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BALANCING THE NEEDS OF PEOPLE AND WILDLIFE: When Wildlife Damage Crops and Prey on Livestock

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This LTC Brief draws from experience on three continents to outline recent advances in understanding and managing human-wildlife conflicts, with twin objectives of biodiversity conservation and poverty alleviation.



WHETHER ONE CONSIDERS LIONS, tigers and bears preying on livestock or elephants, parrots and deer feeding on crops, conflicts arise when the activities of wild animals coincide with those of people. Although damages by wildlife do not have the regional impact that drought and disease have, they do have critical, political and environmental significance for the conservation of biodiversity. They also can have catastrophic economic consequences for vulnerable households. The fringes of protected areas and landscapes with a mix of human development and wild land see most human-wildlife conflicts (HWC). Each year, thousands of people lose their lives and billions of dollars are lost in property because of HWC globally. Traditionally, people respond to wildlife threats by killing “problem” animals and eliminating wild habitat to prevent further losses. The scale of biodiversity and economic costs is hard

to estimate for developing countries, but data from developed nations are indicative. The US government responds to roughly \$1 billion in agricultural damage nationwide by killing approximately 2.5 million wild animals annually. In 2004, this included 107,044 wild carnivores, of which about 3% were threatened or endangered species or killed unintentionally when other species were targeted.

There is no evidence that agricultural damages by wildlife are decreasing in the United States, but in the developing world conditions are more volatile. On the one hand, severe habitat loss has diminished wildlife populations, reducing the number of households affected by HWC, *at great cost to biodiversity*. On the other hand, where nature protections have succeeded, threatened wildlife may recover and cause property damage or loss of life for households once far from wild lands, *at great cost to rural economies*. Recent advances in HWC research and management promise to interrupt the wasteful spiral in either direction

and simultaneously promote biodiversity conservation and poverty alleviation.

Over the past two decades, scientific research has identified a handful of principles of HWC and distilled a number of recommendations for management. This brief outlines the wildlife dimensions of HWC, reviews our understanding of affected people's perceptions of risk and resolution, traces paths to successful intervention through participatory planning and co-management, and examines the key role of research in the resolution of HWC.

Wildlife dimensions: the behavior of problem individuals

The fate of wildlife depends on human tolerance for them. Thus HWC is now seen as a major challenge for conservation, particularly for large animals that require large areas and often exploit the same resources as do people. In the case of large carnivores, few protected areas are large enough to support a viable population and the predominant causes of mortality in all carnivore populations studied thus far come from humans.

Worldwide, spatial analyses emphasize the patchy nature of conflict with wildlife. Some

localities will suffer heavy losses while others go unscathed. Indeed, a minority of individual large mammals pose a threat to crops, livestock or people, just as a minority of households suffer the majority of losses. The patchiness of HWC reduces the cost-effectiveness of large-scale and non-selective wildlife control efforts. For example, culling has repeatedly failed as the problem wildlife were missed and uninvolved animals were removed. However, people often perceive lethal methods as a "final" solution, so other approaches may require persuasion, a subject addressed in detail in the next section.

Also "problem" animals change their behavior when living in and around human property. Timing their activities, modifying vocal behavior and choosing micro-sites to avoid detection and reprisals by people have all been reported. The elusiveness and wariness of problem carnivores is legendary. For example, in Ecuador, nine Andean bears were killed by local farmers before they felt satisfied that they had eliminated the single bear believed to be attacking cattle. In sum, identifying likely culprits in HWC is a critical step in protecting a wildlife population from disproportionate

Definitions

Co-management: Management shared between affected communities and governmental agencies or NGOs.

Coping mechanisms: Steps taken to reduce individual or household vulnerability, which range from individualized self-protection to collective insurance based on social reciprocity. The former depend heavily on individual access to land, labor, and capital, which depend in turn on wealth and political influence. By contrast, communal coping mechanisms depend on kinship networks, traditions of sharing, reciprocity, and joint land management.

Local stakeholders: Affected communities and the nationally appointed authorities charged with wildlife management at a site. While it can be a challenge to identify the appropriate unit of social organization to be involved in management, the natural and obvious unit is composed of the individuals and households affected by human-wildlife conflict in a given locality.

Management: Planning, intervention, and monitoring (including baseline applied research).

Risk: The likelihood of loss for a given locality. (Compare to "vulnerability.")

Vulnerability: Individual or household capacity to cope with risk.

Wildlife: This brief focuses on terrestrial vertebrates (larger than one kilogram) rather than smaller organisms that typically produce greater economic losses, because larger organisms pose a greater immediate physical threat and provoke more political strife between environmental interests and other stakeholder groups.

human retaliation. It is also a step that typically requires research.

Even selective lethal control of wildlife may not be cost-effective, if new animals quickly replace the ones removed, and if distinguishing the culprits from uninvolved animals is fraught with error, as is usually the case. Thus, non-lethal deterrence may be more cost-effective and is usually preferable from a biodiversity conservation standpoint as well.

Wild animals are usually neophobic—wary of new stimuli. Thus, the most successful non-lethal interventions are varied and flexible, using several different deterrents in combination or serially in order to avoid habituation by wildlife. Because a wild animal deflected from one property may move to another, non-lethal deterrents should usually be applied to multiple, neighboring properties. However, the full extent of such installation (for example, fencing) should reflect the ranging behavior of the problem animal, not some sociopolitical unit. This may require working across jurisdictions, which emphasizes the potential benefits of stakeholder participation in planning.

Human dimensions: vulnerability and perceptions

HWC can turn affected communities against wildlife conservation initiatives and, in some cases, cause local governments to de-gazette protected areas. Local resentment over damage by wildlife can preclude discussion of other environmental issues, such as soil erosion, pollution, and water management.

Downplaying or ignoring the problem can generate added resentment.

Perceptions of HWC influence complaints, tolerance for wildlife, approval of management, and cooperation in proposed solutions. Local perceptions of HWC are complementary to systematic, scientific measures of loss and equally important in managing the problem. Three reasons for this follow.

Catastrophic losses versus averages.

Perceptions are shaped by catastrophic events more than frequent, small-scale losses, notwithstanding the higher cumulative, economic costs of the latter. By contrast, most scientific studies of HWC emphasize averages, not extremes. Regional averages can mask the few individuals or households suffering devastating losses. For example, elephants can cause catastrophic damage to a farm but few are affected and only rarely. Yet many farmers will complain bitterly about elephants whereas few mention widespread, chronic losses caused by monkeys.

Time scale and spatial scale. Human perceptions may be distilled from long memories and stories from distant associates. This breadth and depth is rarely captured in scientific studies, which usually sample a smaller area over a briefer period.

Audiences. Affected communities and lay audiences often find personal stories more convincing or comprehensible than scientific data. By contrast, systematic measures can be more compelling to authorities, scientists and outsiders, who may want to see quantitative evidence before investing time and effort.

Perceptions are a management reality. Perceptions of HWC may shape expectations about proposed interventions. In Japan, a majority of surveyed farmers opposed lethal control of suspected crop-raiding monkeys because the monkeys were perceived as physically similar to humans. Furthermore, because perceptions are shaped by catastrophic, rare events more than by small-scale, frequent events, successful interventions against common, small-scale damages may not reduce complaints about HWC, even if economic losses are significantly lessened. Similarly, some highly effective interventions may clash with sociopolitical norms of behavior or cultural traditions.

Interventions against HWC should not appear one-sided in addressing human behavior; this

can be seen as “blaming the victim.” Simultaneous changes in husbandry or human behavior alongside interventions against wildlife behavior may equalize the burden of change. This will usually entail implementing two or more interventions, which also matches recommendations from recent studies that show single interventions rarely work for long.

Perceptions of HWC are shaped not only by the severity and frequency of losses but by numerous social and biophysical factors relating to individual vulnerability and risk. We define “risk” as the likelihood of loss for a given locality. In contrast, “vulnerability” pertains to individual or household capacity to cope with that risk. Neighbors facing identical risk of Andean bear damage to maize fields may have very different vulnerabilities based on their resources and the protective measure in which they have invested. If one of the neighbors has a second job that precludes guarding her farm, then she may suffer more bear damage but her second income may compensate for the losses.

The tradeoffs between alternative coping methods and their outcomes for vulnerability emphasize that coping methods are experiments.

Changing conditions alter these tradeoffs, so we must monitor the outcomes of different coping methods, causes and consequences of differential vulnerability across households, and fluctuating external risk factors—especially if we put in place material and technical interventions in regions of marginal productivity. For example, the five-year, multi-



**Local people often fear or resent wildlife as a symbol of government property.
(Photo by Leela Hazzah)**

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million dollar India Eco-Development Project (IEDP) tried to protect a national park containing tigers, while also protecting crops from wildlife and increasing local incomes. Economic incentives of many sorts were provided in consultation with the beneficiary communities. But biodiversity monitoring was

cut from the budget and long-term monitoring of economic interventions was not included in the project plan. An independent study conducted five years after the IEDP ended

found that the majority (66%) of material contributions—for alternative livelihoods and for crop defense—were not used or maintained (Gubbi 2007). Furthermore, the author’s survey revealed no difference in conservation attitudes between IEDP beneficiaries and non-beneficiaries around the same park. This is a sobering reminder that incentives for

conservation must be paired with sanctions or the inputs become entitlements and attitudes or behaviors will not change. Moreover, efforts to protect affected households from HWC must take into account traditional coping methods and the long-term sustainability of whatever interventions are attempted.

Coping with HWC

Coping mechanisms range from individualized self-protection to collective insurance based on social reciprocity. The former depend heavily on individual access to land, labor, and capital, which depend in turn on wealth and political influence. By contrast, communal coping mechanisms depend on kinship networks, traditions of sharing, reciprocity, and joint land management. The poorest, migrant households face compounding vulnerability. Without large landholdings or kin networks they cannot buffer themselves from wildlife conflict, nor can they hire additional labor.

Some settings limit the use of social coping mechanisms (for example, recent migration by new ethnic groups, incentives for individual land ownership). Of course a continuum exists from individual to fully communal, social coping methods, and affected households may participate in both.

Because HWC often leads to destruction of wildlife and wild lands or political clashes over biodiversity protection, outside groups often become involved. At that point, proposed solutions multiply and traditional coping methods may be forgotten. The risk in such cases is that traditional coping methods are often more understandable, sustainable, and cost-effective for affected households than are novel solutions advocated by stakeholders who are less directly affected by HWC. Moreover, the affected communities are sometimes wholly disenfranchised if wildlife authorities and outsiders step in to control HWC.

To avoid the extremes—either traditional, unregulated control of wildlife, which often

spirals into unsustainable killing, or novel, technical solutions imposed upon affected peoples—this brief focuses on co-management, including participation by affected households in decision-making, implementing experimental interventions, and even monitoring HWC.

Participation and co-management

Our starting assumption is that participation should be *optimized*. Namely, participation in planning, implementation and monitoring has potential advantages and disadvantages. The disadvantages reflect the transactional costs of meeting, building consensus and organizing actors into coordinated roles, as well as potential political clashes that arise from differences of opinion or conflicts of interest. The advantages include recruiting influential stakeholders as partners, generating additional ideas for implementation that a subset might have overlooked, combining resources and personnel to attain a shared goal, and providing a model for more democratic and transparent decision-making. The optimal level of participation maximizes the ratio of benefits to costs at a given site and at each step in a project cycle. In short, participation should be tailored to local conditions and considered strategically as a means to a goal, not an end in itself.

Ideally, affected individuals and households would manage HWC independently without permanently damaging biodiversity. However, several conditions demand collaboration between affected households and other stakeholders. For one, many conflicts occur at the borders of protected areas or involve endangered species, which may fall under the jurisdiction of wildlife managers. A third party (for example, an NGO or outside researcher) may be needed if there is a history of mistrust among local stakeholders. However, outsiders must avoid being seen as allies of central authorities rather than local communities.

Participatory planning of HWC projects requires defining joint objectives, identifying

obstacles (or indirect threats) and opportunities (the facilitating environment that will improve the probability of successful intervention), followed by discourse on selection and design of interventions and monitoring methods. Joint objectives should include both protecting human welfare and abating threats to wildlife. If these two objectives do not get equal attention and equal investment—as in the example of the IEDP above—the project is likely to fail. One sure-fire way projects to manage HWC will fail to conserve wildlife is if the varied wildlife interest groups are under-represented or disadvantaged in the decision process. It is easy to weigh the votes of affected households more heavily than the votes of the wildlife and easy also to focus on economic costs and benefits over non-material costs and benefits of HWC situations. By keeping the twin objectives foremost and designing projects with optimal participation in mind, these pitfalls may be avoided.

Among the benefits of participatory planning for HWC projects are the following.

1. Because interventions, research and monitoring often require access to private properties and possibly other intrusions on people's lives, efforts to build community understanding, involvement and ownership of a HWC project usually make implementation easier.
2. Similarly, many interventions require a change in human behavior. No one likes being told what to do, especially if long-held beliefs or traditions are put in jeopardy; hence, affected individuals or households are more likely to accept changes if they have defined the need for change and identified the change they wish to make, or at least chosen among options offered to them.
3. Sanctions against destruction of wildlife are essential in balancing HWC management goals, lest interest in wildlife conservation be subordinated entirely to development activities, which are easier to persuade

stakeholders to accept. Co-management structures allow affected communities to police themselves, if designed properly. For example, conservation groups working in Mongolia and Nepal have been using bilaterally negotiated contracts with livestock producers in snow leopard range for many years. The local communities' households make wool products from domestic sheep, the conservation group sells the products in developed nations at a premium price, and a pre-negotiated portion of the proceeds is paid to each producer. Also, the community as a whole gets a substantial bonus distributed equally among its members if monitoring of snow leopards and their prey shows that conservation goals were met that year. Community members have turned in outside poachers on their community lands to avoid losing the bonus.

Clearly, the benefits of participation require legitimate representatives of local stakeholders, including fair attention to the differential distribution of vulnerability due to gender, ethnicity, wealth, etc. Because those who complain loudest may not be the most vulnerable, allowing affected households to discuss the distribution of costs and benefits openly and transparently may promote equity in interventions.

Interventions

Sociopolitical acceptance of interventions can be as important as cost-effectiveness. Familiar, inexpensive interventions—those that require little new technology and minimal change to existing behavior—are most likely to succeed. For example, one of the snow leopard teams mentioned above provided modest financial and technical support to build a communal corral after villagers identified this as the most appropriate intervention. In this case, corrals were in wide use but communal herd management was not traditional.

From the outset, it is important to dispel hopes for money or “silver bullet” interventions.

Naturally, many people suffering losses to wildlife want compensation and final solutions. Such solutions are rare or illusory. Yet careful analysis of the factors that make households vulnerable and the factors that elevate risk, in conjunction with information on wildlife behavioral ecology, will usually bring to mind an array of direct and indirect interventions. Combining direct and indirect interventions promises to balance wildlife and human needs most effectively.

Direct interventions. Most HWC situations involve wildlife encountering unintended or undefended property or being attracted to more palatable or nutritious food sources than are found in the wild. Accordingly, most direct interventions attempt to defend property (guards, barriers, removal of wildlife) or reduce its attractiveness (repellents) or some combination of the two (changing the type, timing or location of human activities). Few have tried to increase the relative attractiveness or availability of wild foods, which might be classified as the latter form of intervention. Most direct interventions have been tested experimentally or been subject to generations of testing by producers under operating conditions. This is not true of indirect interventions that grew out of the wildlife conservation movement.

Indirect interventions. Because HWC only requires intervention if the affected households cannot tolerate it, some managers of HWC advocate raising people's tolerance as an indirect means to reduce conflicts. The most common form is compensation—payments after losses have occurred. Compensation has been criticized from every conceivable perspective using both theory and empirical evidence. It is particularly subject to fraud,

corruption and inequity; it discourages investment in defense of property and can forestall investment in more permanent solutions; once begun, its costs inevitably rise and it is very hard to terminate; and it gives greater weight to the voices of wealthy, outside donors in HWC decision-making. On the other hand, compensation does spread the costs of wildlife conservation more equitably across society; it can also bring hostile stakeholders to the discussion and give a stronger voice to wildlife protection interests.

Classification of methods to mitigate HWC

Direct methods reduce the severity or frequency of wildlife damage:

- Barriers (fences, trenches, walls, buffer zones, etc.)
- Guards (human or animal)
- Changing the type, timing or location of human activities
- Repellents (chemical, auditory or visual aversive stimuli)
- Removal of wildlife (capture, killing, sterilization)

Indirect methods raise people's tolerance for conflicts with wildlife:

- Compensation and incentives
- Participation
- Research and environmental education

Providing incentives in the form of material or technical inputs *before* losses occur to avert retaliation against wildlife should be superior to compensation for balancing human and wildlife needs, because incentives support prevention while compensation promotes reaction and dependence on a donor. The caution accompanying the above statements is that incentive-based conservation is an untested idea, despite its recent popularity. As mentioned, participation of affected households may increase their tolerance for a HWC mitigation project. It may also improve their tolerance for wildlife damages. This is somewhat speculative, but preliminary

anecdotes suggest people's complaints soften when something is being done about HWC. Presumably, planning is not sufficient but perhaps interventions are sufficient even if effectiveness has not been demonstrated. Finally, research and ensuing dissemination, often called environmental education or outreach, is sometimes credited with improving people's tolerance for threatening wildlife. We have abundant evidence from studies of human attitudes that people with more formal education are more tolerant of large carnivores. However, individuals that specifically have greater knowledge of wildlife, including carnivores, are not always more tolerant. Hence we need a rigorous experimental test because the need for environmental education is an assumption of many environmental projects.

Role of research

Collecting baseline information is a vital first step in managing HWC because understanding the timing and locations of conflicts, the behaviors of the involved individuals (wildlife and human), and the perceptions of affected stakeholders is essential to planning. Large gaps in knowledge will render inefficient or ineffective any efforts to select and design interventions or monitor the success of such interventions. Research often enjoys a measure of tolerance because it is generally minimally intrusive on people's lives and its product (knowledge) is often clear. However, this positive scenario is not guaranteed. Rural people often want reimbursement or interventions against HWC, not research. One farmer facing elephant crop damage wanted "food, not numbers." Communities marginalized by political conditions may distrust and reject research if it has been used to their detriment in the past. 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. Care should be taken to remain impartial as an honest broker of information; that is, the researcher must relinquish control over the outcome of negotiations between stakeholders.

Human dimensions. Means to study and measure perceptions, vulnerability and coping methods vary and vary in effectiveness. Group meetings are valuable sources of insights into perceptions, but they often only air publicly-sanctioned views or the majority experience. Capturing more representative opinions should

improve understanding of HWC and can build trust among stakeholders.

Gender, economic, and political inequities may require confidential communications. When one interviews people

There is no substitute for a thorough understanding of the behavioral biology of conflict-causing species, especially as it pertains to their interactions with people.

similar to oneself, one may capture more nuance and insight into perceptions. Host-country nationals should probably lead monitoring teams, and it is even better if local community members do so. Even so, interviews with women may not be possible if men block access. By conducting interviews in women's ambits, one may find women perceive and report different wildlife threats than do men. Participatory mapping exercises are usually helpful because HWC is unevenly distributed in space and many people encode natural resource information spatially in mental maps. A hard-copy map can also be brought to individual interviews to gain more nuanced views of the social and spatial distribution of conflicts. However, two-dimensional representations of space are not salient to all individuals or cultures.

Wildlife dimensions. One must have basic measurements of damage location, timing, severity and which species were involved to select the appropriate interventions or install them effectively. If feasible, collect ecological

and behavioral data on the wildlife in and around human use areas rather than relying on studies from wilderness. There is no substitute for a thorough understanding of the behavioral biology of conflict-causing species, especially as it pertains to their interactions with people.

Testing 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. Avoid choosing the first solution that comes to mind. Any proposed solution is an experiment and should be treated as such.

Monitoring interventions

Monitoring is essential to judge the effectiveness of interventions, which are, by their nature, experiments. Monitoring should include three hierarchical measures of performance:

- Were interventions put in place as planned?
- Did the level of HWC diminish?
- Was biodiversity maintained or restored?
Was human welfare improved?

At a minimum, monitoring should distinguish background fluctuations in HWC, wildlife populations and human welfare indicators, from the effects of interventions.

Having designed long-term monitoring protocols, project planners would be well advised to prepare alternatives that are less intrusive on affected households. Having two or more options gives the subjects a choice as to the level of intrusion into their affairs. The two alternatives should be nearly equal in information gained, but differ in logistical features that affect community involvement or interruptions to community schedules. For example, a team discussed two plans to study

and ameliorate cattle losses in Bolivia. The first was simplest for the wildlife managers (ask livestock owners to pool their small herds in one valley with a communal system for rotating between valleys), but the team expected low tolerance for such a plan given the community's reputation for individualism. So they devised a second proposal that was deemed simpler for livestock owners (park guards located in town would inspect cattle carcasses in every valley). In both cases, most incidents of cattle mortality would be detected and investigated (less quickly or reliably in the second plan), yet the first plan involved more change in traditional activities.

Conclusions

This brief outlines the wildlife dimension of human-wildlife conflicts, reviews recent advances in understanding affected people's perceptions of risk and resolution, traces paths to successful intervention through co-management, and finally examines the key role of research in the resolution of human-wildlife conflicts. Our approach emphasizes social science input because HWC is as much a social problem as a technical challenge. Although the steps are simple and straightforward, site-specific details can be maddeningly complex.

The capacity to effectively manage wildlife-related threats to human safety and property—without compromising wildlife population viability or human life and livelihoods—is within our grasp. To do so, we believe co-managers must combine technical expertise with local knowledge and embrace transparent and democratic processes of participatory planning, with the sacrifices this entails.

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