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Beleaguered Chimpanzees in the Agricultural District of Hoima, Western Uganda

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Abstract: With approximately 5,000 chimpanzees, Uganda is important for the conservation of the eastern subspecies *Pan troglodytes schweinfurthii*. The population distribution is highly fragmented, however, and the prospects for the long-term viability of many populations will be greatly improved if dispersal opportunities are maintained between major forests via migratory corridors. Chimpanzees in unprotected human-dominated habitat outside the main forest blocks are often ignored by research and conservation efforts. This study assessed the status and distribution of chimpanzees in northern Hoima District, western Uganda. The survey region covered 400 km² between 1°26'–1°37'N and 31°09'–31°32'E, and separates two major forest blocks, Bugoma and Budongo. Chimpanzees use small forest fragments along watercourses throughout this region, both on private or communal land and in small government reserves, and a number of distinct groups ('communities') are present. There has been no evidence to indicate that chimpanzee populations are isolated; on the contrary chimpanzees appear highly mobile in this forest–farm habitat, confirming the region's corridor potential. At one site in the region, chimpanzees occur at an estimated density of 0.66 individuals/km² which, if extrapolated across the survey area, implies a larger population than previously thought. Recent and rapid habitat change resulting from unregulated timber extraction and clearance of fragments for agriculture—particularly for cash crops such as tobacco—has exposed the chimpanzees, causing increased negative interactions between apes and farming communities. The chimpanzees in northern Hoima are unlikely to survive without immediate intervention.

Key Words: Chimpanzee, corridors, deforestation, distribution, human-wildlife conflict, unprotected areas, Uganda

Introduction

The eastern chimpanzee (*Pan troglodytes schweinfurthii*) occurs in the forests of north and north-eastern Democratic Republic of Congo (DRC) and southeast Central African Republic, as well as remnant forest and woodland in Uganda, Tanzania, Rwanda, Burundi and southwest Sudan (Butynski 2001). In Uganda, chimpanzees inhabit forests along the eastern edge of the Rift Valley in the west and southwest of the country (Stott and Selsor 1959; Reynolds and Reynolds 1965). (The single exception is a small relict population in the north on the Sudanese border [Davenport *et al.* 2001]). A recent census of all main forests within the chimpanzee range gave a population estimate of approximately 5,000 individuals (Plumptre *et al.* 2003), of which the majority inhabit gazetted forest reserves and national parks. The importance of Uganda for the conservation of the eastern subspecies was therefore confirmed by the census.

Although at first glance Uganda appears to harbour a healthy chimpanzee population, the country's tropical high forests are fragmented and the forest blocks are relatively small. In fact only four forests contain populations potentially large enough for mid-term viability (i.e., comprising >500 individuals [Plumptre *et al.* 2003]). Furthermore, recent surveys have demonstrated that, despite their protected status, illegal activities including agricultural encroachment, unlicensed timber harvesting, and hunting of mammals such as duikers and bushpigs are widespread in these and other major forests (Plumptre 2002; Gombya-Ssembajwe *et al.* 2007). Uganda currently has one of the highest annual deforestation rates in Africa (2.2% in 2000–2005 according to FAO [2007]). An estimated 70% of Uganda's woodland and forest occurs patchily outside the main forests on private and communal land, and it is there that most deforestation is presently taking place (Uganda, MWLE 2002). Nevertheless, small forests that support chimpanzees persist in some regions, typically

along watercourses. Where habitat is being converted for agriculture, the chimpanzees' survival prospects are slim (Isabirye-Basuta 2004). From a conservation perspective, this is problematic since some outlying populations may play an important role in maintaining gene flow between main forest blocks. However, populations occupying fragmented, unprotected habitat are usually ignored by research and conservation activities.

Chimpanzees in Hoima

Hoima District was identified in an unpublished report by the Jane Goodall Institute and Uganda Wildlife Authority (UWA) as a region of growing conflict between chimpanzees and local farming communities (JGI/UWA 2002). Fragmentation and clearance of unprotected habitat for agriculture and timber has isolated ape populations and created a problem of crop-raiding, particularly with regard to cash crops such as cocoa. As a result, local intolerance towards chimpanzees was rising (JGI/UWA 2002).

The northern half of the district lies between two major forest blocks, separated by 50 km: Bugoma Forest in the south and Budongo Forest in the north (Fig. 1). Budongo lies across the district border in neighbouring Masindi District and has international standing as a long-term chimpanzee research site (Reynolds 2005). As forest reserves (FR), both Bugoma and Budongo are managed by the National Forest Authority (NFA) for sustainable production of domestic and commercial forest produce (for example, timber). Both forests also have important chimpanzee populations: recent surveys indicated populations of about 600 individuals each, equalling ~25% of the national total (Plumptre *et al.* 2003). According to the population viability analysis of Edroma *et al.* (1997), such numbers imply a low risk of extinction over the course of a century, with a human-induced catastrophe (for example, a disease or war) posing the greatest threat. But since such a catastrophe could feasibly occur in Uganda, the long-term viability of the Budongo and Bugoma populations would be greatly enhanced if managed as a metapopulation. One possibility is to establish or maintain a 'corridor' that links the two forests via a network of smaller FRs, savanna-woodlands and gallery forest (Plumptre 2002). Although the intervening region is settled and cultivated, small forests occur patchily along watercourses throughout northern Hoima (Fig. 1), yet the status and distribution of chimpanzees in this area are poorly known. Nevertheless, the existence of several potentially resident chimpanzee communities currently using forest fragments within the proposed corridor was confirmed in the JGI/UWA (2002) report.

Accordingly, this study aimed to (1) determine the distribution and status of chimpanzees within the proposed corridor area of northern Hoima; and (2) make preliminary assessments of numbers and migratory potential. The study comprises an initial component of a more detailed research project examining chimpanzee ecology and human–chimpanzee interactions at an unprotected, fragmented farm–forest site within

the region (Bulindi), with a view to providing information necessary for management plans.

Methods

Study area

Hoima District forms part of the Bunyoro Kingdom of mid-western Uganda. It is bounded in the west by Lake Albert, across which lies the DRC. At an elevation of 620 m the lake is virtually the lowest and hottest area in Uganda (Uganda, Department of Lands and Surveys 1967). East of the lake, the topography in the north and northeast is weathered and undulating, characterized by broad hills and valleys. Elevations average 1,100 m above sea level, but reach 1,300 m or more on hilltops. For details of the geology, soils, and drainage of the Bunyoro region see Uganda, Department of Lands and Surveys (1967), Groves (1934), and Eggeling (1947). Above the dry and hot rift escarpment, Hoima enjoys a more moderate climate. Although rain falls throughout the year, its distribution follows a typical East African bimodal pattern, with wetter months from March to May and August to November. In the northeast corner of the district at Bulindi, mean annual precipitation was 1,461 mm in 2001–2007. Mean monthly maximum temperature was 29.5°C, remaining fairly constant year-round, with highest temperatures recorded in the driest months of December–February.

Most of Hoima's tropical high forest occurs in the south and southwest, in Bugoma and its outliers. Both Budongo and Bugoma are classified as medium-altitude, moist, semi-deciduous forests, with a tendency for the ironwood tree (*Cynometra alexandri*) to be dominant (Eggeling 1947;

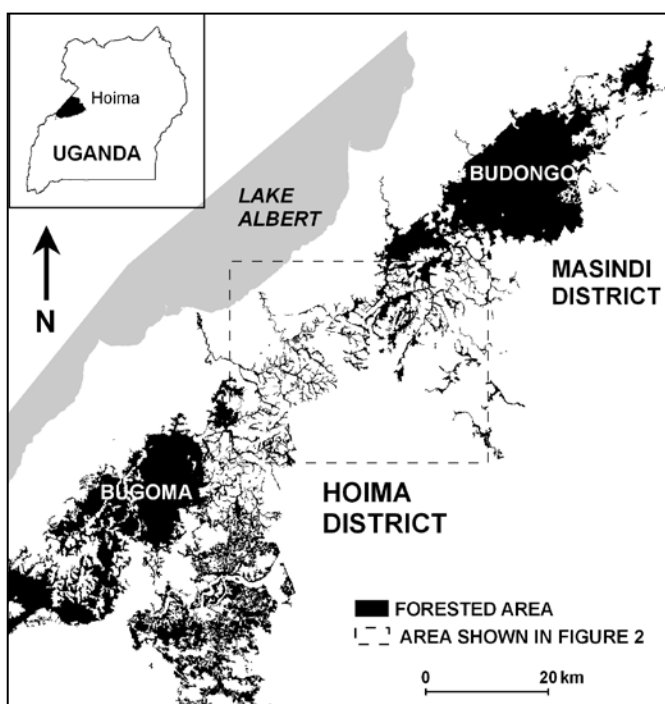


Figure 1. Map showing the main forest blocks referred to in this article: Bugoma (Hoima District) and Budongo (Masindi District).

Langdale-Brown *et al.* 1964). In the north and northeast, the vegetation comprises a mosaic of forest, woodland and grassland, intermixed with the cultivated fields of subsistence farmers and bush fallow. Papyrus (*Cyperus papyrus*) swamps are a common feature in water-logged valleys. The forests in northern Hoima occur patchily, predominantly in swampy valleys along the Waki, Wambabya and Hoima rivers and their many tributaries flowing west to Lake Albert, and along tributaries of River Kafu which flows east to join the Nile. Trees common in the riparian forests include *Trilepisium madagascariensis*, *Antiaris toxicaria*, *Funtumia africana* and *Pseudospondias microcarpa*. The wild date palm (*Phoenix reclinata*) forms dense clumps along the edges of streams and swamps. Chimpanzees are sympatric with five other species of diurnal nonhuman primate: black-and-white colobus (*Colobus guereza occidentalis*), tantalus monkey (*Chlorocebus tantalus budetti*), blue monkey (*Cercopithecus mitis stuhlmanni*), red-tailed monkey (*Cercopithecus ascanius schmidtii*) and olive baboon (*Papio anubis*). (The gray-cheeked mangabey *Lophocebus albigena johnstoni*, present in Bugoma but absent from Budongo, was not seen during surveys in northern

Hoima; Bugoma and its outliers to the east probably mark the northerly limit of the species in Uganda).

Hoima's human population totalled 343,480 in 2002 (= 95.4 people per km²). At 4.7%, the average annual growth rate from 1991 to 2002 was high—the national figure is 3.2%—and the population is projected to rise to 546,000 by 2012 (Uganda, UBOS 2007). Over 90% of the population live in rural areas, of which 74% depend on subsistence agriculture for their livelihoods. Farming is generally accomplished by hand with hoes and *pangas* (machetes), and using fire. Over 95% of rural households use locally gathered firewood for cooking (Uganda, UBOS 2007).

Survey Methods

Field surveys were conducted between February and May 2006. These focused on the region northeast of Wambabya FR, a major forest outlier of Bugoma, across to the east and northeast toward the district border with Masindi. The survey area covered 400 km² between 1°26'–1°37'N and 31°09'–31°32'E (Fig. 2). Forests were identified using 1:50,000 topographic maps published by the Department of Land and Surveys in

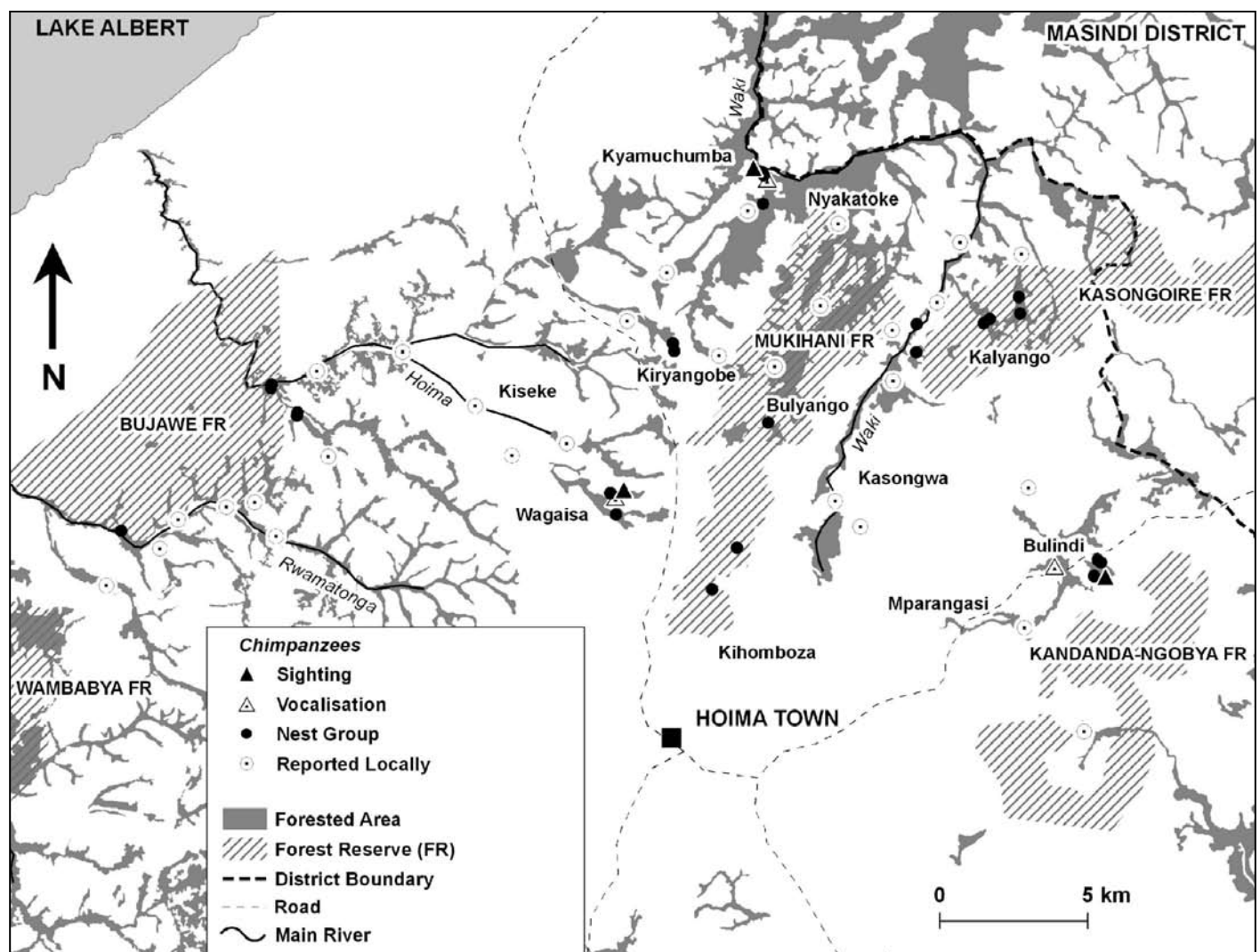


Figure 2. Northern Hoima District with locations of chimpanzee sign/sightings.

1966, and with assistance from Hoima forestry staff. It was appropriate for a forest ranger employed by the NFA or local government to accompany the survey team on initial visits to new areas. A research assistant from Hoima acted as a translator during all surveys. At each locality the following information was sought from local residents, and occasionally from pitsawyers and distillers encountered inside the forest: a) chimpanzee presence/absence, b) frequency of sightings and/or calls (i.e., regular, seasonal or infrequent), c) most recent sightings/vocalizations, d) numbers seen, and e) chimpanzee movements (for example, if chimpanzees are transient visitors, from which direction(s) did they travel to and from?). When we were informed about additional forest patches being used by chimpanzees, these were also visited. Local people tended to speak freely about their experiences with chimpanzees, and these were noted.

Forests were searched opportunistically for evidence of chimpanzees. Understorey vegetation was typically dense and the ground wet in many forest patches. No transects were cut. The locations of chimpanzee sign (nests, dung, knuckle prints, feeding remains) and sightings/vocalizations were recorded with a handheld GPS. As an indicator of the size of the chimpanzee parties using a particular area, we counted the number of same-age nests—assumed to have been built on the same night—occurring within a 50-m diameter circle. *Fresh* nests were less than two days old with only green leaves and, typically, dung sign below. *Recent* nests comprised a combination of green and browning leaves. Disintegrating nests or those comprised solely of brown, dried vegetation were *old*. We recorded information on the size and status of forest patches, and human activities in and around the forest, though we avoided asking direct questions about residents' forest use.

Results

Chimpanzee distribution

Chimpanzees were widely reported by local people to use forest patches along the region's watercourses. Evidence of chimpanzee presence—principally nests—was found at 10 sites across the survey area, confirming a wide distribution (Fig. 2; Table 1). In fact, nests were found at all localities where a more than cursory inspection inside the forest was made. (In some instances, an effort was made to follow the course of a river and assessment was limited to the forest edge). Further, fresh or recent sign of chimpanzees was recorded at nine of the 10 sites listed in Table 1. In total, 154 nests were recorded, though additional nests were sometimes observed but not documented (for example, where they occurred across a swamp). A variety of tree species were used for nesting, though larger nest groups occurred in *Pseudospondias microcarpa* and *Albizia zygia*. Mean size of the largest cluster of same-age nests observed at each site was seven, with the largest clusters found at Kasongoire FR and Bulindi (12 nests at both sites; Table 1). Across the survey area, local people most often reported seeing small parties of up to 10 individuals, though estimates of 15–20 chimpanzees were also given.

We saw chimpanzees on three occasions. On 5 February 2006 six chimpanzees—an adult male and two adult females with offspring—were seen in trees overlooking gardens at Bulindi. On 17 March 2006 chimpanzees were heard calling excitedly at the start of a thunderstorm at Wagaisa in Kitoba subcounty. Four adult males and a subadult subsequently emerged to travel a short distance on the ground along the forest edge before re-entering the forest, calling and drumming; an adult female with a juvenile appeared briefly behind them, but retreated after seeing observers in gardens nearby. During a previous visit to the same forest patch on 28 February, chimpanzees had exploded into calls at our direct approach through the gardens, but remained silent and hidden after we entered the forest. On 7 April 2006 two adults, probably both males, were glimpsed at Kyamuchumba where the Waki River forms a boundary between Hoima and Masindi districts. Subsequent calls suggested a small group was present.

Local reports indicated that chimpanzees were resident (seen regularly and throughout the year) at six localities. From west to east, they were: (1) the Rwamatonga River area, along the south and southeast boundary of Bujawe FR; (2) the River Hoima area, particularly between Kiseke and Wagaisa by Bwendero distillery (confirmed by K. Hiser in 2007, pers. comm.); (3) the Waki River area between Kyamuchumba and Nyakatoke, northwest of Mukihani FR; (4) within Mukihani FR (known locally as 'Rwampanga'), i.e., near Bulyango; (5) around Kalyango in the Hoima portion of Kasongoire FR; and (6) at Bulindi and Mparangasi and east into Kandanda-Ngobya FR (see Fig. 2). Some or all of these local chimpanzee groups probably correspond to discrete communities. Nevertheless, apparent from our surveys, and confirmed by subsequent detailed research at Bulindi during 2006–2008, is the marked mobility of chimpanzees in this fragmented farm–forest mosaic. Aside from regions where chimpanzees are regularly seen and heard, their use of other areas may be seasonal or infrequent. In several such cases villagers reported seeing chimpanzees travel to and from the direction of more than one 'resident area', suggesting the possibility of range overlap and the potential for migration. For example, during mango and *Maesopsis* seasons chimpanzees are attracted to the narrow gallery forest along the Waki River, east of Mukihani. At different localities along the river, locals reported seeing chimpanzees cross from Mukihani in the west, from Kasongoire in the northeast, and from further south along the river. There was no evidence to indicate that chimpanzee populations were isolated.

Forest status and human activities

The forest fragments used by chimpanzees include natural forest in FRs as well as on private and customary land. These forests are small, ranging in size from just a few hectares to several square kilometres (the largest patches are in Mukihani FR), but narrow strips of riparian vegetation extend long distances along watercourses, even where most large trees have been removed. Evident during the surveys was the extent of recent, ongoing and seemingly unregulated forest

clearance in the region. All forest was highly degraded. Along the Rwamatonga, Hoima and Waki rivers forest was being burnt and cleared completely by farmers planting cash crops such as tobacco and rice, exposing wide stretches of riverbank. Men engaged in pit-sawing, charcoal production and distilling were encountered inside the forest throughout the survey area. Yet forest clearance was not limited to private and communal land. With the exception of Mukihani, the small FRs in the region (Bujawe, Kasongire, Kandanda–Ngobyia) contain little natural forest—the predominant vegetation is wooded grassland; all, however, contain riparian forest strips and/or dense hillside thickets used by chimpanzees. We encountered burning, recently burnt or recently converted natural forest within the Mukihani, Bujawe and Kasongire FRs.

Human–chimpanzee conflict

Chimpanzees were widely reported to raid agricultural crops, including cocoa, sugarcane, jackfruit, paw-paw, bananas, mangoes, pineapple, maize and pumpkin. Low-level crop raiding of domestic fruits by chimpanzees is seemingly tolerated by many local people, and where baboons are present they are generally considered a more destructive pest. However, where chimpanzees raided cash crops such as sugarcane and cocoa, this was evidently considered a more serious matter (see ‘Discussion’). At two sites chimpanzees were reported to take domestic chickens. Several people claimed that chimpanzees had been deliberately killed, or caught in traps set to deter crop raiding animals. Many farmers were unaware of the legal status of chimpanzees.

Table 1. Evidence of chimpanzee presence in northern Hoima District, February–May 2006.

Subcounty Location	Coordinates	No. of nests ¹	Largest same-age nest group	No. of fresh nests	Tree species used ²	Other fresh sign ³	No. of chimps seen in encounter
Bugambe/Buseruka							
Rwamatonga River (southern boundary of Bujawe FR)	01°29'700"N 31°10'900"E	4	4	0 (nests recent 2–3 days old)	<i>Khaya anthotheca</i> <i>Phoenix reclinata</i>	–	–
Kitoba/Kigorobyia							
Hoima River (eastern boundary of Bujawe FR)	01°31'900"N 31°14'000"E	15	5	0	<i>Pseudospondias microcarpa</i> <i>Phoenix reclinata</i>	Knuckle marks	–
Kitoba							
Wagaisa (by Bwendero distillery)	01°30'400"N 31°19'800"E	11	4?	4	<i>Pseudospondias microcarpa</i> <i>Funtumia africana</i>	Calls (group), feeding traces (jackfruit)	7 (4 adult males, 1 adult female, 1 subadult, 1 juvenile)
Kiryangobe (west of Mukihani FR)	01°33'100"N 31°20'900"E	10 ¹	5	0 (5 nests recent)	<i>Pseudospondias microcarpa</i> <i>Pycnanthus angolensis</i>	–	–
Mukihani FR–south (Kihomboza area)	01°28'600"N 31°21'700"E	11 ¹	5	5	No data	–	–
Mukihani FR–central (Bulyango area)	01°31'700"N 31°22'700"E	6	No data	0	No data	–	–
Kigorobyia/Kitoba							
Waki River–north (Kyamuchumba area)	01°36'200"N 31°22'600"E	13	9	0	<i>Pseudospondias microcarpa</i> <i>Cordia</i> sp. <i>Alstonia boonei</i>	Knuckle marks	2 (adult males?)
Kitoba/Kyabigambire							
Waki River–east (Kasongwa area)	01°33'000"N 31°25'400"E	16	6	10	<i>Albizia zygia</i> <i>Maesopsis eminii</i> <i>Antiaris toxicaria</i> <i>Sapium ellipticum</i> <i>Funtumia africana</i> <i>Ficus</i> sp.	–	–
Kyabigambire							
Kasongire FR (Kalyango)	01°34'000"N 31°27'200"E	43 ¹	12	4 (+ many recent)	<i>Albizia zygia</i> <i>Trilepisium madagascariensis</i> <i>Funtumia africana</i> <i>Sapium ellipticum</i> <i>Khaya anthotheca</i> <i>Pycnanthus angolensis</i>	–	–
Bulindi (west of Kandanda–Ngobyia FR)	01°29'000"N 31°28'800"E	25 ¹	12	17 ¹	<i>Pseudospondias microcarpa</i> <i>Antiaris toxicaria</i> <i>Maesopsis eminii</i>	Call (single), dung	6 (1 adult male, 2 adult females, 2 juveniles, 1 infant)

¹Indicates additional nests seen but not recorded (for example, across swamp).

²Nest tree species: only identified species are listed.

³Other fresh sign: shown only if recorded independently of an encounter (i.e., on a different day) and, in the case of dung, independently of fresh nests.

FR=Forest Reserve

A common belief is that chimpanzees tend not to bother humans if left alone, but if threatened they are considered very dangerous. Reports of chimpanzee attacks on people in Hoima District (including two in the River Hoima region) seem to have involved a chimpanzee first being speared or attacked with pangas, or set upon by dogs. In these cases an attempt may have been made to take an infant chimpanzee from its mother or otherwise confront a crop raiding ape. However, it is difficult to obtain facts since people are reluctant to admit any wrongdoing. In 2005, a child was apparently fatally attacked by a chimpanzee southeast of Kasongoire FR in what was probably a predatory incident. At two sites women claimed to avoid going to forest wells to collect water when chimpanzees are nearby. Chimpanzees are known to threaten people by slapping the ground or tree-trunks, and may be difficult to chase from gardens (pers. obs.). Around Bulindi, it was claimed that they transmit an unknown skin disease to humans. Several villagers at different sites explicitly stated that chimpanzees do not belong in their forests and should be relocated to a sanctuary or wildlife reserve.

Discussion

Northern Hoima's chimpanzee population

The surveys indicated that chimpanzees have a wider distribution in northern Hoima than previously realized, and point to the existence of a number of distinct communities, resident to particular areas. The nest group data, together with reports of local people, suggest that chimpanzee communities in this region are relatively small, as might be expected in such a disturbed and fragmented habitat. Indeed, elsewhere where chimpanzees have been studied in small forest patches—at Kasokwa in Masindi, just north of the survey area, and at Bossou in Guinea—community size is small (i.e., 12–20 individuals), including just 1–3 adult males (Reynolds *et al.* 2003; Sugiyama 2004). Even so, data from Hoima suggest this may not always be the case. Following this survey, an 18-month ecological study was conducted at Bulindi, in the far east of the area surveyed. There, the chimpanzee community comprises a minimum of 25 individuals, including at least six adult males, and four adult males were encountered together at Wagaisa, as described above. One possibility is that the riparian forests are rich in chimpanzee foods. Vegetation surveys at Bulindi showed that some of the apes' most important fruit sources occur at high densities in the swampy conditions (for example, *Phoenix reclinata* and *Pseudospondias microcarpa*; McLennan unpubl. data).

Based on densities in larger outliers around Bugoma, Plumptre *et al.* (2003) estimated an overall population of ~70 individuals for the area between Budongo and Bugoma. Although the present study aimed to assess distribution rather than census the region's chimpanzee population, a crude estimate of numbers can be made. Preliminary analysis of habitat use indicates that the Bulindi chimpanzee community had a known range of approximately 20 km² during 2006–2007 (calculated by minimum convex polygon method), and a probable

range of about 38 km² if locations of unconfirmed yet reliable reports are included. It is unlikely that this represents a significant underestimate of range size because the outer limits to the east and south include locations where these chimpanzees—which appear to have neighbors only in the north and west—have recently been sighted for the first time by local people (i.e., they appear to be expanding their range). Note that most of this territory comprises seldom-used wooded grassland (principally in Kandanda–Ngobya FR) as well as village areas, and only a small proportion is core habitat (i.e., riparian forest). A minimum community size of 25 occupying a range of 38 km² gives a density of 0.66 individuals/km² at Bulindi. If this estimate was applied to the whole 400 km² survey region it would imply a population of as many as 260 chimpanzees—considerably more than previously estimated. Of course, habitat quality and hence chimpanzee density may vary across the region and this needs to be investigated. Even so, the survey area did not include forest patches occurring inside the Masindi border around the southern periphery of Budongo, such as at Kasokwa (Reynolds *et al.* 2003). One or possibly two resident chimpanzee communities inhabit fragments to the southeast of Kasongoire FR, in the Kinyara sugar estate in Masindi—almost certainly these are different animals to those ranging on the Hoima side of the reserve more than 6 km to the west. In addition, there are unconfirmed reports of chimpanzees near Buhimba, further south of the survey region, and chimpanzees are also present in forested areas east of Bugoma around Munteme (JGI/UWA 2002; pers. obs.).

Threats to chimpanzees in Hoima

Although chimpanzees are undoubtedly more numerous between Budongo and Bugoma than previously recognized, current numbers across this region may be lower than the Bulindi data imply. Food density and availability, for example, could be higher at Bulindi than elsewhere in northern Hoima, thus supporting a greater density of chimpanzees. At any rate, the continuing existence of chimpanzees across this region is seriously threatened by recent and ongoing human activities. Two examples from the survey area illustrate their precarious status.

Case 1. During the 1960s, cocoa gardens (*shambas*) were established in private and communal forests across Hoima, but many were abandoned when the cocoa industry declined during the 1970s and 1980s. The chimpanzees that range around River Hoima at Kiseke and Wagaisa have raided this cocoa for years. A prominent farmer rehabilitated cocoa *shambas* along the river in the 1990s, but complains that chimpanzees eat a significant portion of his crop. He uses a pack of dogs to drive chimpanzees away from his cocoa and, at the time of the survey, was clearing riparian forest either side of his *shambas* as a buffer. He provided neighbours with dogs and recommended they too remove all large trees from in and around their *shambas*. He has repeatedly requested that the Uganda Wildlife Authority (UWA) remove the chimpanzees, and was plainly angry at what he

perceives is a lack of action. During the main harvesting season in 2005 and 2006, UWA provided a ranger to guard the cocoa. The ranger also supervised community hunts, apparently to rid the area of baboons. In October 2006, two juvenile chimpanzees were caught in nets during separate hunts. The second was kept tethered for several days in an outside toilet (Fig. 3); both were subsequently released at the capture site. A year earlier two infants were captured in this same area and taken to Ngamba Island Chimpanzee Sanctuary in Lake Victoria, currently home to 44 rescued chimpanzees (L. Ajarova pers. comm.). Adjacent to the forest fragment at Wagaisa is a large distillery. When surveyed, the managers had recently planted sugarcane alongside the forest. When asked about likely crop raiding by chimpanzees, a manager replied that they were 'hunting them down'. Throughout 2007 this forest patch was further degraded and logged for timber (K. Hiser pers. comm.).

Case 2. During surveys along the Waki River, local people reported that chimpanzees were often found in a valley inside Kasongore FR, known as Kalyango. There are permanent villages in this reserve, and most suitable land is cultivated. The 'main forest' was an approximately 2–3 ha patch of degraded forest on a slope, which contained a concentration of nests. Adjacent to this patch an area equivalent in size had recently been burnt and cleared for farming. Elsewhere, gallery forest had been cut down. Residents claimed the National



Figure 3. Captured chimpanzee in Kiseke village, Kitoba Subcounty, October 2006.

Forest Authority (NFA) required households to plant several trees of fast growing species (for example, *Maesopsis*, pine or eucalyptus) each year, but no restrictions on clearing natural forest were apparent. A road passes through the reserve; local people have complained to the UWA about chimpanzees scaring children as they walk to school. The NFA were apparently unaware of the presence of chimpanzees in this reserve, although this information can be easily obtained from locals. The small FRs in northern Hoima are classified as 'production' reserves intended for development of industrial plantations (Uganda, NFA 2005), mainly of *Pinus* and *Eucalyptus* spp. Evidently, the status of endangered and protected wildlife is not a priority in this region of Uganda. As such, chimpanzee populations that range within these government reserves enjoy no more protection than those on private or communal land.

The pace of change has been fast in Hoima. Forest patches are rapidly depleted as subsistence farmers increasingly shift to cash crops. Currently, tracts of gallery forest throughout Hoima are being cleared for tobacco farming for sale to firms such as British American Tobacco. Further, during 2007 forests in the survey area were targeted by timber dealers and the sound of chainsaws could be heard throughout the region. Even small trees (for example, of 50-cm trunk diameter) of moderate timber value were being systematically removed, in a situation analogous to a 'gold rush'. The logging is seemingly unregulated and plainly unsustainable. In Uganda it is illegal to cut timber in natural forests with a chainsaw, but since many government officials are poorly trained and poorly paid there is little incentive for them to enforce laws and implement policies. Instead, some officials are tempted to make money themselves from the timber. For the local communities, insecurity over land tenure may motivate owners of private and communal forests to sell trees or clear forest quickly in order to get the land under cultivation (Banana and Gombya-Ssembajwe 2000; Romano 2007). Moreover, at Bulindi some local people evidently believe that conservation of chimpanzees and forest will result in a loss of land. Yet addressing land tenure issues was a central component of Uganda's recent forestry reforms. Specifically, local governments are to encourage owners of private or communal forests to legally register their forests so that land tenure is secured, thus promoting responsible management (Uganda, MWLE 2002). In addition to revenue collection, the District Forestry Services are required to provide advisory support to owners of natural forests outside FRs, including preparation of approved sustainable management plans for registered forests (Uganda, MWLE 2002; Uganda, Government of Uganda 2003). Presently, this appears not to be happening. It seems that the recent abolition of graduated tax—previously an important source of income for many local governments—may be prompting district governments such as Hoima, with relatively large expanses of forest on private and communal land, to focus their attention on income generation from forest produce (F. Babweteera, pers. comm.). Thus the need to generate short-term revenue to fund the District budget is at the expense of long-term conservation goals.

It is evident that Hoima's chimpanzees are being forced to adapt to rapid habitat change, including fragmentation, a significant reduction in forest area and loss of large fruit-bearing trees, alterations to forest structure and composition, ever-greater distances across agricultural land between patches, and an overall increase in human activity in and around forests. An inevitable consequence of these processes is a rise in human–chimpanzee interactions, which grow increasingly negative in character, as reflected by reports of farmers killing chimpanzees for raiding crops and chimpanzees attacking humans. It is common for farmers to place steel 'man traps' (or 'leg-hold' traps) at the forest edge and around cultivated fields to deter crop raiding animals (pers. obs.). A chimpanzee caught in such a trap, whether intended or accidental, may have great difficulty removing the device. By way of grim illustration, an adult male of the small Kasokwa community—already missing a foot from a previous trap encounter—died from septicaemia some 10 days after getting his hand caught in a trap (Munn and Kalema 2000). Other cases have recently occurred around Kasongore (Reynolds 2005) and at Bulindi (McLennan unpubl. data), but undoubtedly many more go unreported. As such, trapping of chimpanzees in agricultural areas should be seen as both a conservation problem and a welfare issue. Moreover, the potential for chimpanzee attacks on humans, including predation on children, increases wherever chimpanzees are forced into a close, competitive relationship with humans. In such circumstances, adult male chimpanzees in particular may exhibit frequent aggressive behavior towards humans (pers. obs.). From a conservation perspective attacks are problematic since they generate fear and hostility towards chimpanzees locally, may trigger retaliatory killings, and affect local and public support for chimpanzee protection and related conservation efforts (see also Wrangham 2001).

With regard to hunting, the Ugandan taboo against eating primates probably explains the continuing presence of chimpanzees in northern Hoima despite the relatively high density of farmers. However, recent migrants to the area, such as from DRC, have different traditions and may hunt chimpanzees. For example, the northern tip of Mukihani has recently been settled by Congolese refugees who have encroached on the reserve. Their hunting trails lead deep into the forest. Chimpanzees are apparently nowadays rarely seen in the forest nearest this village, and a guide suggested that this was due to hunting pressure (though no evidence of this was seen). There are current reports of chimpanzees being hunted to supply body parts for traditional medicine in the Hoima–Masindi area (for example, around Kinyara).

Conclusion

The area surveyed falls within a proposed corridor linking two major forests blocks, Budongo and Bugoma. It is, therefore, important that this study found no evidence that

chimpanzee populations were yet isolated within this region, confirming the corridor's potential. However, current human activities are expected to inflict a heavy toll on northern Hoima's apes leading to local extinctions within the next decade. Immediate action is required to reverse this state of affairs, and yet the combination of unprotected habitat, intensive and increasing human pressure on forest land and resources, and inadequate accountability of those involved in natural resource management regionally, offers no easy solutions. As a first step, both the NFA and local government must be publicly called upon to take into account the presence of chimpanzees—protected by Ugandan law—in the management of the district's forests. Likewise, tobacco and sugarcane companies must be made to conduct environmental impact assessments, performed by independent, external agencies. Policy guidelines should be strong on riparian forests to avoid the problem of farmers clearing forest up to the river banks. This is particularly relevant to Hoima where most forest patches are riparian.

Ultimately, however, the benefits to local communities living alongside potentially troublesome—and sometimes dangerous—mammals such as chimpanzees must outweigh the costs (Hill 2002). It seems likely that local people will require economic incentives if they are to manage forest on private and communal land sustainably, and it has been suggested that revenue generation from chimpanzee ecotourism in such areas might provide an answer. Yet it is difficult to imagine successful ape tourism in visibly impoverished, stressed habitats such as those in the area surveyed. Moreover, habituation for tourism is inappropriate where apes and people live in very close proximity, for reasons that include increased likelihood of crop-raiding, risk of aggression to local people and tourists by emboldened and/or stressed chimpanzees, and increased potential for disease transmission. Instead, habitat stabilization and enrichment must be the priority. To this end, novel strategies are required such as alternative income-generating projects and enrichment planting, developed with the full involvement of local communities and delivered with a strong educational emphasis. An additional strategy is to explore possibilities for payment for ecosystem services as an incentive for private forest owners to maintain forest on their land. In this context, it is crucial that land tenure issues are addressed to relieve local anxieties about land loss to conservation projects.

Finally, whilst maintaining gene flow between chimpanzee populations in the Budongo and Bugoma forests is an attractive conservation goal, we must remember that apes inhabiting the proposed corridor live in close contact with a growing human population. The danger is that these 'village' chimpanzees might introduce novel diseases to ape populations in the more remote forest blocks. Conservation projects will need to investigate the health status of chimpanzees within the Hoima corridor, and devise strategies for minimising the risk of disease transmission between apes and humans regionally.

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