

Mitigating Human–Nonhuman Primate Conflict

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One of the challenges facing primate conservation is the rising level of interaction between humans and primates, and the resulting conflicts that might emerge. Human–primate conflict is a subset of human–wildlife conflict that can broadly be defined as “any human–primate interaction which results in negative effects on human social, economic or cultural life, primate social, ecological or cultural life or the conservation of primates and their environment” (adapted from Hockings and Humle 2009:1). Human–primate relationships are complex, ranging from relatively peaceful coexistence to extreme levels of hostility. Living alongside primates can impose costs upon local people that are frequently cited as the “drivers” of conflict, including crop feeding and destruction of stored food, depredation upon livestock, aggressive interactions with humans, damage to property, and disease transmission to humans (these factors combined are hereafter called “primate damage”). As human populations continue to grow and people make deeper incursions into natural habitats (e.g., through agriculture, mining, and other types of extractive industries, roads, and settlements), human–primate interactions and conflicts will become more widespread and prevalent.

While primate damage might drive conflict, it is becoming increasingly acknowledged that different goals, perceptions, and levels of empowerment between humans (researchers, policy makers, and stakeholder groups) might underlie conservation conflicts. New definitions recognize conservation conflicts as “situations that occur when two or more parties with strongly held opinions clash over conservation objectives and

when one party is perceived to assert its interests at the expense of another” (Redpath et al. 2013:100). The term “conflict,” which is regularly used to describe human–primate interactions, might impact the way that researchers, as well as local people, view conflict issues, and might limit the development of effective mitigation strategies by directing people to solely focus on the proximate (i.e., primate damage) rather than the potential underlying human factors (Hill 2015). Similarly, referring to wildlife feeding on cultivated foods as “crop raiding” (where “raiding” has inherent negative connotations) may elicit or exacerbate negative perceptions of primates.

Although research on human–primate conflict might not directly prevent or mitigate conflicts, it forms an integral part of any conflict mitigation scheme. If the ultimate goal is to design and develop mitigation measures or solutions that will be effective and sustainable in the long term, it is essential to fully understand the nature of the problem. The drivers of conflict are sometimes similar across primate species and sites, but the complexities of interactions mean that there is no “one answer fits all” in conflict mitigation. Conflicts occur in a variety of settings (including farms and plantations, roads, temples, villages, towns) and contexts (resource overlap, food provisioning, tourism). To develop a broad understanding of existing and potential conflict situations, and their current and future impacts on both humans and primates, requires the integration of data on multiple aspects of human and primate behavior and ecology and environmental, economic, and political factors, along with a good understanding of local people’s perceptions of the situation, as well as identifying and addressing underlying and unresolved tensions between different stakeholder groups. Such knowledge might then be used to develop effective, locally adapted, management strategies to prevent or mitigate human–primate conflicts, while respecting both conservation objectives and sociocultural–economic–political contexts. However, it is important to emphasize that conflict mitigation should not be considered in isolation from other factors affecting the

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sustainability of primate populations (e.g., habitat destruction, loss of natural food source, hunting) but as part of an integrated conservation strategy.

Understanding the Drivers of Conflict

The typical starting point for evaluating human–primate conflict is determining the level of primate damage. The sophisticated cognitive capacities of primates (e.g., advanced abilities for social learning, solving problems, and innovative behavior) must be considered when assessing how primates perceive and respond to the costs and benefits of human presence and activities, and the likely effectiveness of countermeasures aimed at reducing the frequency and impact of primate damage (Hockings and Humle 2009). In rural, urban, and semi-urban areas, primates can damage human property and some species engage in aggressive and predatory behavior towards humans and domesticated animals, with implications for disease transmission. More commonly, primates cause damage by feeding on crops. In particular, certain members of the genera *Chlorocebus* (vervet and tamar monkeys), *Papio* (baboons), and *Macaca* (macaques) share traits such as curiosity, large social groupings, flexible and omnivorous diets, high agility, terrestriality, and bold temperaments, allowing them to thrive in areas of cultivation and human settlement, including tourist lodges and religious sites; in many parts of Asia, macaques have formed a commensal relationship with people (Priston and McLennan 2013). More specialist primates can also show flexible behavioral responses to human-influenced habitats and frequently incorporate crops into their feeding repertoires (see Nowak and Lee 2013 for an overview), but, unlike macaques, baboons, and vervets, do not reach their highest numbers in areas alongside humans.

Crop feeding by primates can be seasonal, as it is influenced by availability of both crops and wild food resources, and intensity may vary as a function of local crop assemblages, planting patterns, growth stage, and ripening periods, with certain crops and developmental stages being consumed preferentially. For example, chimpanzees (*Pan troglodytes*) at Bossou, Guinea, and Bulindi, Uganda, consume ripe agricultural fruits

most often during periods of wild fruit scarcity, but certain seasonal crops (such as mango) were targeted when available, irrespective of wild fruit availability (Hockings, Anderson, and Matsuzawa 2009; McLennan 2013). Hence, crop consumption may be a fallback strategy, but also a preferential means of accessing a high-energy food.

When primates attack people or livestock, it is important to consider the characteristics and context of any aggressive interaction, as these will sometimes be determined by the species' ecology and behavior. Species that include small mammals in their natural diet, such as baboons and chimpanzees, likely pose a greater risk to livestock. For example, Chacma baboons (*Papio ursinus*) on Gokwe Communal Land, Zimbabwe, predate young goats and sheep, with over half of total livestock killing (52 percent of 241 killings) across three years attributed to baboons (Butler 2000). Attacks on people by free-ranging primates occur mostly in the context of tourism and food provisioning (where primates are also well habituated to people), and in areas of high anthropogenic disturbance, such as on the edge of villages, in towns, and tourist sites. For example, in rural locations, macaques can occasionally show aggressive behavior towards humans, but compared to tourist, temple, and urban sites where macaques are provisioned, physical attacks appear infrequent (Priston and McLennan 2013). Reports suggest that most attacks by nonprovisioned primates are defensive, with primates responding to a perceived human threat (i.e., hunting, harassment), but unprovoked attacks also occur (e.g., chimpanzee predation on children). In the most extreme situations, large-bodied primates (e.g., great apes) occasionally attack and can kill people, especially children (Hockings and Humle 2009), although this is rare (McLennan and Hockings 2016). Attacks might show interannual variation in both distribution and severity, and be initiated by certain individuals. Long-term data collected consistently are sometimes required, therefore, to fully understand the prevalence and extent of the problem. The management of some conflict situations might be easier if "problem" individual primates can be identified. Even if primate attacks on livestock and humans are rarer than more persistent events such as crop feeding,

they can generate very high levels of hostility, prompting retaliatory killings and compromising conservation efforts.

Primate damage is only one aspect of conflict: the level of primate damage might not relate to the level of conflict produced, and reducing wildlife damage alone will often fail to produce long-term conflict resolution. Important factors that might influence the intensity of conflict generated through primate damage include visibility of species, economic and opportunity costs of damage, wealth and power, cultural norms and expectations, fear and lack of knowledge, and instilled human values (Dickman 2010). Additionally, conflicts are often rooted in less visible, more complex social tensions between people (Hill 2015).

The physical or cultural visibility of a primate species may impact how they are viewed by local people. Those that are large bodied, live in large groups, and are diurnal may have a more obvious physical presence to people. Hence, these species can be blamed for losses because they are more easily observed in a location than smaller, more elusive species. Due to large body size, there may also be an elevated “negative” awareness around the potential risks they pose. The real impact of primate damage, and the level of resentment created, might depend upon the relative wealth and financial security of the people affected. If someone has limited assets and no alternative means of income, then even a small amount of primate damage to food sources can be problematic, and makes investment in effective protection strategies for their crops or livestock difficult to afford. People are particularly hostile towards such losses if they feel powerless and are forced to restrict their economic or social choices due to the presence of primates, especially if such costs have been imposed upon them externally, for example by the formation of a nearby protected area or governmental/international regulations protecting species.

Contrasting values between those affected by primate damage (e.g., local human communities) and those who are more focused on wildlife protection interests (e.g., primate conservationists, and agencies deemed responsible for alleviating the problem, including governmental and nongovernmental organizations) are the most common causes of political disagreements

in human–primate conflict situations, and can emerge in different forms. Such disagreements are almost always to the detriment of primate conservation, so it is important to establish whether the conflict problem is politically linked to other issues, such as local hostility towards conservation authorities, or disagreements among people related to empowerment and resource access. Conflicts can escalate when local people feel that the needs or values of wildlife and/or other human groups, such as the government or tourists, are given priority over their own needs. This is especially applicable when people feel they have little to gain and much to lose by sharing land with primates and the species is protected by law. Such tensions are often particularly intense around the borders of protected areas, where people can suffer significant costs from primates, while the government, tourists, and external companies accrue benefits. For example, at Bwindi Impenetrable National Park, Uganda, some mountain gorilla (*Gorilla beringei beringei*) groups living on the border of the Park feed on human crops and sometimes attack local people. Some villagers report that fear of attack by gorillas impedes their farming activities and movements, serving as a constant reminder that they lack the power to deal with these protected yet problematic animals. The association of problematic gorillas with a perceived lack of support by park authorities and a perceived lack of benefit from community-oriented revenue-sharing programs intensifies the negative response to any damage caused (Madden 2006). Distrust is a main barrier to collaboration, so processes that help build trust and facilitate negotiation are likely to encourage engagement in conflict mitigation.

Consideration of the complex cognitive, aesthetic, and spiritual influences on human behavior, attitudes, and perceptions is a major factor in human–primate interactions (Fuentes and Wolfe 2002). Cultural attitudes and practices vary greatly between regions, and the perception of conflicts between humans and primates will differ accordingly. Primates might be afforded protection as a function of local customs, and the clear similarities between primates and humans can lead to cultural taboos on killing or eating primates, even if they cause damage. For example, traditional folklore around Lore Lindu National Park, Sulawesi, sees Tonkean macaques

(*Macaca tonkeana*) as biologically and culturally related to humans, and harming crop-feeding macaques is traditionally taboo (Riley 2010). On the contrary, primates can be attributed human characteristics that elicit hostility and that are condemned by many societies, sometimes causing an exaggerated perception of the damage they cause. For example, farmers in Budongo, Uganda, describe baboons as “the enemy”: baboons are considered “arrogant,” “wasteful,” and “vindictive,” destroying parts of crops they find unpalatable and spoiling crops for their own entertainment (Hill and Webber 2010). Although baboons at this site are responsible for a higher level of damage than other primate species, local people’s perceptions of the risk of crop damage by baboons are disproportionately high compared with actual risk. Improved local knowledge about problematic primate behavior can potentially increase tolerance towards primates, for example through researchers providing information to local farmers on actual levels of crop damage (Riley 2007). To ensure more transparent conservation policy and realistic local-conflict management it is important to ensure that large-scale, top-down processes provide opportunities for local people to share ideas about how they think long-term coexistence can be achieved.

Human–primate conflict issues easily become exaggerated or politicized, particularly in meetings where complainants have an audience and may be speaking to outsiders perceived to have political or other influence. Perceptions may be exaggerated or reality distorted for economic, social, or political reasons. It is essential, therefore, to gain the trust of an affected community and maintain cultural sensitivity when discussing issues connected with conflict in order to acquire a comprehensive and fair understanding of how primates and conflict issues are perceived in a particular locality. Human–primate situations can escalate when local people or institutions are unable to deal with the conflict effectively. Where possible, people assigned to resolving a conflict situation should already have, or be trained to acquire, the necessary expertise. Furthermore, simply arriving at a site and taking an interest in conflict can lead to problems in itself, since it immediately raises expectations that a solution will be forthcoming. If the needs of the local people are not addressed, conflict levels may

increase both between humans and primates, and among humans about the value of primates. It is crucial to understand the local issues related to the conflict, and to assess how you are equipped to address the problem to avoid careless action when implementing any conflict mitigation strategy. Recognizing and easing underlying social tensions is fundamental to effective conflict mitigation. The issues surrounding human–primate conflict will sometimes be site-specific, but a broader understanding of similarities across different sites is beneficial when designing and implementing any conflict mitigation program.

Technical and Social Measures for Human–Primate Conflict Resolution

Effective human–primate conflict mitigation is difficult to implement because it requires a complex set of social and technical measures that need to be combined flexibly at different temporal and spatial scales. Conflict mitigation measures can be implemented directly within the conflict zone or rely heavily on official policy beyond the conflict zone. Methods can also be short term (e.g., traditional deterrent and disturbance methods) and long term (e.g., fencing, land-use planning, research, and community conservation). It is important to consider measures that are appropriate for primates neighboring protected areas and those where the primates are found outside protected areas on private or state land. The protected status of the primate species will determine whether a problem animal can be killed or not. If protected, a problem individual should only be repelled, removed, or tolerated. Although some conflict mitigation trials have been conducted to assess the effectiveness of technical strategies, evidence suggests that long-term conflict resolution is rare, even where targeted technical strategies are implemented. The intelligence and adaptability of some primates can make both traditional and more sophisticated disturbance devices ineffective in the long term.

Basic types of repellents are visual, acoustic, and chemical. Inanimate visual repellents such as scarecrows are often ineffective at deterring primates from entering certain areas, as most primates will readily habituate to them. Research

on the impact of acoustic repellents on the crop-feeding behaviors of primates is limited; however, given their ready habituation to visual stimuli, it is likely that they also readily habituate to sound if it becomes predictable (e.g., stationary noisemakers such as bells). Olive baboons at Gilgil in Kenya habituated quickly to playbacks of baboon alarm calls in crop fields, and would probably have responded in the same way to playbacks of predators, limiting their long-term success in reducing primate damage (Strum 1994). As technology advances and equipment costs go down, there may be future opportunities to test novel forms and combinations of deterrents. Chemical raiding-repellents have been tested against primates with limited success. Some have tried to encourage taste aversion with the use of an emetic, with mixed success. Strum (1994) recommended that emetics should be undetectable, easy to deliver, with rapid emetic action, and negligible side-effects. It is clear that taste aversion interventions need to be designed very carefully for practical and ethical reasons, and should not be implemented by farmers without technical support. Crop palatability can be reduced by applying capsicum solution to crops, although this has had mixed results. Systematic research is needed to determine appropriate concentrations and means of implementation, which will vary between primate species. Caution is required when considering any visual, acoustic, and chemical repellents, as they may displace target primates to new locations and farms, or impact nontarget wildlife and humans.

Guarding crops against damage by wildlife is a common traditional practice across the primate-agriculture interface, despite increased risk of injury and significant time commitment. As crop feeding by primates is sometimes opportunistic and can occur in poorly defended fields, crop loss is often inversely correlated with the farmers' vigilance. Hence, active guarding throughout the day (i.e., not only at predictable times) is important to reduce crop loss. The guarding measures preferred by different groups of people vary, such as patrolling fields and shouting, banging objects, throwing stones or spears, and using guard animals, as does their effectiveness towards different primate species. However, when farmers are directly involved in testing and identifying appropriate crop protection

techniques for systematic evaluation, the crop protection tools are generally more effective at reducing the incidence of primate crop feeding, and farmers are more likely to continue to implement those measures. More advanced early warning systems should be developed and tested (e.g., the use of mobile phone technology for wider ranging species) to inform people that primates are in the vicinity and to protect crops, livestock, or themselves. Understanding when primates target certain areas might enable people to direct their resources more effectively. Primate monitoring response teams can be effective in protecting crops and livestock where primate damage is localized or occurs over an extended period. The long-term employment of response teams requires funding to compensate team members for time spent guarding, so financial support must be secured if such activities are to be sustained.

Fencing is widely used to keep animals out of agricultural areas, but traditional fencing is largely ineffective in excluding primates, due to their agility. Clearing the vegetation around fences may enhance visibility and discourage more fearful primates from entering agricultural areas. Regular small-scale cutting back of vegetation along fields, paths, and trails frequented by humans and primates can also help reduce the incidence of primate aggression toward humans, if these are linked to issues of travel restriction and surprise encounters. Electric fences can become ineffective due to the primates' ability to learn to overcome the problem. Overall, the cost of materials, installation, and maintenance, as well as the theft of materials, make electric fencing often unaffordable, impractical, and unsustainable for large-scale application in economically less-developed countries.

Buffers and barriers around primate habitat might discourage primates from crossing into human settlements and agricultural areas. Water-filled boundary canals can be useful barriers, but alone are unlikely to yield effective results. Not all primates are fearful of water, and canals have to be deep and wide enough to deter them from crossing. In addition, canals may pose disease risks if water becomes stagnant, and could become ineffective if problems develop with maintaining water levels. "Live hedges" of carefully chosen and locally available species known to be unattractive to primates could

be an effective means of isolating vulnerable crops from the forest edge, particularly when interspersed with unpalatable crops. Such preventive measures require testing to assess labor requirements, practicality, cost, effectiveness, and impacts on local fauna and flora. Corrugated zinc sheets placed around individual fruit trees that do not have canopy connectivity have been effective in deterring primates from feeding on fruit crops and tearing bark. At Batan Serangan, Sumatra, the experimental introduction of tree barrier nets to close off arboreal travel pathways reduced crop feeding by orangutans (*Pongo abelii*) at randomly selected farms, compared to control farms where crop feeding increased (Campbell-Smith, Sembiring, and Linkie 2012).

Buffer zones are blocks of land located between natural forests and cultivated areas that can discourage wildlife from crossing between them, and hence where land-use practices and land management can be designed to reduce human–primate interactions. Although research is lacking on their use in human–primate conflict contexts, buffer zones are likely to be more feasible in areas where there is a “hard edge” between primate habitat and human activities (e.g., on the edges of some national parks) rather than forest–farm–village mosaics. Buffer zones can be used for economic gain, but care should be taken that they do not contain plant species that attract foraging primates, unless the intention is to attract primates away from areas utilized by people through the development of exploitable buffers. Many crop-feeding primates are generalist feeders, but in more ecologically specialized species, where crop-type selection is not random, evidence-based management requires a good understanding of species’ ecology and crop-feeding habits. Comprehensive species-wide studies of crop consumption by primates, and their potential to generate conflict (according to their attractiveness to that primate species, as well as the economic and subsistence value of the crop), have potential for aiding on-the-ground stakeholders to develop sustainable primate management schemes (Hockings and McLennan 2012). If considered a viable option, a buffer zone to discourage primates from entering an area should be as wide as possible, and should be either regularly cleared of vegetation that could provide cover for the primates, or as unattractive

as possible. When choosing buffer crops to plant on the forest boundary, it is important to consider whether they will be for subsistence purposes or cash generating, and thus dependent on external markets. Increasing connectivity between forest sites via corridors can reduce the isolation of primate subpopulations, and might provide additional resources to primates, potentially reducing primate damage to crops. Corridors require the collaboration of neighboring concession holders and, ideally, strong support from local communities and government. Like buffer zones, the design and management of corridors depends on adjacent land-uses, and should not attract primates into new agricultural areas. Where conflict between humans and primates is caused by a shortage of natural resources, one solution, especially in unprotected areas, might be to provide alternative resources through habitat enrichment, for example through developing exploitable buffers. If crop feeding by primates is related to periods of wild food scarcity, increasing the presence and availability of natural fallback foods that are not consumed by humans may constitute a means of reducing crop feeding at these times.

If the establishment of a protected area or the expansion of an existing protected area’s boundaries requires the relocation of human populations or agricultural activities, such relocation should take into account primate ecology and habitat use, the risks of human–primate conflict, and local people’s perceptions of the issue, to avoid negative attitudes developing towards conservation initiatives and exacerbating conflict issues. The translocation of people can be unethical and prohibitively expensive, but is more likely to succeed if combined with direct or indirect benefit-sharing schemes. Translocation of “problem” primates should be considered only as a last resort, as it is stressful, dangerous, and potentially life-threatening. It is expensive and labor-intensive, with costs involved in identifying areas appropriate for release, site preparation, and post-release monitoring of individuals to evaluate success. However, under certain conditions, primate translocations can be successful in reducing conflict at a particular site. For example, the translocation of wild olive baboons (studied extensively prior to and post translocation) from a site of high conflict was successful, with birth and survival rates of the released groups

comparable to those of the indigenous control group (Strum 2005).

Education and awareness-raising programs do not offer a technical solution to resolve conflicts, but may promote a better understanding of primate behavior, thus reducing damage across a range of contexts (from tourist settings to village encounters). For example, if people are more informed on how to behave (or not to behave) when encountering primates, education programs may also reduce the incidence of aggressive interactions. Basic tips on body movement and eye contact, and other advice such as not carrying food, can reduce the likelihood that a primate will attack. There are various schemes that attempt to benefit local people and encourage their collaboration in local and national conservation strategies, including those to reduce conflict. For example, local initiatives can include growing of crops that are unpalatable to primates yet of commercial value, financial assistance for the production of handicrafts, beekeeping, and support for campgrounds and eco-lodges for tourists. Benefit-sharing schemes allow local people to gain directly from conservation-oriented activities (e.g., through employment opportunities) and when conservation income contributes to local development projects (e.g., building hospitals and schools).

Although financial incentives can be successful in the resolution of human-primate conflicts, they also need to satisfy the economic and cultural needs of the parties involved in the conflict. When revenue from primates is distributed to local communities, negative perceptions towards primates and the damage they might cause can be improved. However, there are important and well-known risks associated with the commoditization of nature that should be taken into consideration before promoting economically motivated schemes for mitigating human-primate conflict. Schemes that achieve successes in the short term may cause serious problems in the long term; for example, tourism can have negative consequences for primates and requires careful management of disease risks. In addition, revenue-sharing schemes, if not managed appropriately, may destabilize local communities and attract an unsustainable influx of people to the area, which could ultimately negatively affect conflict mitigation goals. It is

important that the benefits from conservation are shared with local land-users and the most affected households, and not solely absorbed by higher-level administrative structures. Community conservation efforts often fail because community-level interventions are steered towards elite groups who tend to have a stronger influence over the management of resources, leaving poorer, more marginalized households with few real benefits. Successful programs require long-term partnerships between the wildlife authorities, local authorities, private sector, and local people, including the key stakeholders, which are often difficult to achieve.

Monetary compensation for damaged property and/or lost revenues can provide short-term alleviation of conflict, but it addresses only the symptoms and not the causes of the problem. The key determinants of success for compensation schemes typically include the accurate and rapid verification of damage, prompt and fair payment embedded in a transparent process, a long-term source of funding capable of responding to variations in damage over time, clear rules and guidelines that link payment to sound management practices, an appreciation of the cultural and socioeconomic context, and an ability to actively monitor the primate population of interest. Compensation schemes often fail to provide incentives for local people to conserve primates, especially when they do not identify and target those most affected by primate damage.

Effective human-primate conflict resolution requires complex and multifaceted approaches, which acknowledge that conflict is a result of not simply economic loss but also deep-rooted cultural values and clashes among human groups with different interests and values. In conflict management, success occurs when the outcome is acceptable to all sides and when parties do not assert their interests to the detriment of others (Redpath et al. 2013). The ability for humans and primates to coexist therefore depends partly on the willingness of stakeholders, academics, and policy makers to recognize problems as shared ones and to discuss them collaboratively and transparently. Primate conservationists must consider the wider socioeconomic, political, ecological, and cultural conditions under which different conflicts arise, and be realistic about how different groups of humans are part of the

problem. To do this accurately is challenging, and requires continued collaborations between researchers with different expertise and the diverse stakeholders with different interests.

SEE ALSO: Community Involvement and Primate Conservation; Crop Raiding; Disease; Ethnoprimatology; Human Dimensions of Primate Management; Human Livelihoods and Primate Conservation; Primates in Folklore; Primates in Urban Settings; Primates in World Religions (Buddhism, Christianity, Hinduism, Islam); Primate Tourism; Protected Areas; Social Taboos

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