Best Practices #2.11: Human Wildlife Conflict Management Plan



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1 Conflict Resolution Overview

Human-wildlife conflict in WMA's occurs when the needs and behavior of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife (Treves et al, 2006), These conflicts may result when wildlife damage crops, injure or kill domestic animals, threaten or kill people or sometimes it's because of unclear boundaries between the communities and the WMA management.

If the WMA authorities fail to address the needs of the local people or to work with them to address such conflict adequately, the conflict intensifies, becoming not only conflict between humans and wildlife, but also between humans about wildlife. It is important to emphasize that human wildlife conflict is not necessarily bad. Conflict can represent the productive interaction of competing interests between the WMA's management and its surrounding communities, an ever-present function in a dynamic society.

Human wildlife conflicts that are properly addressed can be opportunities for problems to be identified and solved, and progress achieved. Many conflicts, however, can become counterproductive and destructive, leading to detrimental results and hostile relationships. Wildlife management areas (WMA) staff face the challenge of trying to respond to conflicts so that unproductive consequences can be avoided while human wellbeing and the natural environment are protected.

1.1 Goals for human wildlife conflicts mitigation guidelines

- To enhance, foster, and sustain human-wildlife coexistence over the long-term throughout wildlife management areas (WMA's) in ways that recognize the security and development needs of local communities and the value of biodiversity conservation to the nation.
- To provides a road map to empower and train local communities to manage human-wildlife conflicts using appropriate mitigation methods,
- To enhance Government and civil society support to communities, install efficient nationwide monitoring to guide management, and build long-term coexistence through wise land use planning and education.
- To create a framework for addressing human wildlife conflict efficiently and effectively, using evidence-based short- and long-term solutions, to meet the needs of both community's welfare and biodiversity conservation.

1.2 Key principles in human wildlife conflict mitigation

All human wildlife conflicts occur, and must be addressed, within a particular cultural, political, and social context. Any conflict management approach must be appropriate for the context in which it happens and must take local conflict resolution customs and institutions into account. Nevertheless,



there are three general principles that should be applicable to the majority of wildlife management areas (WMA's) conflicts.



For more information about managing conflict in protected areas read this study by the International Union for Conservation of Nature and Natural Resources, <u>https://portals.iucn.org/library/efiles/documents/1996-013.pdf</u>

Principle One - Focus on Underlying Interests

A major challenge in resolving human wildlife conflicts is to address the underlying interests that are really at stake rather than getting stuck arguing over positions. The term "interests" is used to mean people's fundamental needs and concerns. The term "positions" is used to mean the proposals that people put forward to try to satisfy their interests.

A human wildlife conflict management effort in which all interest groups are satisfied (i.e., a mutually agreeable or "win-win" outcome) is much more likely to result in a lasting and satisfactory resolution than one in which the interests of only one side are addressed (i.e., a "win-lose" outcome). A win-win solution indicates that all parties includes the communities and WMA management believe they have gained something.

Principle Two - Involve all Significantly Affected Stakeholders in a Fair and Respectful Process

To resolve human wildlife conflicts, there has to be an effort to involve all significantly affected stakeholders. People want to be involved in making decisions when their interests are at stake, they want to have their opinions and ideas heard and valued, and they want to be respected as individuals.

Lack of affected stakeholder's inclusion in making decisions affecting the management of the area after it has been established are major sources of human wildlife conflict. If significantly affected stakeholders are excluded from attempts to address the conflict, they are likely to remain disgruntled over time, because they believe their interests are ignored and because they have no ownership in the outcome. Whereas, if their interests are explicitly considered in the process, they will be more inclined to support a proposed solution to the conflict. Inclusion also gives people a sense of ownership, which is a precursor to stewardship.

Principle Three - Understand the Power That Various Stakeholders Have, and Take That into Account When Trying to Resolve a Conflict.

Power is a critical element in human wildlife conflict resolution. Each WMA stakeholder's decisions about how they approach the conflict will depend to a large extent on their view of the power they have and the power balance among the various stakeholders. For example, a group that feels powerless to influence an outcome through a bureaucratic decision-making process may choose to use illegal activity such as poaching instead.



The wildlife management area manager who is involved in a conflict resolution process needs to understand the relative power (both perceived and real) of the stakeholders involved in the conflict.



- power of knowledge (having information);
- personal power (being personally forceful/persuasive);
- economic power (having financial resources);
- political power (having a supportive constituency or access to political leadership);
- legal power (having a "good" legal case, expert legal counsel, or access to courts);
- coercive physical power (having police or military backing, or weaponry);
- family power (being from a well-connected family); and
- group power (being a member of an ethnic, religious, or other type of group that has power or, for example, being male in a male dominated society).

2 Scoping

2.1 A framework for resolving conflicts.

The framework may include both and long-term time horizons. In a difficult conflict, it may be necessary in the short term to simply bring the situation under control (to manage the conflict) and to start building trust among stakeholders while planning in the long term to address the real issues that are at stake (to resolve the conflict).

The components of the conflict resolution framework are:

1. Getting Started/Determining Roles – Getting the conflict resolution process going.

For a conflict resolution process to be initiated, someone needs to decide that the problem has gotten bad enough to want to do something about it. Then, a determination of how to get a conflict resolution process underway needs to take place

2. Assessment



A structured attempt to assess the nature of the conflict, determine who is involved, and obtain other information that would be useful in designing an effective conflict resolution process.

The conflict assessment is the systematic collection of information to be used in designing a conflict resolution process. Assessment is usually on-going throughout any conflict resolution effort because the initial assessment almost always reveals the need for additional information which needs to be acquired as the conflict resolution effort proceeds.

3. Involving Affected Stakeholders

The communication/negotiation phase in which an attempt is made to find a resolution that addresses the interests of the stakeholders.

The third component of the conflict resolution framework is to involve affected stakeholders in the search for a solution to the conflict. This is the problem solving and/or negotiation phase of conflict resolution. Someone or some group (the convener - probably the same entity that has conducted the assessment) needs to design and initiate the effort. The design of a process to involve affected stakeholders will be based on the assessment described above. It should be developed with local customs and institutions in mind. If possible, it should build on existing communication channels. As has already been mentioned, the intent should be to include all significantly affected stakeholders in a fair, credible, equitable, and respectful process that leads to an outcome in which everyone's interests are considered.

4. Implementation and Evaluation

Solutions are implemented and evaluated. Then, very often, the process repeats itself as more issues are identified, and more conflict occurs.

This component of the conflict resolution framework involves formalizing, implementing, and then evaluating the solutions to the conflict that stakeholders have agreed to, or that decisionmakers decide on even without stakeholder agreement

3 Research

Collecting baseline information is a vital first step in managing HWC in WMAs because understanding the timing and locations of conflicts, as well as the behaviors of the involved individuals (wildlife and human) is essential to planning (Treves et al, 2006). Much HWC research falls into three broad categories: (a) identifying the involved parties, timing, and distribution of wildlife damage; (b) experimental or quasi-experimental studies of techniques to mitigate conflicts; and (c) surveys of people's attitudes, perceptions, and response to wildlife and candidate interventions

Research findings may also be useful to catalyze dialogue about interventions, especially when the research has been invited and co-designed by local stakeholders, capturing more representative opinions should help build a thorough understanding of the problems and build trust among all stakeholders(Halvorsen, 2003)



3.1 Consideration in doing human wildlife conflict resolutions

- Initial survey questions should be brief and designed for easy application to management
- Consider the culture, literacy and education level of respondents as well as the survey team, when designing the survey instrument
- Avoid questions about illegal activities until much later in the project if at all
- The resulting hard-copy map can also be brought to individual interviews to gain more nuanced views of the social and spatial distribution of conflicts
- In collecting, analyzing, and reporting data on perceptions, skepticism is out of place.

3.2 Primary objective

- Study the timing and locations of conflicts, as well as the behaviors of the involved individuals (wildlife and human)
- Define joint objectives, build consensus on which interventions to implement and who to involve during conflict resolutions
- Measure the success of the management project at three levels: (a) implementation, (b) threat-reduction, and (c) outcomes for targets.

3.3 Advantages

- Research often enjoys a measure of tolerance because it is generally minimally intrusive on people's lives and its product (knowledge) is often clear.
- Research findings may also be useful to catalyze dialogue about interventions, especially when the research has been invited and co-designed by local stakeholders around a WMA.

3.4 Disadvantages of research in human wildlife conflict mitigations

- Rural people often want reimbursement or interventions against HWC, not research
- Often conflicts, complaints, and resentment have built up over years, so a call to start research can fall on deaf ears or provoke hostility
- Research itself can be politicized because the things one measures, how one frames questions, and how one interprets the results, may favor one side or another
- Researchers may bias her or his results by identifying HWC as a serious problem before learning how local stakeholders prioritize it.

4 Strategies for Conflict Resolution

4.1 Enforcement

In some instances, conflict resolution may reduce the need for enforcement, especially when the conflict resolution effort addresses the real interests that underlie the conflict. However, in most cases, enforcement will continue to be a necessary compliment to the conflict resolution effort. There are several reasons why enforcement is important and necessary:

• Enforcement may be required to protect the resources of the protected area while the conflict resolution effort is underway.



- Strong enforcement may provide an incentive for violators to enter into discussions about how to resolve a conflict. Without strong enforcement, there may be little reason for violators to consider any alternatives to illegal behavior that is contributing to a conflict.
- Enforcement is usually necessary to ensure that agreements arising from a conflict resolution effort are implemented.
- There always seem to be a few individuals who continue to operate outside the law, in spite of attempts to address their needs and interests. Enforcement can be labor-intensive and costly. Faced with insufficient resources to staff, train, and equip their personnel, many WMA's area enforcement systems remain woefully inadequate.

Strategies:

- 1. Consider enforcement as an integral part of any conflict resolution strategy.
- 2. As part of the conflict assessment process, determine the root causes of violations on the protected area. Determine the interests at stake for the violators and try to develop solutions that address those interests.
- 3. Consider incentives and disincentives for ensuring compliance with protected area rules and regulations. Try to strengthen the incentives and minimize the disincentives.
- 4. Try to get as much understanding and ownership as possible from local people regarding the rules and regulations that are being enforced.
- 5. Consider collaborative efforts/partnerships in designing and conducting enforcement efforts. If possible, use local community members as enforcement personnel.

4.2 Education and public relations

Local people and protected area users may not be aware of the conservation values associated with the area. It is unrealistic to expect them to support protection measures or accept compromises that may be necessary to resolve a conflict unless they have a sense of those values. Therefore, education and public relations are key elements in most conflict resolution processes(Espinosa & Jacobson, 2012). Educating the public about the potential benefits associated with a protected area can be an important tool in avoiding and resolving protected area conflicts, especially over the long term, and can be critical in gaining support for the establishment of a protected area in the first place.

In situations where protected areas have been established without prior public education, consultation, or dialogue with local communities regarding the reasons for and benefits of the area, the predictable outcome is conflict, especially when there is a negative impact on local communities associated with the protected area.

Typically, the intent of education and public relations is to inform affected groups of the protected area's goals, regulations, activities, and benefits; build a supportive constituency for the area; and help generate understanding of why enforcement measures are necessary, making them more palatable. It may also be a way to foster two-way dialogue between the protected area and its constituencies.



Strategies:

- 1. Education/public relations efforts should begin as early in the protected area planning process as possible.
- 2. Education/public relations efforts should involve two-way communication so they can contribute to developing an open dialogue between the protected area and its constituencies.
- 3. To be most effective, education/public relations programs need to be designed according to the specific needs, audiences, and circumstances of the protected area.

4.3 The role of non-governmental organizations

Non-governmental organizations (NGOs) can play a tremendously important role in conflict resolution. NGOs' ability to play an effective role, and what exactly that role might be in a conflict situation, will depend a great deal on what the NGO is set up to do, its' credibility with local people and the government, and its' vision and resources. The breadth of approaches that NGOs have been able to undertake successfully in the conflict resolution context include advocacy, education, facilitation of consensus-building efforts among diverse interests, procurement of funds and resources, bolstering enforcement, and conducting research.

NGOs may be able to respond rapidly and introduce new initiatives or approaches to a conflict situation because they usually operate independently of government bureaucracy; they are sometimes able to tap into resources not normally available to, government agencies; they may be able to apply pressure to higher decision making levels in the government more effectively than the responsible government entities; and they are often successful in gaining local support for their activities (especially when they operate primarily at the local level). In a conflict situation,

NGOs may be perceived as more neutral, and therefore better suited as mediators, than protected area managers or other government bodies. When negotiation is used to resolve a conflict, it is often NGOs who negotiate on behalf of certain interest groups. NGOs may also be helpful in conducting research, delivering education, and in easing the root causes of the conflict by providing economic development opportunities or other community development services that reduce the pressure on protected area resources

Strategies:

1. When conducting a human wildlife conflict assessment, give particular attention to the potential role that local, national, and international NGO's might be able to play, (e.g., as mediators, negotiators, educators, or sources of resources to help resolve the conflict.)

2. NGOs should be viewed as groups representing constituencies with interests at stake, and should be included in the conflict resolution effort along with other legitimate interested parties.



Case study

Conflict and Protected Areas in Rwanda, Uganda, and Zaire

J. P. d'Huart

This case illustrates several possible approaches for anticipating and responding to armed conflicts involving protected areas.

In the last 30 years, numerous conflicts in the Central African nations of Rwanda, Uganda, and Zaire have had very important impacts on the wealth and maintenance of many of the region's protected areas., but whatever their nature, their consequences have tended to be diverse and persistent. Disintegration of protected area management and enforcement systems are among the most prevalent consequences.

Possible Preventative Strategies:

The history of conflicts in Central Africa has shown that in the many critical moments the motivation and discipline of the personnel is what counts most. In times of conflict, respect for the protected area matters much less than the bravery of the wardens. In Zaire, before the political events of 1960, the Virunga National Park (at the time Albert National Park) was the object of diverse attacks: initial invasions by local populations, illegal fishing, massacres of animals, lack of discipline on the part of the guards, etc. The situation could not have been saved by the army or the politicians. Only the courageous men of the Institute of Parks were effective. The training, salary levels, quality of equipment, and the worth of their superiors are the key elements which will determine the attitude personnel will choose in times of trouble.

Suggested specific preventative strategies that might be utilized. Among them are:

- Improving training and development of park personnel to develop loyalty and motivation;
- Improving salary levels and quality of equipment to create incentives;
- Involving the community in decision making and implementation efforts in the park;
- Developing a collaborative relationship between park authorities and the communities for protection;
- Launching park education and information-dissemination programs to promote the park's image as patrimonial heritage and;
- Avoiding alarmist reports from protected areas, which can be helpful in generating aid for the area, but can also be dangerously misleading in sensationalist media.



5 Community-Based Human Wildlife Conflict Mitigation

This section considers the existing interactions between people and the focal 'conflict' species in Tanzania, and reviews and prioritizes the practical, frontline mitigation methods that can be applied and managed for immediate effect by communities, either by themselves or in collaboration with Government, NGOs and other partners.

5.1 Carnivores

Key Mitigation Methods

- Improved bomas (Ogada et al, 2003) These include several adaptations of traditional bomas to make them more effective at preventing carnivores from entering and attacking livestock, including chain-link fence and living walls (trees *C. africana* and chain-link). This is an effective and scale-able method which can be used in combination with audio or visual deterrents, such as flashing lights systems.
- Good husbandry practices and livestock guarding dogs

Guarding herds and taking steps to actively defend them are important practices for reducing livestock depredations. Where guard dogs or adult herders are present, the rate of depredation is generally lower than in free-ranging herds (Kaczensky, 1996; Ogada et al., 2003; Breitenmoser et al., 2005; Woodroffe et al. 2006).

Risk of depredations can be reduced by herding during the day, having a guard dog, keeping livestock in a predator-proof enclosure at night, and avoiding high-risk areas. Noisemakers such as vuvuzelas or horns can have shown some success in chasing off carnivores approaching livestock. Refinement of livestock husbandry techniques may be among the most financially feasible, practical and effective approaches to conflict mitigation (Holland et al. 2018).



Note that dogs are forbidden in most protected areas, including in the wildlife management areas because of predation on small mammals such as rabbits and dik diks.

• Safe shelters and protective measures around homestead

Building of stronger houses (mud or mud-brick) in villages in farms, shelters on stilts, or watchtowers in agricultural fields reduce risk of attack while people are asleep. Wooden fencing around the homestead can be used to enclose cooking areas and outdoor toilets to limit the chance of encountering lions.

Lion Guardians

The Lion Guardians (LG) program employs community members to advise their peers on techniques to reduce livestock depredation, to intervene during lion hunts, to use local beliefs



and cultural traditions to improve local tolerance of large carnivores (Infield 2001; Stringer et al. 2006), and monitors lion numbers and movements. LGs also help to recover cattle, reinforce livestock bomas, and respond to emerging conflict situations. LGs also serve as an early warning system by patrolling areas for carnivore sign, thereby helping to alert herders in the vicinity to carnivore presence. In Amboseli, Kenya, the Lion Guardian program resulted in a near-total cessation of lion killings (Hazzah et al. 2014). Similar programs are being implemented in Tanzania by Tanzania People and Wildlife, Ruaha Carnivore project, and KopeLion.



For more information about human-carnivore conflict over livestock , read this study about African Wild Dogs in Botswana, https://escholarship.org/uc/item/6nd6w7st

5.2 Elephants

Key Mitigation Methods

• Elephant crop protection toolkit

This method involves the use of a toolkit by trained, voluntary village crop protection teams to guard farms against elephants. The toolkit comprises of four parts, which are deployed sequentially, including a flashlight, horn, chilli cracker and firework. The method works well where farmers are already guarding farms, where farms are clustered in close proximity, such that farmland can be guarded communally, and where elephant crop-raids are frequent and limited to a peak crop-raid period. Village crop protection teams could employ patrolling of farm boundaries to assist with early detection of elephants.

Beehive fences

Beehive fences are fences made up hives hung on poles spaced 10m apart, connected with wire strands, which causes the hives to swing and disturb bees if an elephant attempts to cross the fence. This method works because elephants are afraid of bees, who can cause painful stings. Beehive fences may be used to encircle farms, or be placed in a linear fashion along the interface between farmland and protected areas. In Kilombero, beehive fences resulted in a 50% reduction in elephant visits to farms. Beehive fences also provide income through elephant-friendly honey, and through "coexistence tourism". The method requires considerable investment in materials, training, capacity-building and monitoring.

• Chilli-based methods

Capsaicin, the active ingredient in chilli, is an irritant to elephants, and they have been shown to avoid chilli smoke, and the smell of chilli wafting from ropes or cloth. Chilli-based methods include chili fences, which are simple fences placed around farms or along a farm-protected area boundary, made from simple poles sisal ropes and rags soaked in a chili-oil mixture. Chilli



briquettes made of dried elephant or cow dung mixed with chilli has also been shown to repel elephants at short distances, and could be used to protect farmland. Chilli can also be grown as a cash crop, thereby providing income.

Watchtowers

Where farmers are actively guarding farms, watchtowers can help with early detection of elephants into farmland to help timely deployment of response methods such as the crop protection toolkit or other escalation tactics, and for reporting to zonal hotlines. Watchtowers can be built by communities from locally available materials.

Method	Advantages	Limitations
Flashlight (Torch)	 Environmentally friendly and Gives farmers a low- tech way to scare these animals away from their crops without violence. Higher success with non- elephant crop raiders 	 Elephants might easily adapt to lights and not view them as deterrents Some bull elephants already shown to be undeterred by lights Lights, if in the wrong hands, could be used for poaching
Airhorn	 Inexpensive at about \$10 USD per horn Requires minimal training to use, thus easily adopted by communities Success in deterring elephants proven, especially when with lights 	 Again, elephants might easily adapt to horns and not be deterred
Chili Cloud	 Combines two known deterrents into one Inexpensive and easy for anyone to assemble given basic training Effective in deterring elephant herds if used in succession 	 Risk to the user and the elephant if used improperly Some bull elephants return to farm not long after being chased Regular higher-level training required to ensure proper use
Roman Candle	 Proven to be extremely effective even in chasing risk-taking bull elephants 	 Relatively expensive at approximately \$30USD per explosive





- Elephants rarely return to the farm the same night after intervention is used.
- Increased risk with larger explosion, requiring more training
- As of now, only developed by one supplier in Arusha, Tanzania.

6 Long-term sustainability of human wildlife interference management

6.1 Land use planning and management

WMA officials should put forward Participatory Land Use Planning (LUP) as a primary tool for longterm coexistence. This is the most just and the most effective way of planning for wise land use management that seeks to harmonize diverse land use systems including coexistence between people and wildlife in protected areas including WMAs. It is the most just approach because, firstly, it builds a consensus between communities and civil society, local and national Government, and all other relevant stakeholders, on the best way to use land that meets the coexistence goals of the LUP.

Participatory LUP is the most effective approach precisely because of the consensus-building methodology it embraces. This approach maximises the chances of long-term sustainability of the agreed LUP through long-term compliance with the Plan by all stakeholders, because they were all involved in the participatory planning process and mutual consent was reached.

6.2 Wildlife corridors

Tanzania's Protected Areas are vital for long-term conservation of wildlife and ecosystem services, however they cannot and do not cover the entire range of wildlife species in the country. Wildlife use these areas and routes to access essential resources, and protection of these corridors are therefore critical to maintaining the viability of the wildlife populations whose "core areas" are in the Protected Areas. The nationwide network of wildlife management Areas and the wildlife they support can only be sustained by maintaining the wildlife corridors between them.

Moreover, complex land tenure arrangements and lack of management of these wildlife corridors are some of the key drivers of human-wildlife conflicts. Unregulated or poorly planned development in wildlife corridors inevitably leads to increased crop losses, livestock losses, endangerment of human lives, and other economic and social disruption. Species such as elephants have knowledge of migratory routes that are passed down from generation to generation, and continue to attempt to move along these paths even when they are blocked by farmland, settlements or infrastructure, creating conflict hotspots.

As called for in the Regulations, a National Priority Corridor Action Plan (NPCAP) is under development (to be published in 2020), which will identify priority corridors for restoration and protection based on



several criteria which are both ecological and socioeconomic, including levels of human-wildlife conflict and the potential for corridor management to reduce these conflicts.

6.3 Buffer zones

Buffer zones are areas adjacent to the boundary of a Protected Area, where some restrictions are placed on resource use(Sayer, 1991). A primary purpose of the buffer zone is to reduce human-wildlife conflict. Buffer zones also serve to strengthen protection of wildlife management Areas by "reducing dependence of local human populations on WMA resources" (DeFries et al, 2007) and by protecting habitat and wildlife by diluting the impact of pesticides and other agricultural poisons. Multiple studies of spatial patterns of human-wildlife interactions have shown that they are significantly and positively correlated with distance from the Protected Area boundary.

Buffer zones are essential for reducing human-wildlife conflict, management of Wildlife management Areas, and improvement of human livelihoods. Starting from these principles, there are uses of the resources in buffer zones that can be beneficial for communities but are also compatible with conserving natural habitat adjacent to Protected Areas, and therefore do not compromise the ecological and coexistence roles of the buffer zone. Crucially, these land uses should be agreed with the communities, and then well managed and enforced.



For more information about buffer zones, read this study by..... (Link here) (DeFries et al, 2007)

6.5 Improving farming practices

In the end, conflict between people and terrestrial wildlife is rooted in the needs of humans and nonhuman animals for space, including land, water and resources that the land supports. As human populations and the associated need for land increase, space for animals decreases, wildlife comes into more frequent contact with people. There remains enough land in Tanzania for both its strong Protected Area network, which is so important for the Tanzanian economy, and the needs of the human population. Therefore, another component of the long-term solution for coexistence is to increase the efficiency of land use outside of wildlife areas for human needs, in order to be able to continue to set aside land for use by wildlife.

According to Tanzania's 2015 Agricultural Development Strategy, half of suitable land for livestock and a quarter of suitable land for farming is being used to its potential (ASDS-II: Agricultural Sector Development Strategy, 2015), largely by small-holder farmers. There are substantial increases in yield that can be made, even for small-holders, through the use of modern farm technologies and simple best practices in agronomy.



To identify the critical factors that motivate or impede the adoption of farming practices, barrier analyses can be conducted for relevant groups.



Suitability Analysis of Mitigation and Response Methods

	Cost	Where	How	Challenges
Elephants				
Crop Protection Toolkit		Areas with a high density of inter-connected farms, with frequent elephant incursions during a short and defined peak crop-loss period.	Established commitment to and experience in communal guarding; training; early communication of exit strategy; backup vehicle and ranger response unit.	Not suitable in areas with large isolated farms, or where crop damage is infrequent and unpredictable. Potential habituation by some elephants to toolkit elements.
Beehive Fence		Areas with a hard boundary between WMA and farmland with defined elephant trails, an environment suitable for beekeeping, and frequent, year-round crop damage.	Ground surveys and careful planning prior fence installation; hive occupancy; established capacity for beekeeping and beehive fence management.	Not suitable in areas with shifting agriculture, very large farms or an extensive farmland-WMA interface; lacking in suitable habitat for beekeeping. Farmer participation during harvesting period can be low. Several years of external support may be needed.
Chili Fence		Areas with a hard boundary between PA and farmland, or between fenced and unfenced farms with clear elephant trails, with frequent crop damage.	Ground surveys and careful planning prior to installation; farmers commitment to application; established capacity; income-generation	Availability of engine oil, chilli, and local suitability for chilli-growing. Frequent application of chilli-oil mixture in high rainfall areas. Farmer dislike of working with chilli- oil mixture. To reduce habituation, fences can be removed following harvest.
Alternative domestic water supplies		Areas without piped water supply for domestic use, where access to rivers or	Identify local needs and ensure regular supply and fair access. In areas with elephants, stone	Water from safe water points may be used for drinking and domestic

	lakes exposes people to a high risk of attacks from crocodiles and other wildlife.	walls can be used to protected water sources against elephant damage. Defined responsibility for maintenance.	use, but people may still go to rivers/lakes to bathe, swim or fish.		
Drones	Areas with intense crop damage and frequent elephant incursions into farmland, with defined peak conflict period.	Drone operators need to be well-trained, well-equipped, and mobile. A system for rapid reporting of elephant incursions must be in place.	Where crop damage is infrequent and unpredictable, drones may not be efficient and cost-effective due to high equipment, training, and running costs. Legislation and restrictions on drone use. Risk of habituation to drones by elephants.		
Carnivores					
Improved livestock bomas	Areas where lion and hyena attacks on livestock at the household or boma are common. <i>Commiphora</i> <i>africana</i> trees required for living walls.	Correct construction and installation. Boma owner investment in proper use and maintenance, good herding practices ensuring livestock are returned to the boma at night.	Where pastoralist households are truly semi-nomadic or move seasonally, they will not agree to build a permanent structure. Leopards can learn to jump over the fence and climb out carrying small- stock.		
Active livestock guarding	Areas where large carnivore attacks on livestock out grazing are common.	Use of guard dogs is key. Presence of herder. Local understanding of risk factors for carnivore attacks.	Access to labour for herding; training, food and veterinary care for guard dogs. Dogs must be vaccinated to prevent disease transfer to humans and wildlife.		
Both Elephants and Carnivores					
Watchtowers or improved guarding huts	Areas with a high density of inter-connected farms, with consistent, frequent elephant or bush pig	Established commitment to and experience in communal guarding. Towers must be built securely. Huts must be built with	Watchtowers do not prevent wildlife crop damage. Rather, they provide farmers with a safe station for crop		

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	incursions, or where farmers guarding fields are at high risk of lion attacks.	mud or mud-brick walls and have a roof to provide protection from lions.	guarding and when sleeping in fields.
Education about safety guidelines and safe behaviors	Useful in many contexts	Guidelines should be informed by local knowledge and analysis of local risk factors. Well- designed materials. Effective and respectful delivery.	Increased awareness about risky activities or behaviour may not necessarily reduce people's engagement in those activities (e.g. crop guarding): barriers to behaviour change must be identified and addressed.
Translocation	Translocation as an HWC management tool is a last resort method, as it has a low success record and can increase mortality risk for the translocated animal. A protocol should be developed to identify the limited qualifying conditions under which relocation should be considered, suitable release sites should be identified nationally, and a standard procedure for relocation and post-release monitoring must be developed.	A secure and suitable release site is an essential requirement, sufficiently far away from the capture site, with consideration of food availability, local safety concerns, territorial issues, and the impact of translocation at the release site. See Supplement for more detail. Translocation requires highly trained personnel, vehicles/boats/helicopter, traps, and drugs to calm and immobilize the animals.	The success rate of translocation is low (Holland et al. 2018; TAWIRI, unpublished data). Translocated animals often 1) return to their capture site or otherwise move away from their release site (observed for elephant, leopard, lion and crocodile) (2) have reduced survival, and (3) resume their 'conflict' behavior at the release site (review in Linnell et al. 1997), which has the effect of simply moving the problem elsewhere. For instance, 12 habitual fence-breaking and crop- using elephant bulls were translocated from Laikipia to Meru National Park in Kenya. These bulls continued their fence-breaking behaviour at the release site, and other elephants acquired the behaviour from them, thus

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		introducing fence-breaking to a
		population where it previously did
		not occur (Evans & Adams 2018).
		Translocation, by inducing stress
		and disrupting social ties at capture
		and release sites, can cause
		abnormal behaviour, as observed
		for elephants (Fernando et al. 2017).

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