze, in near-real time, data from over 100 sources, such as Garmin devices, GPS collars, Global Forest Watch, and Google Earth Engine assets. Through built-in 'analysers', EarthRanger can analyze and send alerts based on (i) animal immobility, (ii) animal proximity, (iii) low-speed, (iv) geofencing, (v) Google Earth Engine, and (vi) silence (when a device fails to report data within a defined period). It is particularly suited to wildlife movement monitoring and protected area management. EarthRanger does not include any pre-designed surveys or indicators, but can accommodate many types of data.	**Outcome:** People **Attribute:** Risk of injury or death to people; Governance (compliance) **Outcome:** Livelihoods & Assets **Attribute:** Economic vulnerability and resilience (livestock depredations) **Outcome:** Wildlife **Attribute:** Population; Risk of injury or death to wildlife **Outcome:** Habitat **Attribute:** Quality
STRENGTHS	**PLATFORM**
Regular online training sessions (https://support.earthranger.com/en_US/earthranger/training-registration) Fast integration of data from multiple sources Mobile application works offline Ideal for Predator Alert Systems based on GPS collars and geofences (can send notifications automatically, if needed)	• Mobile • iOS • Android • Desktop • Any web browser
LIMITATIONS	**AVAILABILITY**
Most tools are focused on wildlife population and movement monitoring, with few applications beyond that and poaching Extensive configuration required for deployment (but the Allen Institute for AI provides free assistance for conservation, ecological monitoring, and protected area management)	• www.earthranger.com • Open-source • Free
DATA OWNERSHIP AND PRIVACY	**ORGANIZATIONAL SUPPORT**
Data are user-owned and protected	Allen Institute for Artificial Intelligence (https://allenai.org)

MONITORING ALONG THE COEXISTENCE AND CONFLICT SPECTRUMS	
EarthRanger does not include any built-in indicators that can easily identify whether a given site is on the coexistence or conflict spectrum. Rather, practitioners will need to decide benchmarks for each of their indicators that would suggest what counts as acceptable or unacceptable. For example, it will be up to practitioners to decide how many breaches of a geofence or how much poaching paraphernalia is acceptable. With these benchmarks, practitioners can use EarthRanger similarly to other monitoring tools. First, start tracking data with EarthRanger and collect enough for an adequate baseline. Based on the data, identify any pertinent attributes to address and then plan and implement an intervention to do so. Then continue collecting data via EarthRanger. If the target attributes showed improvement and other attributes being monitored stayed the same or also showed improvement, it is likely that these attributes are on the coexistence spectrum. Conversely, if the target attributes stayed the same or declined and other attributes did the same, it is likely that these attributes are on the conflict spectrum.	

SMART

C2C Elements: Monitoring

DESCRIPTION	OUTCOMES AND ATTRIBUTES
The Spatial Monitoring and Reporting Tool (SMART; www.smartconservationtools.org) is a highly customizable web and mobile application for monitoring observation and spatial data in defined areas. The application integrates any spatial data (point, polygon, raster), which may come from patrols, ecological surveys, GPS collars or other sensors. The tool allows these data to be quickly analyzed, visualized, and mapped, and it assists in creating reports. Data can be compiled and managed from multiple users and alerts can be sent based on pre-configurations. SMART does not include any pre-designed surveys or indicators, but can accommodate most types of data.	**Outcome:** People **Attribute:** Risk of injury or death to people; Governance (compliance) **Outcome:** Livelihoods & Assets **Attribute:** Economic vulnerability and resilience (livestock depredation) **Outcome:** Wildlife **Attribute:** Population dynamics; Risk of injury or death to wildlife (poaching) **Outcome:** Habitat **Attribute:** Connectivity; Quality
STRENGTHS	**PLATFORM**
• Strong support community of users across the globe • Mobile application works offline • Extensive library of technical manuals • Data analysis plug-ins for R statistical software • Supports over 10 languages	• Mobile • iOS • Android • Desktop • Any web browser
LIMITATIONS	**AVAILABILITY**
Diverse and growing functions lead to a steep learning curve	• www.smartconservationtools.org • Open-source • Free

DATA OWNERSHIP AND PRIVACY	ORGANIZATIONAL SUPPORT
Data are user-owned and private	• WWF • Wildlife Conservation Society • Wildlife Protection Solutions • Frankfurt Zoological Society • Zoological Society of London • North Carolina Zoo • Panthera • re:wild
MONITORING ALONG THE COEXISTENCE AND CONFLICT SPECTRUMS	
SMART does not include any built-in indicators that can easily identify whether a given site is on the coexistence or conflict spectrum. Rather, practitioners will need to decide benchmarks for each of their indicators that would suggest what counts as acceptable or unacceptable. For example, it will be up to practitioners to decide how many breaches of a geofence or how much poaching paraphernalia is acceptable. With these benchmarks, practitioners can use SMART similarly to other monitoring tools. First, start tracking data with SMART and collect enough for an adequate baseline. Based on the data, identify any pertinent attributes to address and then plan and implement an intervention to do so. Then continue collecting data via SMART. If the target attributes showed improvement and other attributes being monitored stayed the same or also showed improvement, it is likely that these attributes are on the coexistence spectrum. Conversely, if the target attributes stayed the same or declined and other attributes did the same, it is likely that these attributes are on the conflict spectrum.	

COLLECT EARTH ONLINE

C2C Elements: Monitoring

DESCRIPTION	OUTCOMES AND ATTRIBUTES
Collect Earth Online (CEO; www.collect.earth) [166] is a system for viewing and interpreting high-resolution satellite imagery. CEO allows users to define their area of interest and select which land cover variables they would like to measure. All data are stored in the cloud and users can collaborate to interpret and code different land cover classifications. Once classifications are agreed upon, the same analysis can be applied over time, yielding temporal data on land cover change in a designated area of interest. Data can also be analyzed in Google Earth Engine or exported for further analysis in other statistical or geospatial information system software.	**Outcome:** Habitat **Attribute:** Connectivity; Quality
STRENGTHS	**PLATFORM**
• User guides and video tutorials available • Easy interface • Works for any land cover	• Mobile • None • Desktop • Any web browser

LIMITATIONS	AVAILABILITY
• No dedicated mobile application • Data analysis may require statistical modeling skills	• www.collect.earth • Open-source • Free
DATA OWNERSHIP AND PRIVACY	**ORGANIZATIONAL SUPPORT**
CEO does not allow users to input their own data. All data are available from other, free sources.	• US Agency for International Development • US National Aeronautics and Space Administration • UN Food and Agriculture Organization • openforis
MONITORING ALONG THE COEXISTENCE AND CONFLICT SPECTRUMS	
Collect Earth Online does not include any built-in indicators that can easily identify whether a given site is on the coexistence or conflict spectrum. Rather, practitioners will need to decide benchmarks for each of their indicators that would suggest what counts as acceptable or unacceptable. For example, it will be up to practitioners to decide what degree of connectivity or how much land cover change is acceptable. With these benchmarks, practitioners can use Collect Earth Online similarly to other monitoring tools. First, start tracking data with Collect Earth Online and collect enough for an adequate baseline. Based on the data, identify any pertinent attributes to address and then plan and implement an intervention to do so. Then continue collecting data via Collect Earth Online. If the target attributes showed improvement and other attributes being monitored stayed the same or also showed improvement, it is likely that these attributes are on the coexistence spectrum. Conversely, if the target attributes stayed the same or declined and other attributes did the same, it is likely that these attributes are on the conflict spectrum.	

FORESTWATCHER

C2C Elements: Monitoring	
DESCRIPTION	**OUTCOMES AND ATTRIBUTES**
ForestWatcher is a monitoring tool designed to provide real-time alerts to users about deforestation or fire events in their areas of interest. Users specify what areas they are interested in and how they would like to receive alerts, and then ForestWatcher will send alerts about those areas, regardless of mobile connectivity. It will also help you navigate to the alert areas using GPS. Most functions can be completed on the mobile app, but a web interface also allows users to create reports, further manage data, and assign teams	**Outcome:** Habitat **Attribute:** Quality

STRENGTHS	PLATFORM
• Works offline • Relatively simple to use • Training materials and instructions available at www.globalforestwatch.org/help/forest-watcher/ • Available in English, Spanish, French, Portuguese, Bahasa Indonesia, Dutch, and Malagasy • SMART and EarthRanger can read data from ForestWatcher	• Mobile • iOS • Android • Desktop • Any web browser
LIMITATIONS	**AVAILABILITY**
Limited to monitoring habitat quality in forested landscapes only	• www.forestwatcher.globalforestwatch.org • Free • Not open-source
DATA OWNERSHIP AND PRIVACY	**ORGANIZATIONAL SUPPORT**
Any user-inputted data are user owned and not shared. But data used for alerts are proprietary.	Global Forest Watch
MONITORING ALONG THE COEXISTENCE AND CONFLICT SPECTRUMS	
ForestWatcher does not include any built-in indicators that can easily identify whether a given site is on the coexistence or conflict spectrum. Rather, practitioners will need to decide benchmarks for each of their indicators that would suggest what counts as acceptable or unacceptable. For example, it will be up to practitioners to decide how much land cover change or how many alerts are acceptable. With these benchmarks, practitioners can use ForestWatcher similarly to other monitoring tools. First, start tracking data with ForestWatcher and collect enough for an adequate baseline. Based on the data, identify any pertinent attributes to address and then plan and implement an intervention to do so. Then continue collecting data via ForestWatcher. If the target attributes showed improvement and other attributes being monitored stayed the same or also showed improvement, it is likely that these attributes are on the coexistence spectrum. Conversely, if the target attributes stayed the same or declined and other attributes did the same, it is likely that these attributes are on the conflict spectrum.	

REMAP

C2C Elements: Monitoring	
DESCRIPTION	**OUTCOMES AND ATTRIBUTES**
Remap, the Remote Ecosystem Monitoring and Assessment Pipeline (remap-app.org) [167], is an online mapping platform designed to allow quick mapping and reporting of ecosystems using machine learning. Training data for the machine learning algorithm can either be uploaded or annotated within the platform. This enables map development and export within time frames of less than 10 minutes. Classification can be informed by biophysical, spectral, and climatic datasets, which are all freely available and automatically processed into relevant indices, such as the Normalized Difference Vegetation Index (NDVI). The platform output is a georeferenced .tiff file that can be used in other software for analysis.	**Outcome:** Habitat **Attribute:** Connectivity; Quality
STRENGTHS	**PLATFORM**
• User guides and video tutorials available • Easy interface • Works for any land cover	• Mobile • None • Desktop • Any web browser
LIMITATIONS	**AVAILABILITY**
• No dedicated mobile application • Does not allow upload of external data, other than training data • The only output is a georeferenced .tiff file, meaning that further analysis outside Remap is required for tracking indicators overtime.	• www.remap-app.org • Open-source • Free
DATA OWNERSHIP AND PRIVACY	**ORGANIZATIONAL SUPPORT**
No data, other than training data sets, are uploaded to Remap. All data used in the system are open and freely available.	• Google Earth Engine • University of New South Wales, Sydney
MONITORING ALONG THE COEXISTENCE AND CONFLICT SPECTRUMS	
Remap does not include any built-in indicators that can easily identify whether a given site is on the coexistence or conflict spectrum. Rather, practitioners will need to decide benchmarks for each of their indicators that would suggest what counts as acceptable or unacceptable. For example, it will be up to practitioners to decide what degree of connectivity or how much land cover change is acceptable. With these benchmarks, practitioners can use Remap similarly to other monitoring tools. First, start tracking data with Remap and collect enough for an adequate baseline. Based on the data, identify any pertinent attributes to address and then plan and implement an intervention to do so. Then continue collecting data via Remap. If the target attributes showed improvement and other attributes being monitored stayed the same or also showed improvement, it is likely that these attributes are on the coexistence spectrum. Conversely, if the target attributes stayed the same or declined and other attributes did the same, it is likely that these attributes are on the conflict spectrum.	

HOW POLICY ADVOCACY WORKS: ADVOCACY COALITION FRAMEWORK

Achieving policy change is often necessary to implement many of the interventions summarized above, particularly conservation financing mechanisms and governance based on design principles or good governance principles. However, there are very few studies that have assessed the effectiveness of conservation policy advocacy in a robust way. Thus, this last section complements the intervention and monitoring tool summaries by outlining one theoretical framework that seeks to explain how advocacy has an effect on policy, called the Advocacy Coalition Framework. With this framework in mind, practitioners can collaborate with their organization's policy team to develop a strategy to achieve policy change that will enable the implementation of interventions to manage human-wildlife interactions. Apart from this theoretical framework, readers should also see the "WWF Policy Advocacy Toolkit: Towards Strategic and Effective Advocacy" for ideas about how to advocate for desired policy change [168].

The Advocacy Coalition Framework (ACF) is a causal model for understanding the policy change process [169]. ACF assumes that people's beliefs are the causal driver of political behavior, and categorizes these beliefs into three tiers: (1) deep core beliefs, which are largely normative and stable, such as conservative or liberal political beliefs, (2) policy core beliefs, which pertain only to the realm of policy and are more likely to adjust based on verification or refutation, and (3) secondary beliefs, which are more narrow and empirically based. ACF predicts that these secondary beliefs are the most likely to change over time and are the most susceptible to advocacy. Advocacy coalitions are groups of actors who share policy core beliefs and coordinate their actions to influence policy change. Conservation groups are one example of an advocacy coalition who coordinate to implement stronger biodiversity protection policies.

Components of the political environment. ACF understands these coalitions as working within a policy subsystem that itself is embedded within a broader political environment (Figure 4). This broader political environment has four components: (1) Relatively stable parameters, such as the distribution of natural resources, fundamental social values and structures, and basic constitutional rules, (2) external events, such as changes in public opinion or governing coalition, (3) long-term coalition opportunities, such as the degree of consensus needed for policy change, and (4) short-term constraints and resources of actors. These four components of the broader political environment influence the policy subsystem in which coalitions with different policy goals strategically deploy their resources to direct legislative or policy decisions of governmental authorities.

Pathways to policy change. Within this framework, the ACF identifies four main paths through which policy changes. First, external events, such as changes in socioeconomic conditions, public opinion, and governing coalitions, can result in policy change by shifting resources, tipping the power of coalitions, and changing beliefs. External events can be large, such as the COVID-19 pandemic leading to some of the most significant climate legislation in United States history, or small, such as a viral video of a plastic straw being removed from a sea turtle's nose leading companies to shift to paper straws. Second, policy-oriented learning can lead to changes in secondary beliefs over extended periods of time, such as when mounting evidence about the negative effects of greenhouse gas emissions led to progressively stronger climate legislation over time. Third, policy can change as a result of internal subsystem events that highlight the failures of current subsystem practices, such as when leadership changes within ruling political parties lead to amendments to previous policy [170]. Fourth, policy change can happen through negotiated agreement among contesting coalitions, such as when environmental and industry representatives work to reach consensus on policy recommendations [171]. These paths are opportunities for coalitions to exploit as a means of achieving their desired policy change. Recognizing when these paths are open is crucial to deploying the strategies described in the WWF Policy Advocacy Toolkit.

Capitalizing on opportunities for policy change. The four pathways listed in the previous paragraph have bearing for planning policy advocacy campaigns. The first path, external events, implies that advocates can either work to create an external event, such as through viral marketing or actions meant to gain publicity, or be ready to capitalize on an external event when it happens. This latter option could include having policy materials drafted ahead of time and waiting for an opportunity to advocate for them until some appropriate external event happens. The second path, policy-oriented learning, implies that advocates can help policy-makers learn by distributing educational material on a particular topic or information on constituency opinion about that topic. The third path, internal subsystem events, again suggests that advocates should have policy materials ready in the event that a shift within the ruling political party opens a policy change opportunity. The fourth path, negotiated agreement, suggest that advocates should be open to negotiation with potentially conflicting parties, or initiate such negotiation in the first place.

As mentioned above, there are few studies that evaluate the effectiveness of policy advocacy on policy change. Some studies from behavioral science have investigated policy shifts among policy-makers and potential behavioral interventions that may be effective, including providing information on constituent opinion (see Read and Selinske (2024) [149] for a summary of this literature and examples). Whatever advocacy strategy is pursued, it is important that it remains grounded in the realities of human-wildlife interactions in particular sites, and that it is crafted in collaboration with rights-holders, stakeholders, and internal policy teams.

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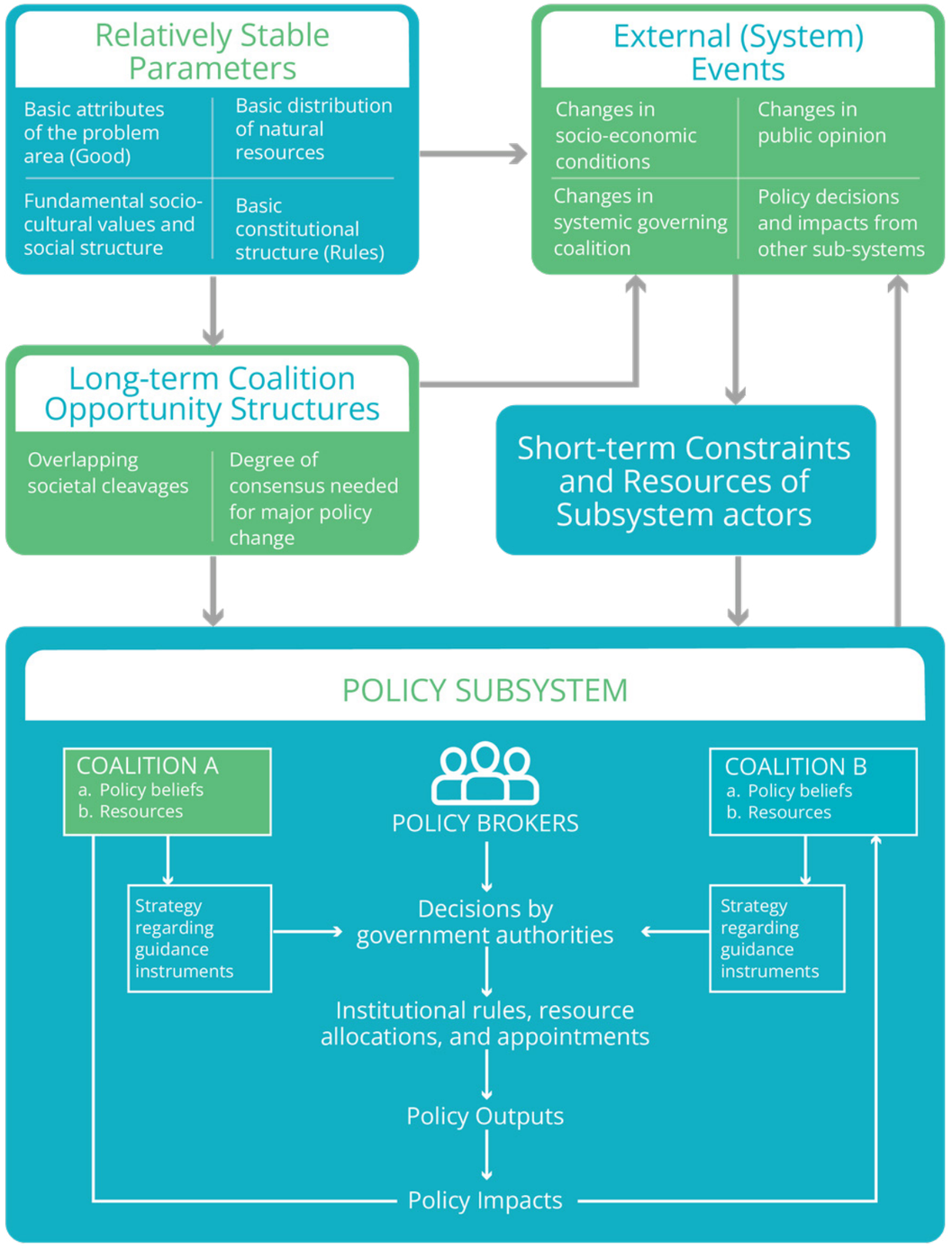

Figure 4: Flow diagram adapted from Weible et al. 2009 [169] , where the arrows indicate directional influence over the policy change process.

CONCLUSION

In two parts, this report has outlined a process through which practitioners can work with Indigenous Peoples and local communities living with tigers to identify what tiger-related issues are most important to them and to identify what interventions could help address those issues. The first part explained how this process can be used in a way that strengthens coexistence and manages conflict, highlighting the feedbacks and spectrums that define these relationships. It then introduced the four outcomes (People, Livelihoods & Assets, Wildlife, Habitat) and nine attributes of the C2C framework and described a collaborative method through which practitioners and IPs & LCs can prioritize what outcomes and attributes to focus on. The second part of the report provided brief overviews of how 29 interventions and nine monitoring tools can and cannot contribute to facilitating and maintaining human-tiger coexistence in different contexts. Due to limitations in robust evaluation studies, the effectiveness of many of these interventions at addressing different attributes is unknown. There may also be unknown relationships between these interventions and attributes against which they have not been tested. Further, their effectiveness will likely vary across different social, political, economic, and ecological contexts. Because of these unknown relationships and variability, understanding these contextual factors, either through the initial steps of the C2C approach or through other means, is especially important. Co-deciding and co-designing interventions with Indigenous Peoples and local communities, as suggested in the first part of this report, will be crucial to help ensure that the interventions are appropriately and equitably implemented and monitored.

Nothing in this report is meant to be prescriptive or exhaustive. Whether to implement any interventions, and if so, which ones, are best decided with affected Indigenous Peoples and local communities. There are also other interventions, monitoring tools, , co-design activities, and ways of conceptualizing human-tiger conflict and coexistence that are not detailed in this report. The field of human-wildlife interactions is rapidly evolving. Coupled with the accelerating changes to Earth's climate, biodiversity, and socio-ecological systems, new interventions may need to be co-designed to address emergent issues surrounding human-tiger interactions.

Together with recent reports and guidance published by several conservation organizations [172–174], including the C2C Approach [10], this report aims to expand the knowledge and skills available to practitioners to collaboratively plan, design, implement, and monitor interventions that will help to facilitate human-tiger coexistence.

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REFERENCES CITED

1. Abrahms, B. *et al.* Climate change as a global amplifier of human–wildlife conflict. *Nat. Clim. Change* **13**, 224–234 (2023).

2. Ma, D. *et al.* Global expansion of human-wildlife overlap in the 21st century. *Sci. Adv.* **10**, eadp7706 (2024).

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

4. Pereira, J. *et al.* Livelihood vulnerability increases human–wildlife interactions. *Environ. Conserv.* **48**, 301–309 (2021).

5. Lamba, A. *et al.* Climate co-benefits of tiger conservation. *Nat. Ecol. Evol.* **7**, 1104–1113 (2023).

6. Thinley, P. *et al.* The ecological benefit of tigers (Panthera tigris) to farmers in reducing crop and livestock losses in the eastern Himalayas: implications for conservation of large apex predators. *Biol. Conserv.* **219**, 119–125 (2018).

7. Pooley, S. *et al.* An interdisciplinary review of current and future approaches to improving human–predator relations. *Conserv. Biol.* **31**, 513–523 (2017).

8. Margulies, J. D. & Bersaglio, B. Furthering post-human political ecologies. *Geoforum* **94**, 103–106 (2018).

9. McInturff, A., Cannon, C. E., Alagona, P. S. & Pellow, D. N. Meeting at the crossroads: An environmental justice framework for large carnivore reintroductions and recoveries. *Elem Sci Anth* **9**, 00172 (2021).

10. Gross, E. M. *et al.* C2C—conflict to coexistence: A global approach to manage human–wildlife conflict for coexistence. *Conserv. Sci. Pract.* **7**, e13292 (2025).

11. Carter, N. H. & Linnell, J. D. Co-adaptation is key to coexisting with large carnivores. *Trends Ecol. Evol.* **31**, 575–578 (2016).

12. Bhatia, S., Redpath, S. M., Suryawanshi, K. & Mishra, C. Beyond conflict: exploring the spectrum of human–wildlife interactions and their underlying mechanisms. *Oryx* **54**, 621–628 (2020).

13. Sultana, N. & Dey, S. From vulnerability to resilience: A study of the livelihood struggles of tiger widows in Bangladesh. *Asian J. Womens Stud.* **27**, 2–21 (2021).

14. Saif, S., Rahman, H. T. & MacMillan, D. C. Who is killing the tiger Panthera tigris and why? *Oryx* **52**, 46–54 (2018).

15. Harihar, A., Ghosh-Harihar, M. & MacMillan, D. C. Human resettlement and tiger conservation–socio-economic assessment of pastoralists reveals a rare conservation opportunity in a human-dominated landscape. *Biol. Conserv.* **169**, 167–175 (2014).

16. Read, D. J., Mawaskar, R. G. & Habib, B. Translating legitimacy: Perspectives on institutions for human-wildlife coexistence in central India. *Geoforum* **101**, 38–48 (2019).

17. Read, D. J., Habib, B., Stabach, J. & Leimgruber, P. Human movement influenced by perceived risk of wildlife encounters at fine scales: Evidence from central India. *Biol. Conserv.* **254**, 108945 (2021).

18. Lemos, M. C. & Agrawal, A. Environmental governance. *Annu Rev Env. Resour* **31**, 297–325 (2006).

19. Arias, A. Understanding and managing compliance in the nature conservation context. *J. Environ. Manage.* **153**, 134–143 (2015).

20. Birnbaum, S. Environmental co-governance, legitimacy, and the quest for compliance: when and why is stakeholder participation desirable? *J. Environ. Policy Plan.* **18**, 306–323 (2016).

21. Thinley, P. *et al.* The ecological benefit of tigers (Panthera tigris) to farmers in reducing crop and livestock losses in the eastern Himalayas: implications for conservation of large apex predators. *Biol. Conserv.* **219**, 119–125 (2018).

22. Schoen, J. M. *et al.* Synthesizing habitat connectivity analyses of a globally important human dominated tiger conservation landscape. *Conserv. Biol.* e13909 (2022).

23. Inskip, C., Fahad, Z., Tully, R., Roberts, T. & MacMillan, D. Understanding carnivore killing behaviour: Exploring the motivations for tiger killing in the Sundarbans, Bangladesh. *Biol. Conserv.* **180**, 42–50 (2014).

24. Karanth, K. U., Nichols, J. D., Kumar, N. S., Link, W. A. & Hines, J. E. Tigers and their prey: predicting carnivore densities from prey abundance. *Proc. Natl. Acad. Sci.* **101**, 4854–4858 (2004).

25. Treves, A., Wallace, R. & White, S. Participatory planning of interventions to mitigate human–wildlife conflicts. *Conserv. Biol.* **23**, 1577–1587 (2009).

26. Hugé, J. & Mukherjee, N. The nominal group technique in ecology & conservation: Application and challenges. *Methods Ecol. Evol.* **9**, (2018).

27. O. Nyumba, T., Wilson, K., Derrick, C. J. & Mukherjee, N. The use of focus group discussion methodology: Insights from two decades of application in conservation. *Methods Ecol. Evol.* **9**, 20–32 (2018).

28. Guest, G., Namey, E. & McKenna, K. How many focus groups are enough? Building an evidence base for nonprobability sample sizes. *Field Methods* **29**, 3–22 (2017).

29. Fontana, L. B. & Grugel, J. The politics of indigenous participation through "free prior informed consent": Reflections from the bolivian case. *World Dev.* **77**, 249–261 (2016).

30. Dunlap, A. "A Bureaucratic Trap:" Free, Prior and Informed Consent (FPIC) and Wind Energy Development in Juchitán, Mexico. *Capital. Nat. Social.* **29**, 88–108 (2018).

31. Mahanty, S. & McDermott, C. L. How does 'Free, Prior and Informed Consent'(FPIC) impact social equity? Lessons from mining and forestry and their implications for REDD+. *Land Use Policy* **35**, 406–416 (2013).

32. Simmons, A. J., Gutierrez, M. & Transue, J. E. Ranked-choice voting and the potential for improved electoral performance of third-party candidates in America. *Am. Polit. Res.* **50**, 366–378 (2022).

33. Aiyadurai, A. ' Tigers are Our Brothers': Understanding Human-Nature Relations in the Mishmi Hills, Northeast India. *Conserv. Soc.* **14**, 305–316 (2016).

34. Brosius, P. J., Tsing, A. L. & Zerner, C. *Communities and Conservation: Histories and Politics of Community-Based Natural Resource Management*. (Rowman Altamira, 2005).

35. Ogra, M. V. Human–wildlife conflict and gender in protected area borderlands: a case study of costs, perceptions, and vulnerabilities from Uttarakhand (Uttaranchal), India. *Geoforum* **39**, 1408–1422 (2008).

36. Harris, N. C., Wilkinson, C. E., Fleury, G. & Nhleko, Z. N. Responsibility, equity, justice, and inclusion in dynamic human–wildlife interactions. *Front. Ecol. Environ.* **21**, 380–387 (2023).

37. Krafte Holland, K., Larson, L. R. & Powell, R. B. Characterizing conflict between humans and big cats Panthera spp: A systematic review of research trends and management opportunities. *PloS One* **13**, e0203877 (2018).

38. Khorozyan, I. & Waltert, M. A global view on evidence based effectiveness of interventions used to protect livestock from wild cats. *Conserv. Sci. Pract.* **3**, e317 (2021).

39. Eklund, A., López-Bao, J. V., Tourani, M., Chapron, G. & Frank, J. Limited evidence on the effectiveness of interventions to reduce livestock predation by large carnivores. *Sci. Rep.* **7**, 2097 (2017).

40. Van Eeden, L. M. *et al.* Managing conflict between large carnivores and livestock. *Conserv. Biol.* **32**, 26–34 (2018).

41. Khorozyan, I. Defining practical and robust study designs for interventions targeted at terrestrial mammalian predators. *Conserv. Biol.* **36**, e13805 (2022).

42. Steinmetz, R., Srirattanaporn, S., Mor Tip, J. & Seuaturien, N. Can community outreach alleviate poaching pressure and recover wildlife in South East Asian protected areas? *J. Appl. Ecol.* **51**, 1469–1478 (2014).

43. Sutherland, W. J., Dicks, L. V., Petrovan, S. O. & Smith, R. K. *What Works in Conservation 2021*. (Open book publishers, 2021).

44. Sarkar, M. S., Krishnamurthy, R., Johnson, J. A., Sen, S. & Saha, G. K. Assessment of fine-scale resource selection and spatially explicit habitat suitability modelling for a re-introduced tiger (Panthera tigris) population in central India. *PeerJ* **5**, e3920 (2017).

45. Malviya, M. *et al.* Correlates of physiological stress and habitat factors in reintroduction-based recovery of tiger (Panthera tigris) populations. *Hystrix* **29**, 195 (2018).

46. Lamichhane, B. *et al.* Are conflict-causing tigers different? Another perspective for understanding human-tiger conflict in Chitwan National Park, Nepal. *Glob. Ecol. Conserv.* **11**, 177–187 (2017).

47. Doubleday, K. F. Human-tiger (re) negotiations: A case study from Sariska Tiger Reserve, India. *Soc. Anim.* **26**, 148–170 (2018).

48. Consorte-McCrea, A., Kolipaka, S., Owens, J. R., Ruiz-Miranda, C. R. & Waters, S. Guidelines to facilitate human-wildlife interactions in conservation translocations. *Front. Conserv. Sci.* **3**, 788520 (2022).

49. Woolaston, K. *et al.* A review of the role of law and policy in human-wildlife conflict. *Conserv. Soc.* **19**, 172–183 (2021).

50. Fletcher, R. & Toncheva, S. The political economy of human-wildlife conflict and coexistence. *Biol. Conserv.* **260**, 109216 (2021).

51. Madden, F. M. The growing conflict between humans and wildlife: law and policy as contributing and mitigating factors. *J. Int. Wildl. Law Policy* **11**, 189–206 (2008).

52. Linkie, M. *et al.* EDITOR'S CHOICE: Safeguarding Sumatran tigers: evaluating effectiveness of law enforcement patrols and local informant networks. *J. Appl. Ecol.* **52**, 851–860 (2015).

53. Delpech, D., Borrion, H. & Johnson, S. Systematic review of situational prevention methods for crime against species. *Crime Sci.* **10**, 1 (2021).

54. Johnson, A. *et al.* To protect or neglect? Design, monitoring, and evaluation of a law enforcement strategy to recover small populations of wild tigers and their prey. *Biol. Conserv.* **202**, 99–109 (2016).

55. De Jong, M. & Butt, B. Conservation violence: Paradoxes of "making live" and "letting die" in anti-poaching practices. *Environ. Plan. E Nat. Space* **6**, 2400–2423 (2023).

56. Witter, R. Why militarized conservation may be counter-productive: illegal wildlife hunting as defiance. *J. Polit. Ecol.* **28**, 175–192 (2021).

57. Duffy, R. *et al.* Why we must question the militarisation of conservation. *Biol. Conserv.* **232**, 66–73 (2019).

58. Naha, D., Chaudhary, P., Sonker, G. & Sathyakumar, S. Effectiveness of non-lethal predator deterrents to reduce livestock losses to leopard attacks within a multiple-use landscape of the Himalayan region. *PeerJ* **8**, e9544 (2020).

59. Maercker, A., Zöllner, T., Menning, H., Rabe, S. & Karl, A. Dresden PTSD treatment study: Randomized controlled trial of motor vehicle accident survivors. *BMC Psychiatry* **6**, 1–8 (2006).

60. Kowalik, J., Weller, J., Venter, J. & Drachman, D. Cognitive behavioral therapy for the treatment of pediatric posttraumatic stress disorder: A review and meta-analysis. *J. Behav. Ther. Exp. Psychiatry* **42**, 405–413 (2011).

61. Mendes, D. D., Mello, M. F., Ventura, P., de Medeiros Passarela, C. & de Jesus Mari, J. A systematic review on the effectiveness of cognitive behavioral therapy for posttraumatic stress disorder. *Int. J. Psychiatry Med.* **38**, 241–259 (2008).

62. Kar, N. Cognitive behavioral therapy for the treatment of post-traumatic stress disorder: a review. *Neuropsychiatr. Dis. Treat.* 167–181 (2011).

63. Roberts, N. P., Kitchiner, N. J., Kenardy, J., Lewis, C. E. & Bisson, J. I. Early psychological intervention following recent trauma: A systematic review and meta-analysis. *Eur. J. Psychotraumatology* **10**, 1695486 (2019).

64. Rolfsnes, E. S. & Idsoe, T. School based intervention programs for PTSD symptoms: A review and metaanalysis. *J. Trauma. Stress* **24**, 155–165 (2011).

65. Dhungana, R., Savini, T., Karki, J. B. & Bumrungsri, S. Mitigating human-tiger conflict: An assessment of compensation payments and tiger removals in Chitwan National Park, Nepal. *Trop. Conserv. Sci.* **9**, 776–787 (2016).

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

67. Hazzah, L. *et al.* Efficacy of two lion conservation programs in Maasailand, Kenya. *Conserv. Biol.* **28**, 851–860 (2014).

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

69. Karanth, K. K. & Vanamamalai, A. Wild seve: A novel conservation intervention to monitor and address human-wildlife conflict. *Front. Ecol. Evol.* **8**, 530144 (2020).

70. Hamm, J., Holmes, G. & Marti Ortega, J. The importance of equity in payments to encourage coexistence with large mammals. *Conserv. Biol.* e14207 (2024).

71. Ogra, M. & Badola, R. Compensating human–wildlife conflict in protected area communities: ground-level perspectives from Uttarakhand, India. *Hum. Ecol.* **36**, 717–729 (2008).

72. Bhattarai, B. R., Morgan, D. & Wright, W. Equitable sharing of benefits from tiger conservation: Beneficiaries' willingness to pay to offset the costs of tiger conservation. *J. Environ. Manage.* **284**, 112018 (2021).

73. Carter, H. *et al.* Hopes and Fears for Incentivising Coexistence With Big Cats Through Innovative Market Based Financial Mechanisms. *Wildl. Lett.* wll2.70002 (2025) doi:10.1002/wll2.70002.

74. Hyde, M. *et al.* Refining carbon credits to contribute to large carnivore conservation: The jaguar as a case study. *Conserv. Lett.* **15**, e12880 (2022).

75. García, J. H. & Moros, L. M. Key issues in carbon markets and lessons for biodiversity conservation and financing. *Curr. Opin. Environ. Sustain.* **77**, 101586 (2025).

76. Bonham, C. *et al.* Conservation trust funds, protected area management effectiveness and conservation outcomes: lessons from the Global Conservation Fund. *Parks* **20**, 89–100 (2014).

77. Gallo Cajiao, E. et al. Crowdfunding biodiversity conservation. Conserv. Biol. 32, 1426–1435 (2018).

78. Cassimon, D., Prowse, M. & Essers, D. The pitfalls and potential of debt-for-nature swaps: A US-Indonesian case study. *Glob. Environ. Change* **21**, 93–102 (2011).

79. Niwamanya, R., Tumwa, S., Lawson, C. & Mohanan, K. Community-led sustainable finance mechanism for conservation in Uganda. *Oryx* **56**, 329–329 (2022).

80. Medina, C. & Scales, I. R. Finance and biodiversity conservation: insights from rhinoceros conservation and the first wildlife conservation bond. *Oryx* **58**, 90–99 (2024).

81. Bhutta, U. S., Tariq, A., Farrukh, M., Raza, A. & Iqbal, M. K. Green bonds for sustainable development: Review of literature on development and impact of green bonds. *Technol. Forecast. Soc. Change* **175**, 121378 (2022).

82. Ostrom, E. *Governing the Commons: The Evolution of Institutions for Collective Action.* (Cambridge University Press, Cambridge, 1990).

83. Cox, M., Arnold, G. & Tomás, S. V. A review of design principles for community-based natural resource management. *Ecol. Soc.* **15**, (2010).

84. Anthony, B. P., Scott, P. & Antypas, A. Sitting on the fence? Policies and practices in managing human-wildlife conflict in Limpopo Province, South Africa. *Conserv. Soc.* **8**, 225–240 (2010).

85. Gulzar, S., Lal, A. & Pasquale, B. Representation and forest conservation: Evidence from India's scheduled areas. *Am. Polit. Sci. Rev.* **118**, 764–783 (2024).

86. Oldekop, J. A., Sims, K. R., Karna, B. K., Whittingham, M. J. & Agrawal, A. Reductions in deforestation and poverty from decentralized forest management in Nepal. *Nat. Sustain.* **2**, 421–428 (2019).

87. Miller, D. C. *et al.* A global review of the impact of forest property rights interventions on poverty. *Glob. Environ. Change* **66**, 102218 (2021).

88. Baragwanath, K. & Bayi, E. Collective property rights reduce deforestation in the Brazilian Amazon. *Proc. Natl. Acad. Sci.* **117**, 20495–20502 (2020).

89. Blackman, A., Corral, L., Lima, E. S. & Asner, G. P. Titling indigenous communities protects forests in the Peruvian Amazon. *Proc. Natl. Acad. Sci.* **114**, 4123–4128 (2017).

90. Salazar, G. *et al.* Using environmental education to nurture positive human–wildlife interactions in India. *Conserv. Sci. Pract.* **6**, e13096 (2024).

91. Marcus, S., Marquis, P. & Sakai, C. Three-and 6-month follow-up of EMDR treatment of PTSD in an HMO setting. *Int. J. Stress Manag.* **11**, 195 (2004).

92. Cuijpers, P., Veen, S. C. van, Sijbrandij, M., Yoder, W. & Cristea, I. A. Eye movement desensitization and reprocessing for mental health problems: A systematic review and meta-analysis. *Cogn. Behav. Ther.* **49**, 165–180 (2020).

93. Jeffries, F. W. & Davis, P. What is the role of eye movements in eye movement desensitization and reprocessing (EMDR) for post-traumatic stress disorder (PTSD)? A review. *Behav. Cogn. Psychother.* **41**, 290–300 (2013).

94. Mahajan, S. L. *et al.* Introducing Elinor for monitoring the governance and management of area based conservation. *Conserv. Biol.* **38**, e14213 (2024).

95. Decker, D. *et al.* Governance principles for wildlife conservation in the 21st century. *Conserv. Lett.* **9**, 290–295 (2016).

96. Christensen, D., Hartman, A. C. & Samii, C. Citizen monitoring promotes informed and inclusive forest governance in Liberia. *Proc. Natl. Acad. Sci.* **118**, e2015169118 (2021).

97. Potgieter, G. C., Kerley, G. I. & Marker, L. L. More bark than bite? The role of livestock guarding dogs in predator control on Namibian farmlands. *Oryx* **50**, 514–522 (2016).

98. Khorozyan, I. *et al.* Effects of shepherds and dogs on livestock depredation by leopards (Panthera pardus) in north-eastern Iran. *PeerJ* **5**, e3049 (2017).

99. Alexander, J. S. *et al.* Assessing the effectiveness of a community-based livestock insurance program. *Environ. Manage.* **68**, 87–99 (2021).

100. Puri, M. *et al.* An integrated approach to prioritize restoration for carnivore conservation in shared landscapes. *Biol. Conserv.* **273**, 109697 (2022).

101. Bhagabati, N. K. *et al.* Ecosystem services reinforce Sumatran tiger conservation in land use plans. *Biol. Conserv.* **169**, 147–156 (2014).

102. Sun, Q., Fu, C., Bai, Y., Oduor, A. M. & Cheng, B. Livelihood diversification and residents' welfare: evidence from Maasai mara national reserve. *Int. J. Environ. Res. Public. Health* **20**, 3859 (2023).

103. Dickman, A. J., Macdonald, E. A. & Macdonald, D. W. A review of financial instruments to pay for predator conservation and encourage human–carnivore coexistence. *Proc. Natl. Acad. Sci.* **108**, 13937–13944 (2011).

104. Ferraro, P. J. & Hanauer, M. M. Quantifying causal mechanisms to determine how protected areas affect poverty through changes in ecosystem services and infrastructure. *Proc. Natl. Acad. Sci.* **111**, 4332–4337 (2014).

105. Eshoo, P. F., Johnson, A., Duangdala, S. & Hansel, T. Design, monitoring and evaluation of a direct payments approach for an ecotourism strategy to reduce illegal hunting and trade of wildlife in Lao PDR. *PloS One* **13**, e0186133 (2018).

106. Naidoo, R. *et al.* Evaluating the impacts of protected areas on human well-being across the developing world. *Sci. Adv.* **5**, eaav3006 (2019).

107. Salzman, J., Bennett, G., Carroll, N., Goldstein, A. & Jenkins, M. The global status and trends of Payments for Ecosystem Services. *Nat. Sustain.* **1**, 136–144 (2018).

108. Dinerstein, E. *et al.* Enhancing conservation, ecosystem services, and local livelihoods through a wildlife premium mechanism. *Conserv. Biol.* **27**, 14–23 (2013).

109. Jayachandran, S. *et al.* Cash for carbon: A randomized trial of payments for ecosystem services to reduce deforestation. *Science* **357**, 267–273 (2017).

110. Börner, J. *et al.* The effectiveness of payments for environmental services. *World Dev.* **96**, 359–374 (2017).

111. Calvet-Mir, L., Corbera, E., Martin, A., Fisher, J. & Gross-Camp, N. Payments for ecosystem services in the tropics: a closer look at effectiveness and equity. *Curr. Opin. Environ. Sustain.* **14**, 150–162 (2015).

112. Kolinjivadi, V., Van Hecken, G. & Merlet, P. Fifteen years of research on payments for ecosystem services (PES): Piercing the bubble of success as defined by a Northern-driven agenda. *Glob. Environ. Change* **83**, 102758 (2023).

113. Hamm, J., Holmes, G., Mabele, M. B. & Martin Ortega, J. "Milking the lions": An analysis of conservation performance payments in eastern and southern Africa. *Conserv. Sci. Pract.* **7**, e70015 (2025).

114. Fletcher, R. & Büscher, B. Conservation basic income: A non-market mechanism to support convivial conservation. *Biol. Conserv.* **244**, 108520 (2020).

115. Sheehan, C. & Martin-Ortega, J. Is conservation basic income a good idea? A scoping study of the views of conservation professionals on cash giving programmes. *Biol. Conserv.* **279**, 109914 (2023).

116. Sumaila, U. R. *et al.* Utilizing basic income to create a sustainable, poverty-free tomorrow. *Cell Rep. Sustain.* (2024).

117. de Lange, E. *et al.* A global conservation basic income to safeguard biodiversity. *Nat. Sustain.* **6**, 1016–1023 (2023).

118. Malerba, D. Poverty alleviation and local environmental degradation: An empirical analysis in Colombia. *World Dev.* **127**, 104776 (2020).

119. Ferraro, P. J. & Simorangkir, R. Conditional cash transfers to alleviate poverty also reduced deforestation in Indonesia. *Sci. Adv.* **6**, eaaz1298 (2020).

120. Alix-Garcia, J., McIntosh, C., Sims, K. R. & Welch, J. R. The ecological footprint of poverty alleviation: evidence from Mexico's Oportunidades program. *Rev. Econ. Stat.* **95**, 417–435 (2013).

121. Wilebore, B., Voors, M., Bulte, E. H., Coomes, D. & Kontoleon, A. Unconditional transfers and tropical forest conservation: evidence from a randomized control trial in Sierra Leone. *Am. J. Agric. Econ.* **101**, 894–918 (2019).

122. Dyngeland, C., Oldekop, J. A. & Evans, K. L. Assessing multidimensional sustainability: lessons from Brazil's social protection programs. *Proc. Natl. Acad. Sci.* **117**, 20511–20519 (2020).

123. Agrawal, A., Kaur, N., Shakya, C. & Norton, A. Social assistance programs and climate resilience: reducing vulnerability through cash transfers. *Curr. Opin. Environ. Sustain.* **44**, 113–123 (2020).

124. Samelius, G. *et al.* Keeping predators out: testing fences to reduce livestock depredation at night-time corrals. *Oryx* **55**, 466–472 (2021).

125. Di Minin, E., Slotow, R., Fink, C., Bauer, H. & Packer, C. A pan-African spatial assessment of human conflicts with lions and elephants. *Nat. Commun.* **12**, 2978 (2021).

126. Vélez, J. *et al.* Cattle exclusion increases encounters of wild herbivores in Neotropical forests. *J. Appl. Ecol.* **61**, 2444–2454 (2024).

127. Miller, J. R. *et al.* Effectiveness of contemporary techniques for reducing livestock depredations by large carnivores. *Wildl. Soc. Bull.* **40**, 806–815 (2016).

128. Smith, D., King, R. & Allen, B. L. Impacts of exclusion fencing on target and non target fauna: a global review. *Biol. Rev.* **95**, 1590–1606 (2020).

129. Løvschal, M., Juul Nørmark, M., Svenning, J.-C. & Wall, J. New land tenure fences are still cropping up in the Greater Mara. *Sci. Rep.* **12**, 1–12 (2022).

130. Soanes, K. *et al.* Do wildlife crossing structures mitigate the barrier effect of roads on animal movement? A global assessment. *J. Appl. Ecol.* **61**, 417–430 (2024).

131. Saxena, A. & Habib, B. Crossing structure use in a tiger landscape, and implications for multi-species mitigation. *Transp. Res. Part Transp. Environ.* **109**, 103380 (2022).

132. Miller, J. R. Mapping attack hotspots to mitigate human–carnivore conflict: approaches and applications of spatial predation risk modeling. *Biodivers. Conserv.* **24**, 2887–2911 (2015).

133. Soh, Y. H. *et al.* Spatial correlates of livestock depredation by Amur tigers in Hunchun, China: relevance of prey density and implications for protected area management. *Biol. Conserv.* **169**, 117–127 (2014).

134. Dertien, J. S. *et al.* Mitigating human–wildlife conflict and monitoring endangered tigers using a real-time camera-based alert system. *BioScience* **73**, 748–757 (2023).

135. Weise, F. J. *et al.* Lions at the gates: Trans-disciplinary design of an early warning system to improve human-lion coexistence. *Front. Ecol. Evol.* **6**, 242 (2019).

136. LeFlore, E. G., Fuller, T. K., Tomeletso, M., Dimbindo, T. C. & Stein, A. B. Human dimensions of human–lion conflict: a pre-and post-assessment of a lion conservation programme in the Okavango Delta, Botswana. *Environ. Conserv.* **47**, 182–189 (2020).

137. Kolipaka, S. S., Tamis, W. L. M., Van 't Zelfde, M., Persoon, G. A. & De Iongh, H. H. Wild versus domestic prey in the diet of reintroduced tigers (Panthera tigris) in the livestock-dominated multiple-use forests of Panna Tiger Reserve, India. *PLoS One* **12**, e0174844 (2017).

138. Cassaigne, I. *et al.* Augmentation of natural prey reduces cattle predation by puma (Puma concolor) and jaguar (Panthera onca) on a ranch in Sonora, Mexico. *Southwest. Nat.* **65**, 123–130 (2021).

139. Zhang, C., Zhang, M. & Stott, P. Does prey density limit Amur tiger Panthera tigris altaica recovery in northeastern China? *Wildl. Biol.* **19**, 452–461 (2013).

140. Rejuan, A. S. M. *Community-Based Volunteer Management to Mitigate Human Tiger Conflict in the Bangladesh Sundarbans*. https://ruffordorg.s3.amazonaws.com/media/project_reports/15413-1%20Detailed%20Final%20Report.pdf (2015).

141. Fontúrbel, F. E. & Simonetti, J. A. Translocations and human carnivore conflicts: problem solving or problem creating? *Wildl. Biol.* **17**, 217–224 (2011).

142. Athreya, V., Odden, M., Linnell, J. D. & Karanth, K. U. Translocation as a tool for mitigating conflict with leopards in human dominated landscapes of India. *Conserv. Biol.* **25**, 133–141 (2011).

143. Lennox, R. J., Gallagher, A. J., Ritchie, E. G. & Cooke, S. J. Evaluating the efficacy of predator removal in a conflict-prone world. *Biol. Conserv.* **224**, 277–289 (2018).

144. Massei, G., Quy, R. J., Gurney, J. & Cowan, D. P. Can translocations be used to mitigate human–wildlife conflicts? *Wildl. Res.* **37**, 428–439 (2010).

145. Sibanda, L. *et al.* Effectiveness of community-based livestock protection strategies: a case study of human–lion conflict mitigation. *Oryx* **56**, 537–545 (2022).

146. Chausson, A. *et al.* Evaluating the impact of Warrior Watch: Behaviour change to promote human-lion coexistence. *Biol. Conserv.* **271**, 109571 (2022).

147. Hazzah, L., Bath, A., Dolrenry, S., Dickman, A. & Frank, L. From attitudes to actions: predictors of lion killing by Maasai warriors. *PloS One* **12**, e0170796 (2017).

148. Sibanda, L. *et al.* Exploring perceptions of subsistence farmers in northwestern Zimbabwe towards the African lion (Panthera leo) in the context of local conservation actions. *Afr. J. Wildl. Res.* **50**, 102–118 (2020).

149. Read, D. J. & Selinske, M. J. Achieving transformational change through the consilience of behavioral science and radical alternatives. *Sustain. Sci.* 1–12 (2024).

150. O'Rourke, D. & Lollo, N. Transforming consumption: from decoupling, to behavior change, to system changes for sustainable consumption. *Annu. Rev. Environ. Resour.* **40**, 233–259 (2015).

151. Bowie, M. J., Dietrich, T., Cassey, P. & Veríssimo, D. Co designing behavior change interventions to conserve biodiversity. *Conserv. Sci. Pract.* **2**, e278 (2020).

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

153. Villaseñor, E., Porter-Bolland, L., Escobar, F., Guariguata, M. R. & Moreno-Casasola, P. Characteristics of participatory monitoring projects and their relationship to decision-making in biological resource management: a review. *Biodivers. Conserv.* **25**, 2001–2019 (2016).

154. Muhl, E. K., Armitage, D., Silver, J., Swerdfager, T. & Thorpe, H. Indicators are Relational: Navigating Knowledge and Power in the Development and Implementation of Coastal-Marine Indicators. *Environ. Manage.* **70**, 448–463 (2022).

155. Danielsen, F. *et al.* Community Monitoring of Natural Resource Systems and the Environment. *Annu. Rev. Environ. Resour.* **47**, 637–670 (2022).

156. Sigouin, A. *et al.* Enabling participatory monitoring and evaluation: Insights for conservation practitioners and organizations. *Conserv. Sci. Pract.* **7**, e70032 (2025).

157. Lavariega, M. C. *et al.* Community-Based Monitoring of Jaguar (Panthera onca) in the Chinantla Region, Mexico. *Trop. Conserv. Sci.* **13**, 1940082920917825 (2020).

158. Dickman, A. *et al.* Community Camera Trapping: A Novel Method for Encouraging Human–Big Cat Coexistence on Human Dominated Land. *Wildl. Lett.* wll2.70006 (2025) doi:10.1002/wll2.70006.

159. Mascia, M. B. *et al.* Commonalities and complementarities among approaches to conservation monitoring and evaluation. *Biol. Conserv.* **169**, 258–267 (2014).

160. Zwerts, J. A. *et al.* Methods for wildlife monitoring in tropical forests: Comparing human observations, camera traps, and passive acoustic sensors. *Conserv. Sci. Pract.* **3**, e568 (2021).

161. Kerry, R. G. *et al.* An overview of remote monitoring methods in biodiversity conservation. *Environ. Sci. Pollut. Res.* **29**, 80179–80221 (2022).

162. Dixon, K. M., Cary, G. J., Worboys, G. L., Banks, S. C. & Gibbons, P. Features associated with effective biodiversity monitoring and evaluation. *Biol. Conserv.* **238**, 108221 (2019).

163. Kansky, R., Kidd, M. & Knight, A. T. A wildlife tolerance model and case study for understanding human wildlife conflicts. *Biol. Conserv.* **201**, 137–145 (2016).

164. Kansky, R., Kidd, M. & Fischer, J. Does money "buy" tolerance toward damage causing wildlife? *Conserv. Sci. Pract.* **3**, e262 (2021).

165. Wall, J. *et al.* EarthRanger: An open source platform for ecosystem monitoring, research and management. *Methods Ecol. Evol.* **15**, 1968–1979 (2024).

166. Saah, D. *et al.* Collect Earth: An online tool for systematic reference data collection in land cover and use applications. *Environ. Model. Softw.* **118**, 166–171 (2019).

167. Murray, N. J., Keith, D. A., Simpson, D., Wilshire, J. H. & Lucas, R. M. Remap: An online remote sensing application for land cover classification and monitoring. *Methods Ecol. Evol.* **9**, 2019–2027 (2018).

168. Ljungman, A., Vandermaesen, T., Leong, K. & Rachler, P. *WWF Policy Advocacy Toolkit: Towards Strategic and Effective Policy*. https://wwfint.awsassets.panda.org/downloads/wwf_2022_advocacy_toolkit___version_for_use_with_wwf_partners.pdf (2022).

169. Weible, C. M., Sabatier, P. A. & McQueen, K. Themes and variations: Taking stock of the advocacy coalition framework. *Policy Stud. J.* **37**, 121–140 (2009).

170. McLendon, M. K. & Cohen-Vogel, L. Understanding Education Policy Change in the American States: Lessons from Political Science. in *Handbook of Education Politics and Policy* (eds Cooper, B. S., Cibulka, J. G. & Fusarelli, L. D.) 30–51 (Routledge, New York, 2008).

171. Sabatier, P. A. & Weible, C. M. The Advocacy Coalition Framework: Innovations and Clarifications. in *Theories of the Policy Process* (ed. Sabatier, P. A.) 189–220 (Westview Press, Boulder, 2007).

172. Belecky, M. *et al. Living with Tigers: How to Manage Coexistence for the Benefits of Tigers and People*. (2022).

173. IUCN. *IUCN SSC Guidelines on Human-Wildlife Conflict and Coexistence*. (2023).

174. Gross, E. *et al. A Future for All: The Need for Human-Wildlife Coexistence*. (2021).

APPENDIX 1: RESOURCES FOR NOMINAL GROUP TECHNIQUE

APPENDIX 1A: TEMPLATE FOR RANKING HUMAN-TIGER CONFLICT ISSUES

Below is a template that can be used as part of the collaborative decision making process to decide what human-tiger conflict issue are most important to address. Space is provided at the bottom for more issues that may arise during discussion, and there is no limit to how many issues can be added. Similarly, space is provided for participants to rank their top 3 issues. However, more or fewer options can be added depending on the resources available to practitioners to address different issues. It is important to remember that participants should only mark one issue as their top ranked choice, one issue as their second ranked choice, and one issue as their third ranked choice.

Issue	Rank 1	Rank 2	Rank 3
People in this area generally cannot financially withstand or recover from a tiger attack on a family member or livestock			
People in this area generally cannot emotionally and mentally withstand or recover from a tiger attack on a family member or livestock			
People cannot tolerate living near tigers			
People in this area try to injure or kill tigers			
People generally disobey laws about using forest resources and interacting with tigers			
The people who manage tigers and their habitat are generally not effective at doing so			
Outside organizations that work to support tiger conservation are harmful to us and/or our interactions with tigers			
Negative interactions with tigers happen very frequently here			
The population of tigers in this area is quickly reducing			
Injured tigers in need of help are usually ignored			
There are few large areas of forest around here			
There are few animals for tigers to eat and/or little underbrush in the forests near here			
The risk of encountering risks makes it unsafe for people to go into the forest			

APPENDIX 1B: RESOURCES FOR ANALYZING RANKING RESULTS

Tallying Votes

Once everyone has voted, the resources below can be used to tally and count their votes. A Vote tallies can be recorded in a spreadsheet in which the columns are issues being ranked, rows represent each participant, and the cells are filled with their rankings. For example, a hypothetical example might look like this:

Once votes are entered into a similar spreadsheet (more issues can be added as other columns, and more participants can be added as rows), the file can be saved as a .csv and analyzed in either R statistical software or with freely available online applications.

Livelihood vul	Psych vul	No tolerance	Danger to tiger	Non Compliance	Ineffective mgm	Harmful orgs	Freq neg interation	Pop decline	Injured tiger	Small forests	No prey	Unsafe for people
	1		2				3					
		3				2			1	1		
2					3							
1		2		3								
	3				2		1					
			3						1			2

Analyzing Tallies in R

If analyzing the results in R, the following code can be pasted into the R console and run to get immediate results. If you need to download R, you can do so as http://rproject.org. Note though that "`C:/User/Tiger/Vote_Tally_Template.csv`" in the third line should be changed to the same file name and path where your .csv spreadsheet is saved. Additionally, the code below is set to pick the top three issues. If you want to change how many issues are selected, you can do so by changing the number after "`nseats =`" in the fourth line. More information on the R code can be found at the following URL: "https://cran.r-project.org/web/packages/vote/vote.pdf".

```
>install.packages("vote")

>library(vote)

>ranks <- read.csv("C:/User/Tiger/Vote_Tally_Template.csv", header = TRUE)

>stv.ranks <- stv(ranks, nseats = 3, eps = 1)

>summary(stv.ranks)
```

Analyzing Tallies with RankedVote.co

RankedVote.co also has a free online tool to calculate ranked choice voting results (https://app.rankedvote.co/import). You can upload the same .csv file you created earlier, except you need to add one column at the beginning in which each row is a participant number. So column A should have the heading 'Participant', and then the next rows should be sequential numbers, like 1, 2, 3, 4, and so on. Once this .csv is uploaded, the tool will tell you if there are any data issues and ask you how many winners to select. After that, you can calculate the results. Note that this online tool only allows free analysis of 15 or fewer participants' rankings.

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