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Troublesome neighbours: Changing attitudes towards chimpanzees (*Pan troglodytes*) in a human-dominated landscape in Uganda

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ABSTRACT

Long-term human–wildlife sympatry depends on the willingness and capacity of local people to coexist with wild animals. With human population growth and deforestation for agriculture, farmers increasingly live in proximity to wildlife, including large mammals of conservation concern. Understanding local perspectives and concerns regarding wildlife is essential for informing appropriate management strategies that reduce conflicts and promote sustainable coexistence. Social science approaches therefore have a critical role in integrated conservation programmes. We undertook an attitude survey to understand residents’ perspectives about sharing a landscape with chimpanzees (*Pan troglodytes*) in an unprotected forest–agriculture mosaic in Uganda. Interviews (n = 134) in 12 villages demonstrate residents’ ambivalence towards living alongside these protected yet potentially troublesome mammals. Chimpanzee behaviour is reported to have undergone recent changes. Residents claim apes increasingly enter villages for food, threaten people, and pose a particular threat to children’s safety. Chimpanzee numbers are believed to have increased locally. Most interviewees fear chimpanzees, considering them dangerous. Crop losses to chimpanzees were widely reported. Farmers tolerate raiding of domestic fruits, but not cash-crops. Results demonstrate that attitudes towards wildlife are not fixed. Reported changes to chimpanzee behaviour are challenging villagers’ traditionally benign attitude towards them. Even so, residents acknowledge benefits to chimpanzees because they reportedly displace other crop-raiding wildlife which, unlike chimpanzees, damage important staple food crops. Survey findings are contextualised with respect to recent, major land-use changes in Uganda (clearance of unprotected forest for timber and agriculture) that have precipitated a sharp rise in farmer–chimpanzee interactions. We discuss the study’s broader implications for protected mammal management and conflict mitigation in human-dominated landscapes, and ask whether it is appropriate to expect impoverished rural farmers to accommodate large-bodied mammals that pose a potential threat to their safety and livelihoods.

Key Words: anthropogenic landscapes, attitude survey, coexistence, conservation, crop-raiding, human–wildlife conflict, problem animals

INTRODUCTION

Humans are an inescapable feature of most environments inhabited by wildlife. Although human encroachment and modification of natural habitats is associated with declines in many animal populations, certain taxa can adapt to anthropogenic landscapes, for example by incorporating cultivated foods or livestock into their diets, which brings them into conflict with humans (Clarke, 1953; Engeman et al., 2010; Knight, 2003; Osborn and Hill, 2005; Palmeira et al., 2008; Perez and Pacheco, 2006; Treves and Karanth, 2003). Additionally, certain wildlife, particularly species of large mammal, present an actual or perceived risk to human safety in shared landscapes, and may be feared by local people (Campbell-Smith et al., 2010; Kaltenborn et al., 2006; Nyhus et al., 2000; Quigley and Herrero, 2005). Aside from the continuing availability of suitable habitat and resources for wild animals, long-term human–wildlife sympatry is dependent on the willingness and capacity of local people to coexist with wildlife. It is therefore critical that conservationists take account of the relationship between humans and potentially troublesome or threatening wildlife in shared habitats, and consider the conservation implications of their interactions when developing

management strategies (Dickman, 2010; Majić and Bath, 2010; Naughton et al., 1999; Thornton and Quinn, 2009).

Conservation is intrinsically a multidisciplinary field, dealing with the interface between environmental and human concerns and interests (White and Ward, 2010). Effective conservation requires the support and participation of local human communities (Ancrenaz et al., 2007; Browne-Nuñez and Jonker, 2008; Kasenene and Ross, 2008). Yet conflicts with wild animals arising from threats to human livelihoods and/or physical safety promote negative attitudes towards wildlife and reduce local support for conservation – especially if animals involved are protected by legislation (Hill et al., 2002; Madden, 2008; Naughton-Treves and Treves, 2005; Newmark et al., 1993). Consequently, understanding local attitudes and concerns regarding wildlife is essential for informing locally-appropriate conservation and management strategies to reduce conflict (Browne-Nuñez and Jonker, 2008; Hill, 2004). Social science approaches therefore have a critical role to play in any integrated conservation programme (Manfredo, 2008; Newing, 2011; Redford, 2011; White and Ward, 2010).

Human population growth, forest fragmentation and agricultural expansion have increased contact between great apes and rural farming communities (Campbell-Smith et al., 2011; Hockings and Humle, 2009; Reynolds, 2005; Madden, 2006; McLennan, 2008). There is thus a need to examine the dynamic relationships between people and apes in shared environments. Unless hunted or persecuted, chimpanzees seem able to adapt to anthropogenic habitats including forest–farm ecotones (Hockings and McLennan, 2012). In Uganda – which has important populations of eastern chimpanzees (*P. t. schweinfurthii* Giglioli 1872) – primates are not traditionally eaten. A situation has arisen in which chimpanzees living outside Uganda’s main protected areas persist in shrinking forests surrounded by people, amid expanding agricultural land-use systems (McLennan, 2008). Relatively harmonious relationships between sympatric chimpanzees and humans have been reported elsewhere (e.g. Guinea: Dunnett et al., 1970; Leciak et al., 2005; Guinea-Bissau: Hockings and Sousa 2011). In some regions humans perceive chimpanzees as kin and are therefore tolerant of them (Yamakoshi, 2005). But where human population densities are high and people and apes encounter one another frequently and utilise the same resources, competition and conflict are an inevitable outcome of this interaction (Hockings and Humle, 2009; McLennan, 2008, 2010a; Reynolds, 2005; Wrangham, 2001). Chimpanzees readily incorporate cultivars into their diet (Hockings and McLennan, 2012). Moreover, in common with other great ape species, chimpanzees are large-bodied, may exhibit threatening behaviour when encountered and occasionally attack people, particularly when threatened or provoked (Hockings et al., 2010; McLennan and Hill, 2010). Thus local people sometimes fear great apes (Campbell-Smith et al., 2010; Madden, 2006; Wrangham, 2001). Most seriously, chimpanzees living in close proximity to people have been known to kill and eat young children (Kamenya, 2002; Wrangham et al., 2000). Such problematic behaviours by chimpanzees inevitably reduce human tolerance, potentially leading to retaliatory killings (Reynolds, 2005; Wrangham, 2001).

All currently recognised species and subspecies of great ape are classified as Endangered or Critically Endangered (IUCN, 2010). This calls for urgent conservation strategies that reduce conflict and facilitate sustainable coexistence between people and great apes in shared landscapes (Hockings and Humle, 2009). Yet insufficient attention has been devoted to understanding the experiences and opinions of local people who live alongside them

(Campbell-Smith et al., 2010; Watkins, 2006). In this report we explore residents' experiences of, and attitudes towards, chimpanzees in Bulindi, an unprotected forest–agriculture mosaic in western Uganda, where apes and people live in very close proximity. Previous studies indicated that farmers in this region are traditionally tolerant of chimpanzees (Hill and Webber, 2010; Watkins, 2006). Given recent, major land-use changes regionally (i.e. extensive logging and clearance of unprotected forest, and increased cash-cropping; McLennan 2008; Mwavu and Witkowski, 2008), our aim was to establish the current relationship between sympatric farmers and chimpanzees. Specifically, we sought to determine whether residents perceive any changes over time in (i) chimpanzee numbers locally, (ii) the visibility of chimpanzees in the landscape, (iii) chimpanzee behaviour, including their interactions with humans, and (iv) people's behaviour towards sympatric apes. Further, since human–great ape sympatry may incur costs for farmers (i.e. through crop damage and aggressive behaviour), we asked residents about crop losses to chimpanzees compared to other wildlife, and whether they regard these animals as a threat to their safety. To determine the extent to which residents hold positive attitudes towards the apes, we also asked residents about potential benefits of chimpanzees. Finally, since strategies to conserve chimpanzee populations in anthropogenic landscapes in Uganda (including in Bulindi) were being developed by wildlife authorities and conservation groups at the time of our study, we sought local opinion about the need for outside intervention to address reported concerns about the apes (e.g. crop damage).

METHODS

Study site

Bulindi Parish (1°28'N, 31°28'E) is located in Hoima District in the Bunyoro Kingdom of western Uganda, 25 km south of the nearest main forest block, Budongo Forest. The landscape comprises a mosaic of small riverine forest patches, papyrus swamp and wooded grassland, intermixed with farmland and villages, and dissected by the Hoima–Masindi road (Figure 1). A community of ≥ 25 chimpanzees, including six adult males, inhabit the 40 km² study area. The apes encounter humans daily but are unhabituated to close observation (McLennan and Hill, 2010). Four other diurnal primates occur at Bulindi: black and white colobus (*Colobus guereza occidentalis*), tantalus monkey (*Chlorocebus tantalus budetti*), blue monkey (*Cercopithecus mitis stuhlmanni*) and olive baboon (*Papio anubis*).

Forest patches are owned by local households according to traditional customary tenure. Important land-use changes have occurred regionally during the last decade: unprotected forests have been extensively logged and cleared for farming (McLennan, 2008; McLennan and Plumptre, 2012). Human population density in Hoima District was 95.4 individuals per km² at the most recent census in 2002 (UBOS, 2007). The average annual growth rate in the district during 1991–2002 was 4.7% (UBOS, 2007). Agriculture is the main economic activity at Bulindi; local people practise a combination of subsistence farming and cash-cropping. Major food crops are maize, cassava, potato, and ground-nuts, and the main cash crop is currently tobacco; lesser cash crops are sugarcane, banana and rice. Cocoa was grown as a cash crop in the 1960s–1970s when cocoa gardens (*shambas*) were established within private forests across the District (Kayoby et al., 2001). These were abandoned during the 1980s, though the trees continue to produce pods.

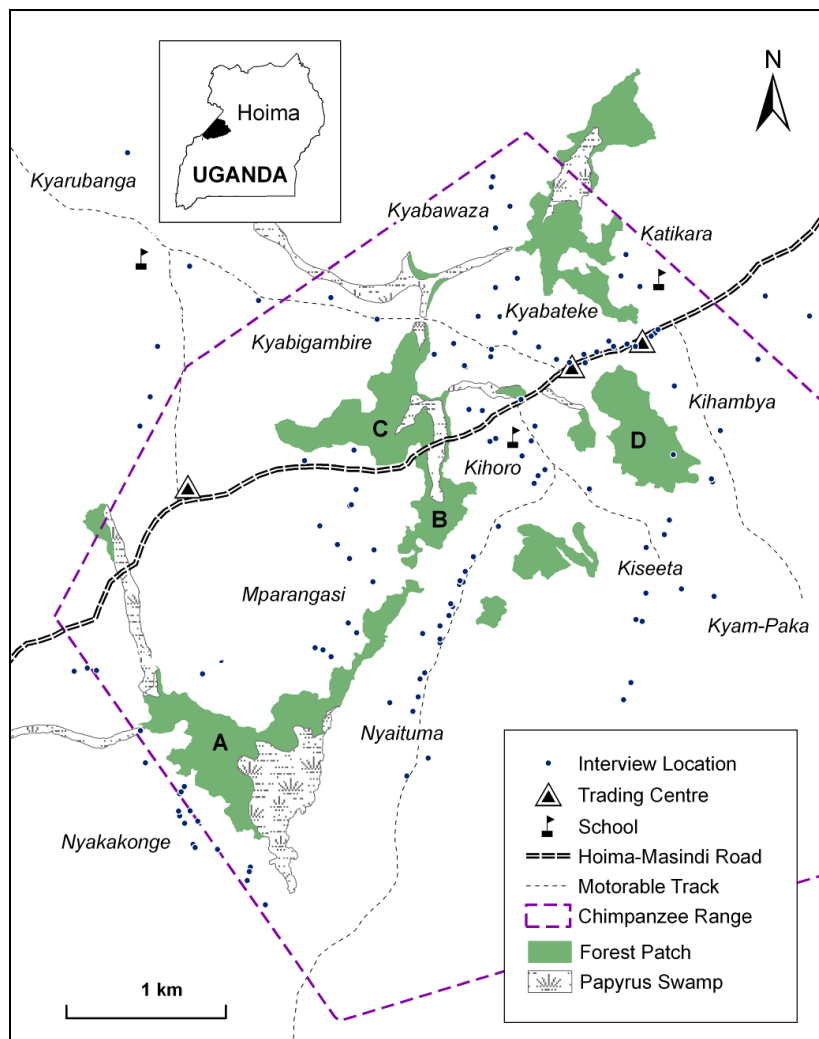


Figure 1. Map of the study site at Bulindi, Hoima District. The locations of interviews ($N = 134$) with residents of 12 villages (*italicised names*) are indicated by small dots. The known home range of the chimpanzee community during December 2006–January 2008 is shown as a minimum convex polygon; their range extends into wooded grassland to the east where there are few settlements. Forest patches labelled A–D were most frequently used by chimpanzees (utilised in $>50\%$ months) (McLennan, 2010b). The surrounding matrix is dominated by scattered homesteads and farmland; wooded grassland occurs on hillsides to the east.

Data collection

During 2006–2008, the first author (M.M.) conducted an 18-month study of chimpanzee ecology and sympatry with humans in Bulindi (McLennan, 2010b). Research was approved by the District Chairman, the Subcounty Chief, and by village Chairpersons. During May–August 2007, 134 structured interviews (Newing, 2011) were carried out with voluntary

participants from 12 villages. Data were collected at a time of growing outside interest in Bulindi's chimpanzees. Village meetings were held previously to explain the purpose of the research to residents. During 2006 and 2007, personnel from national and local non-government organisations visited Bulindi to develop a community conservation initiative linked to chimpanzee conservation (unrelated to our research). Consequently, residents were exposed to 'outsider' views of chimpanzees and conservation. An additional well-known limitation to surveys of this kind is that stated attitudes may not reflect actual beliefs or correspond with behaviour (Browne-Nuñez and Jonker, 2008). However, interviews were just one component of a broader interdisciplinary study, and interpretation of results was aided by information gained outside of interviews (i.e. attitudes communicated during informal discussions with villagers, and opportunistic observations of land-use and human–chimpanzee interactions) and, particularly, the intimate local knowledge of locally-hired assistants. Ethics clearance was granted by Oxford Brookes University Research Ethics Committee. Informed voluntary consent was obtained from all participants prior to their inclusion in the interview survey, in accordance with AAA (American Association of Anthropologists) research ethics guidelines.

Interviews were performed by a female European research assistant with previous experience of conducting social science interviews, and a locally-employed male assistant. Prior to data collection the local assistant was trained in interview practice by M.M. Researchers followed a random route through villages, stopping at homesteads if adults were home. Data were not collected during early morning (before 0900) when many residents tend their crops. However, individuals encountered in their fields were often willing to arrange to be interviewed at a later time. Interviews were also conducted at roadside trading centres. With few exceptions, a single interview was carried out per household. Survey aims were explained to would-be interviewees (i.e. that we wished to understand residents' experiences of chimpanzees and their views on future management of the apes). Most interviews (58%) were conducted in the local Lunyoro language, 25.5% were conducted in English and 16.5% were carried out in both Lunyoro and English. Participants were asked a predetermined set of questions (Table 1). Nevertheless, interviews were carried out in an informal manner and participants were not dissuaded from discussing topics at length if they wished to do so. Interviews lasted 20–60 min. Following the interview participants were given the opportunity to ask questions about the research.

Most interviewees (88%) resided in seven villages surrounding four forest patches that constitute the chimpanzees' core area; the remainder lived in villages situated towards the periphery of their home range (Figure 1). Men accounted for 54% of interviewees and women for 46%. Participants ranged in age from 17–ca. 90 years. Twenty percent were below 30 years, 53% were aged 30–59, and 27% were aged 60 years or above. The majority of interviewees (93%) were native Banyoro and many had lived locally all their lives: 24% had lived in Bulindi for 5–20 years, 33% for 21–40 years, and 41% for >40 years; only three individuals (2%) were resident for <5 years. Most interviewees (69%) gave their occupation as farming. Other stated occupations included teaching, shop-keeping, carpentry, cattle-herding and pit-sawing, but such individuals also engaged in agriculture to varying degrees.

Data analysis

Data are presented as the percentage of interviewees that gave a particular response to each survey question. Response sample size for individual questions varies because participants sometimes gave responses that were vague, ambivalent, or inapplicable to the question. Only responses that could be unambiguously categorised as ‘yes’, ‘no’ or ‘unsure’, or readily grouped into common themes (Newing, 2011), were included in analyses (Table 1). The mean percentage of responses per question used in analysis was 93% (range: 83–100%). Relationships between responses and interviewee sex, age (17–29; 30–59; ≥ 60 years), and length of residency (5–20; 21–40; >40 years; excluding three individuals resident for <5 years) were examined with chi-square tests. The small number of non-Banyoro participants ($n = 9$) were from four different ethnic groups; consequently, sample sizes were too small to examine the influence of ethnicity on attitudes. Since interviewees from villages at the periphery of the chimpanzees’ range ($n = 16$) were no more likely to answer ‘yes’ or ‘no’ to any survey question than those from villages surrounding the apes’ core area ($n = 118$) (Fisher’s exact tests: $p = 0.35\text{--}1.0$), this distinction is not generally made in the results. In some instances, the number or percentage of interviewees that raised a particular issue at any point during their interview is given, but these data were not analysed statistically. Likewise, qualitative data obtained outside of interviews are included for supplementary purposes only. Data were analysed using SPSS v.17 and $p < 0.05$ was considered significant.

NB. – All tables are at end of text

RESULTS

Perceived changes in chimpanzee numbers

Interviewees were asked if the number of chimpanzees in local forests has changed or remained stable over time. A large majority (86%) said chimpanzee numbers have increased (see Table 1 for the distribution of responses to all questions). Asked why they thought this, 75% said chimpanzees are “producing” (i.e. breeding), or seen with young. Other reasons included: chimpanzees are not hunted; are “feeding well”; and are nowadays seen in areas where previously they were not. Several interviewees noted that chimpanzees nowadays travel in big groups, whereas in the past only small numbers were seen (e.g. “one or two”). Only three participants (2%) claimed chimpanzees have decreased in number. Most residents said they see (83%) and hear (91%) chimpanzees more often in recent years compared to past years.

Chimpanzees as dangerous animals

Most interviewees (74%) consider chimpanzees dangerous. Of these, 26% said the apes are only dangerous if disturbed or threatened by people (Table 2). However, 24% gave the example of a serious, non-fatal chimpanzee attack on a local child in January 2007 as proof of their dangerousness. A further 10% said chimpanzees can carry away, attack or eat human children, but did not refer to a specific incident; 7% cited recent chimpanzee attacks on humans elsewhere in the Bunyoro region. Twenty-one percent said chimpanzees are

dangerous because they chase or “disturb” people. At various points during interviews, five participants claimed chimpanzees can rape women. Eleven individuals said the apes transmit an unidentified skin disease (called ‘*ekisararu*’) to humans, or asked if it was true.

Women were significantly more likely than men to say chimpanzees are dangerous ($\chi^2 = 5.44$, $df = 1$, $p = 0.02$), though neither sex was more likely to offer a particular reason to support the claim. Women were also significantly more likely than men to say they fear chimpanzees ($\chi^2 = 17.84$, $df = 1$, $p < 0.001$).

Changing behaviour of chimpanzees and people

More than half the interviewees (58%) claimed chimpanzee behaviour has changed over time. Additionally, many individuals who gave negative or unsure responses to the question “Has the behaviour or habits of chimpanzees changed over time?” described how chimpanzee behaviour has recently changed in response to other survey questions. Of those who answered ‘yes’, the most common reason offered was that nowadays the apes come out of the forest to people’s homes and gardens and damage crops (54%) (Table 3). A further 37% said chimpanzees now chase, threaten or attack people, while 20% noted they no longer fear or run away from people. Residents commented that chimpanzees have become “stubborn”, “tough” or “rude”. Neither age nor length of residency influenced people’s tendency to claim chimpanzee behaviour has changed (Age: $\chi^2 = 0.815$, $df = 2$, $p = 0.67$; Residency: $\chi^2 = 1.47$, $df = 2$, $p = 0.48$).

Interviewees commonly described chimpanzee display behaviour towards humans (e.g. slapping the ground, shaking vegetation). Fourteen interviewees (10% of participants; ten women, four men) described a recent instance in which they were pursued or approached in a threatening manner by ≥ 1 chimpanzee, though we did not specifically ask this. Likewise, 18 interviewees (13%; 14 women, four men) claimed they or their children fear entering forest for firewood or water if chimpanzees are nearby, and at times go without. A risk to children’s safety outside the forest was also cited. For example, one man complained, “You can’t leave children alone at home in case chimps come to the house, and you can’t tell children to guard gardens from baboons and monkeys as they may find chimps there”. One woman claimed she cut guava trees to stop chimpanzees coming to her homestead out of concern for her children’s safety; at least two other residents cut domestic fruit trees for the same reason during our study. Asked when the perceived behavioural changes began, residents variously estimated that chimpanzees have been entering gardens for 2–10 years and behaving aggressively towards people for <5 years.

Approximately half the participants (49%) said people’s attitudes or behaviour towards chimpanzees have also changed over time. Among these, the most common reason offered was that nowadays people harass chimpanzees or chase them from gardens (43%). Twenty-two percent said people now fear chimpanzees. A further 22% said residents are angry because the apes destroy crops and/or chase people. Several interviewees claimed other residents want to kill chimpanzees. Although no evidence indicated residents hold totemic beliefs about chimpanzees, several villagers said that if a person kills a chimpanzee they or their clan will have bad luck or die.

Crop damage by chimpanzees

Fifty-three percent of interviewees claimed chimpanzees consume cultivars from their gardens. Interviewees from villages within the apes' core range were no more likely to claim losses to chimpanzees than those in peripheral villages ($\chi^2 = 0.44$, $df = 1$, $p = 0.83$). Of 12 crops reported eaten, the most common was sugarcane (29% of interviewees), papaya (25%), mango (18%) and banana (14%) (Table 4). Most participants (64%) said chimpanzees cause "little" or "not much" damage to crops compared to other animals, while (26%) said they cause no damage. Only 8% claimed chimpanzees cause "a lot" of damage. In each case this was to specific cash crops (sugarcane in six instances, cocoa in four and banana in two; mango and papaya were additionally cited by one participant). Several interviewees noted that chimpanzees cause non-consumptive damage to other food or cash crops, for example by treading on tobacco seedlings or knocking down maize.

Participants were asked which animal(s) cause the most damage to crops. Species most frequently cited were baboon and tantalus monkey (each cited by 66% of interviewees) and colobus monkey (34%) (Table 5). Interviewees often made the point that, unlike chimpanzees, these primates eat important food crops including cassava, maize and potato. Only five participants (4%) said chimpanzees cause the most damage. These individuals had sugarcane or banana plantations, or forest cocoa *shambas*, and each claimed to have lost their entire crop to chimpanzees. Chimpanzee predation on livestock (chicken, goat and, in one case, a piglet) was mentioned by seven interviewees. In Kyabateke village several residents claimed a local bee-keeping enterprise was abandoned because chimpanzees took all the honey.

Positive aspects of living alongside chimpanzees

Most interviewees (70%) acknowledged benefits ("good things") about chimpanzees. Of these, the prevailing reason (offered by 76%) was that chimpanzees chase away, or otherwise displace, baboons, tantalus monkeys and/or black and white colobus (Table 6). Others (13%) noted that chimpanzees "plant trees" (i.e. disperse seeds) while 13% cited their educational value, especially for children, or said they are interesting to watch. Participants commonly remarked upon the intelligence of chimpanzees and/or noted they are "like people". Seven individuals (8%) mentioned the apes' value as a future tourist attraction, which would bring in cash and job opportunities for residents. (Eight other persons made this point elsewhere during their interview). There was a significant difference in the tendency of different-aged participants to acknowledge benefits of chimpanzees ($\chi^2 = 8.97$, $df = 2$, $p = 0.01$). Persons aged ≥ 60 years were less likely to say there were good things about them compared to adults aged 30–59 or <30 years. More men said there were good things about chimpanzees than women, though this trend was non-significant ($\chi^2 = 3.42$, $df = 1$, $p = 0.064$).

What should be done about the chimpanzees?

Asked if anything needed doing about the chimpanzees, most participants (66%) answered 'yes'. The two most common suggestions, each given by 28% of these interviewees, were: (i)

chimpanzees should be “collected” in one forest to stop them roaming around and, in some cases, so that tourists can view them; and (ii) food should be planted for them (Table 7). Fifteen participants (20%) said chimpanzees should be relocated to a government reserve such as Budongo; as one elderly man remarked, “You can’t see lions and hyenas here as they’re in the game park – a chimp is also dangerous, so remove it”. Similarly, an elderly woman asked, “Is this really a good place for chimps to stay, in the middle of people?” Only seven individuals (9%) argued that chimpanzees and/or forest should be protected, for example by stopping people harassing apes and/or restricting timber cutting. Five participants said residents should be “sensitised” to live peacefully with chimpanzees.

Among the 31% of participants that said nothing needed doing, or else offered little opinion on the matter, typical remarks were “what is there to do?” or “people have always lived with chimps”. For some residents the chimpanzee issue was evidently unimportant; as one woman observed, “Ugandans don’t care about chimps, but *muzungus* do” (*muzungu* refers to a white person in current usage). Elderly interviewees (≥ 60 yrs) were less likely than younger adults to state a need for intervention ($\chi^2 = 6.17$, $df = 2$, $p = 0.046$), perhaps regarding chimpanzees as undeserving of such attention. Interviewee sex had no effect on stated opinion ($\chi^2 = 0.95$, $df = 1$, $p = 0.33$).

DISCUSSION

Changes in human–chimpanzee interactions

Landscapes surrounding Uganda’s protected areas are characterised by high-density, expanding human farming populations, with associated rapid conversion of unprotected forest for other land-uses (Hartter et al., 2011; Mwavu and Witkowski, 2008). This study’s findings must be contextualised with regard to regional land-use changes that have precipitated a recent increase in the frequency of human–chimpanzee interactions. Evidence strongly indicates that major forest clearance in Hoima District did not occur until about 2000 (C.H., unpubl. data). Widespread commercial logging was also initiated at about that time. During our study, Bulindi forests were heavily logged (McLennan and Plumtre, 2012) and parts were clear-felled for agriculture, particularly tobacco cash-cropping. Chimpanzee behaviour is widely perceived to have undergone recent negative changes. That neither residents’ age nor length of residency influenced this view suggests the changes are indeed recent, concurrent with major shifts in local land-use. First, the consensus among residents is that chimpanzees traditionally stayed inside forests and were seldom seen. Regular sightings of groups of apes outside the forest and, in particular, adult females with dependent offspring, are a recent phenomenon. Therefore, the prevalent belief that chimpanzee numbers have increased may simply reflect their growing visibility in an increasingly fragmented, deforested landscape. Nevertheless, forest clearance in surrounding areas (e.g. for a commercial sugar estate in neighbouring Masindi District) might have led to recent immigration of females into Bulindi and an increase in community size.

Second, though crop damage by chimpanzees is not new (their consumption of cocoa planted within forests reportedly created conflict with farmers as far back as the 1960s), persistent incursions by apes into villages to raid crops is widely considered a recent development, affecting households across the survey area. Examination of their diet confirmed the

chimpanzees feed on most crops reportedly raided (see Table 4), with guava, cocoa, mango, papaya and sugarcane among their most important foods (McLennan, 2010b). The apes appear to know the locations of favoured crops throughout their range and travel several hundred metres across farmland to reach them; thus not only residents with gardens alongside forest suffer crop losses to chimpanzees. However, crop-raiding by chimpanzees *per se* is generally not considered a serious problem unless it involves cultivars such as sugarcane and banana grown predominantly for market. Farmers growing these as cash crops complained they incur a considerable financial loss because of chimpanzees. Some individuals claimed they abandoned a particular crop owing to persistent chimpanzee raiding. Since we did not quantify crop damage by the apes, such claims should be viewed with caution. For instance, cocoa farmers consistently maintained they abandoned their forest *shambas* because chimpanzees ate all the pods. In fact, the breakdown in Uganda's cocoa industry during the late 1970s and 1980s is the more likely reason for abandonment of *shambas* in Bulindi and elsewhere in Hoima (Kayoby et al., 2001). Although these forest *shambas* are long-abandoned, farmers still regard the cocoa trees as their property. Additionally, it was not uncommon for sugarcane, cocoa or banana farmers to explicitly state their wish for compensation for crop losses to chimpanzees. Thus, losses were perhaps exaggerated by some farmers (cf. Siex and Struhsaker, 1999). Nevertheless, repeated raids by chimpanzees on sugarcane gardens, for example, plainly cause substantial damage (pers. obs.).

In contrast, many villagers tolerate the apes' occasional consumption of domestic fruits that are neither cash-crops nor staple foods, and losses may have been under-reported. For example, only four interviewees reported losses of guava – considered children's food – to chimpanzees. Yet guava was the most frequently eaten fruit cultivar, as indicated by analysis of chimpanzee faeces (McLennan, 2010b). The distinction between cash or food crops and domestic tree fruits is illustrated by one man's comment that, "Chimps don't spoil gardens – they come for fruits". Even so, residents object to the threatening presence of chimpanzees when they enter villages in search of these fruits, and the fact they can be difficult to chase from gardens. Chimpanzee predation on livestock is an additional cause of provocation, but is relatively rare. The chimpanzees were known to have preyed on chickens on only two occasions during 2007, as determined from faecal analysis and the remains of a kill, respectively (McLennan, 2010b). Elsewhere in Hoima District, residents also claimed chimpanzees took chickens (McLennan, 2008).

Third, reports of chimpanzees confronting, threatening, charging or pursuing humans indicate this behaviour has emerged only recently. A widely-held conviction among residents is that chimpanzees are unafraid of women and children, and thus threaten or chase them more often than men (see also Hockings et al., 2010). Indeed, women were more likely than men to say they fear chimpanzees. However, men may simply be less inclined to admit fearing wild animals (cf. Campbell, 2009; Kaltenborn et al., 2006). Nonetheless, adult male chimpanzees in Bulindi also display notably bold and aggressive behaviour towards men (McLennan, 2010a), including researchers (McLennan and Hill, 2010). Residents perceive a particular threat to children's safety from the apes. Such concerns are justified: twice during 2007 a chimpanzee attacked a child (McLennan, 2010b). Apparently, such incidents had not previously occurred at Bulindi.

Fear of physical aggression places conflict between farmers and chimpanzees (among other great apes) in a different realm to most conflict scenarios involving smaller-bodied primates

(see also Madden, 2006 for gorillas *Gorilla beringei*; Campbell-Smith et al., 2010 for orangutans *Pongo abelii*). Thus to some extent, human–great ape conflict parallels people–wildlife conflicts involving other large, potentially dangerous mammals including elephants and large carnivores (Kaltenborn et al., 2006; Nyhus et al., 2000). Nevertheless, given the frequency that chimpanzees encounter children at Bulindi, perhaps the most striking aspect of these incidents is their rarity. But as Hockings et al. (2010:894) note, a single attack “can elicit much more hostility and panic than less immediately severe but persistent problems, such as crop-raiding.” Previously, we suggested that frequent human-directed aggression in this population is a behavioural response to increased harassment and competition with people (McLennan and Hill, 2010). Harassment of apes including shouting, stone-throwing and chasing with dogs occurred frequently during our study, most often in the context of crop-raiding or when a threat of crop-raiding was perceived. Furthermore, intentional provocation of chimpanzees by children was witnessed several times (McLennan, 2010b). Such provocation was recognised as a particular problem by villagers during informal discussions, and was cited by some residents as the probable causal factor in the first attack on a child. Provocation by children was also implicated in at least one chimpanzee attack on a child at Bossou, Guinea (Hockings et al., 2010). Relevant to these observations, Goldberg et al. (2008) describe unusual human-directed aggression by red colobus monkeys (*Procolobus rufomitratu*s) in forest fragments around Uganda’s Kibale National Park, which they attribute to frequent hostile interactions that these primates have with villagers and dogs.

Despite these negative interactions, chimpanzees are widely believed to perform a valuable service by chasing away other crop-raiding wildlife, particularly monkeys and baboons. (A similar ‘crop-guarding’ service by chimpanzees was reported by residents around Budongo Forest; Watkins, 2006). Aside from the angry protestations of a minority of farmers, residents were overall keen to emphasise how “good” chimpanzees are compared to these other primates, which damage important food crops including maize and cassava. Recognition of the chimpanzees’ beneficial role in seed dispersal likely reflects residents’ exposure to environmental messages broadcast on local radio and/or communicated by non-government workers at village meetings. Older residents generally hold the least positive views of chimpanzees, but no evidence suggests such persons have less exposure to environmental messages than younger residents; rather, this may reflect an inter-generational difference in stated attitudes towards wildlife generally. Nevertheless, adults of all ages expressed the opinion that it is “not good” to harm chimpanzees, though villagers do not revere them as ancestors (cf. Yamakoshi, 2005).

The chimpanzee–human relationship at Bulindi is currently in a state of flux. Changes in chimpanzee behaviour in response to habitat alteration and increased contact with people are challenging residents’ traditionally benign attitude towards them. Although many villagers recognise that provocation by people contributes to aggressive behaviour of chimpanzees, harassment of the apes has become commonplace. Some farmers are resorting to illegal, potentially lethal methods to deter chimpanzees (e.g. setting traps) – something they apparently would not have previously done. Following the second attack on a child, local men discussed whether the chimpanzees should be killed. Some villagers believe the close proximity of chimpanzees poses a potential health risk to humans. A similar belief was reported among villagers around Kibale (Wrangham, 2001).

Challenges to conservation

These problems are not specific to Bulindi. Our findings concur with the emerging view of deteriorating farmer–chimpanzee interactions elsewhere in Uganda, where apes are not hunted but high-density human populations are rapidly converting remaining chimpanzee habitat outside or along the border of protected areas (e.g. Budongo: Reynolds, 2005; Kibale: Wrangham, 2001). At numerous localities in Hoima District unprotected forest is being logged, burned and cleared, forcing resident apes into conflict with people (McLennan, 2008). Outside of Uganda, similar conflicts occur at sites across the chimpanzee's geographic range (Hockings and Humle, 2009). Apes in unprotected, remnant forest will not survive unless urgent steps are taken to address the degradation and conversion of their habitats (see below). However, the results of this survey point to a troubling dilemma: conserving chimpanzees in human-dominated landscapes demands that rural farmers tolerate a large-bodied, potentially dangerous mammal which may threaten their livelihoods and which they may fear. In Uganda, chimpanzees are not perceived by local people to have the same intrinsic value that the international and scientific community assigns this species. If villagers are to continue sharing their environment with chimpanzees, the benefits must outweigh the costs considerably.

Our study suggests sustainable coexistence between people and apes in forest–farm mosaics may hinge on the following conditions: (i) chimpanzees do not eat important food crops such as maize and cassava; (ii) chimpanzees stay inside forests and refrain from ‘disturbing’ people; and (iii) residents derive economic benefits from the apes. All three conditions are problematic. Elsewhere chimpanzees readily eat maize and cassava (Hockings and McLennan, 2012). Therefore, populations that do not currently raid staple crops, such as in Bulindi, could feasibly do so in the future, thereby substantially reducing residents’ tolerance of them. Ongoing degradation of chimpanzee habitat in Uganda implies that chimpanzees are unlikely to cease foraging in farmland. Still, residents may tolerate this situation providing the third condition – substantial economic benefits – is met. Our survey was conducted during a period of growing outside interest in the region’s chimpanzees by conservation organisations and scientists. Villagers’ stated attitudes should therefore be interpreted in this context. While relatively few residents proposed removal of chimpanzees from Bulindi forests, it is unclear to what extent attitudes were influenced by speculation that wealthy tourists would soon come to view the chimpanzees. The popular misconception that chimpanzees can be ‘collected’ and maintained in one area, viewable to tourists, apparently reflects local confusion about the aims of community conservation initiatives under development at the time of interviews. Viewing-based ecotourism is not recommended where great apes live in close proximity to people for reasons including increased likelihood of crop-raiding following habituation, risk of aggression to local people and tourists from emboldened or stressed apes, and increased potential for disease transmission (Macfie and Williamson, 2010; McLennan and Hill, 2010). Alternative forms of community-based ecotourism are now underway at Bulindi and additional sites in Hoima District (e.g. construction of an education centre and a roadside ‘eco-cafe’). These are likely to be more appropriate.

Currently, conservation organisations are exploring a variety of additional approaches including the feasibility of using carbon funds, among other alternative income-generating

strategies, as incentive for private forest owners in this region to maintain forest on their land and, more generally, to reduce local reliance on forest resources such as timber and fuelwood (e.g. Akwetaireho et al., 2011). Appraisal of the applicability and practicality of different strategies is beyond the scope of this paper. Clearly, however, such initiatives should be accompanied by targeted conflict-mitigation strategies and culturally-sensitive education programs to encourage human behaviours that reduce negative or aggressive interactions with great apes (see Hockings and Humle, 2009; Hockings et al., 2010). Relocating chimpanzees from Bulindi and other forest–farm mosaics regionally, as proposed by some residents in this survey, is unlikely to be a feasible option for a variety of reasons, including the cost and practicalities involved in relocating entire wild ape communities and the problem of finding alternative suitable habitat.

Whether sustainable coexistence between expanding human populations and large mammals such as great apes is achievable in shared landscapes remains unresolved. The reality is that the long-term requirements of large mammals in increasingly fragmented, ‘agriculturalised’ landscapes may be incompatible with the needs of sympatric humans. Where potentially dangerous wildlife no longer have sufficient habitat, and are forced into close proximity and competition with people, we may ask whether it is appropriate to promote coexistence. The question of whether impoverished rural people should be expected to accommodate species that are endangered, but also frightening and occasionally dangerous, warrants further debate.

Our study provides a valuable illustration of how people’s perceptions of, and attitudes towards, wildlife are not fixed in time or space, but change as a consequence of the dynamic nature of people–wildlife interactions. Understanding how people view their own interactions with wildlife, and particularly the factors that promote or dampen their willingness to tolerate the presence and behaviour of wild animals, should be an integral component of conflict-mitigation initiatives (Dickman, 2010). The potential mutability of local perceptions of, and attitudes towards, wildlife should be utilised through development of conservation education initiatives that build on local understandings and perspectives to foster more positive attitudes to wildlife (Hill and Webber, 2010), while taking into account local livelihood needs.

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Table 1. Framework of the structured interview. For each question sample size (the number of unambiguous/relevant responses; N = 134) and the % responses categorised as ‘yes’, ‘no’ or ‘unsure’ are shown; alternative (other) responses are indicated in parenthesis where applicable.

Question	n	% Interviewee Response				
		Yes	No	(other)	Unsure	Total
1. In the time you have lived here have chimpanzees become more, less or stayed the same in number? • Interviewees who perceived a change in number were asked why this was so.	132	86.4 (‘more’)	2.3 (‘less’)	4.5 (‘same’)	6.8	100
2. Do you see chimpanzees more often, less often, or about the same, in recent years compared to in the past?	125	83.2 (‘more’)	6.4 (‘less’)	5.6 (‘same’)	4.8	100
3. Do you hear chimpanzees more often, less often, or about the same, in recent years compared to in the past?	125	91.2 (‘more’)	4.0 (‘less’)	4.8 (‘same’)	0.0	100
4. Are chimpanzees dangerous animals? • Interviewees who answered ‘yes’ were asked to provide a reason(s).	125	73.6	22.4	–	4.0	100
5. Do you fear them?	118	72.9	27.1	–	0.0	100
6. Has the behaviour or habits of chimpanzees changed over time? • Interviewees who answered ‘yes’ were asked to provide a reason(s).	122	58.2	28.7	–	13.1	100
7. Has the behaviour or attitudes of people towards chimpanzees changed over time? • Interviewees who answered ‘yes’ were asked to provide a reason(s).	111	48.6	39.6	–	11.7	100
8. Do chimpanzees eat any crops from your own garden? • Interviewees who answered ‘yes’ were asked which crops.	134	53.0	45.5	1.5 (no garden)	0.0	100
9. How much damage do chimpanzees cause to crops compared to other animals? (Answers were categorised as none, little [or “not much”], or a lot)	128	25.8 (‘none’)	64.1 (‘not much’)	7.8 (‘a lot’)	2.3	100
10. Which animal(s) cause the most damage? (see Table 5 for distribution of responses)	116	–	–	–	–	–
11. Are there any good things about chimpanzees? • Interviewees who answered ‘yes’ were asked to provide a reason(s).	128	70.3	25.8	–	3.9	100
12. In your view, should anything be done about the chimpanzees? • Interviewees who answered ‘yes’ were asked to provide a reason(s).	116	65.5	31.0	–	3.4	100

Table 2. Explanations given by interviewees as to why they consider chimpanzees dangerous. Cells show the number and percentage of interviewees that said chimpanzees are dangerous (n = 92) who gave each reason.

Reason	n	%¹
Chimpanzees are dangerous if people ‘disturb’ (i.e. harass) them	24	26.1
Jan 2007 chimpanzee attack on local child cited	22	23.9
Chimpanzees chase / ‘disturb’ people	19	20.7
General risk to children cited	9	9.8
Other chimpanzee attack on a person cited	6	6.5
Chimpanzees are wild animals	4	4.4
Chimpanzees do not fear people or dogs	2	2.2
Chimpanzees are dangerous if carrying infant	2	2.2
Other individual reason	8	8.7

¹ Percentage values total >100% because several interviewees gave >1 reason.

Table 3. Explanations given by respondents as to why they think chimpanzee behaviour has changed over time. Cells show the number and percentage of interviewees that said chimpanzees have changed (n = 71) who gave each reason.

Reason	n	%¹
Chimpanzees are now coming out of the forest to homes and/or gardens	38	53.5
Chimpanzees are now chasing, threatening or attacking people	26	36.6
Chimpanzees no longer fear people	14	19.7
Other individual reason	4	5.6

¹ Percentage values total >100% because some interviewees gave >1 reason.

Table 4. Crops reported eaten by chimpanzees and the number and percent of interviewees claiming losses from their gardens; percentage values exclude two individuals without gardens in Bulindi (n = 132).

Crop reported eaten ¹	Part reported eaten	n	%
Sugarcane (<i>Saccharum officinarum</i>)	Pith	38	28.8
Papaya (<i>Carica papaya</i>)	Fruit	33	25.0
Mango (<i>Mangifera indica</i>)	Fruit	24	18.2
Banana (<i>Musa</i> spp.)	Fruit, Pith	18	13.6
Jackfruit (<i>Artocarpus heterophyllus</i>)	Fruit	8	6.1
Cocoa (<i>Theobroma cacao</i>)	Fruit	7	5.3
Guava (<i>Psidium guajava</i>)	Fruit	4	3.0
Maize (<i>Zea mays</i>)	Pith	4	3.0
Passion fruit (<i>Passiflora</i> spp.)	Fruit	3	2.3
Pineapple (<i>Ananas comosus</i>)	Fruit	3	2.3
Avocado (<i>Persea americana</i>)	Fruit	1	0.8
Yam (<i>Dioscorea</i> sp.)	Pith	1	0.8

¹ Evidence of consumption by chimpanzees via direct observation, faecal analysis and/or feeding traces was obtained for all crops listed except maize, pineapple and avocado (McLennan, 2010b).

Table 5. Animals reported to cause the most damage to crops. Cells show the number and percentage of interviewees that cited each animal; most interviewees cited >1 animal.

Animal	n	%
Baboon (<i>Papio anubis</i>)	77	66.4
Tantulus monkey (<i>Chlorocebus tantalus</i>)	76	65.5
Black and white colobus monkey (<i>Colobus guereza</i>)	39	33.6
Porcupine (<i>Hystrix cristata</i>)	14	12.1
Wild pig (<i>Potamochoerus</i> sp.)	8	6.9
Chimpanzee (<i>Pan troglodytes</i>)	5	4.3
Cane rat (<i>Thryonomys</i> sp.)	3	2.6
Domestic animal: cow (<i>Bos taurus</i>) or goat (<i>Capra hircus</i>)	2	1.7
Birds (unknown sp.)	1	0.9
Squirrel (<i>Xerus erythropus</i>)	1	0.9

Table 6. Benefits of chimpanzees. Cells show the number and percentage of interviewees that said there were “good things” about chimpanzees (n = 90) who gave each reason.

Benefits	n	%¹
Chimpanzees chase away baboons / monkeys / colobus	68	75.6
Chimpanzees “plant trees”	12	13.3
Interesting to watch / educational value	12	13.3
Tourist attraction	7	7.8
Other individual reason	1	1.1

¹ Percentage values total >100% because several interviewees gave >1 reason.

Table 7. Residents’ suggestions regarding what to do about chimpanzees. Cells show the number and proportion of interviewees that said something needed doing (n = 76) who gave each reason.

Suggestion	n	%¹
Keep chimpanzees in one forest/area (to ‘stop their roaming’)	21	27.6
Plant food for chimpanzees	21	27.6
Take chimpanzees away (e.g. to government reserve)	15	19.7
Protect chimpanzees and/or forests	7	9.2
Stop chimpanzees coming out of the forest	6	7.9
Stop chimpanzees chasing/disturbing people	5	6.6
‘Sensitise’ residents to live with chimpanzees	5	6.6

¹ Percentage values add up to >100% because several interviewees gave >1 suggestion.