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# Human-Chimpanzee Sympatry and Interactions in Cantanhez National Park, Guinea-Bissau: Current Research and Future Directions

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**Abstract:** Increasing human populations and the rapid conversion of forest to agricultural land increase the likelihood of interactions and conflict between humans and nonhuman primates. Understanding such interactions requires a broad cross-disciplinary approach that assesses the implications of sympatry for primate conservation and human social, cultural and economic needs. Although chimpanzees were declared extinct in Guinea-Bissau in 1988, recent reports estimate that between 600 and 1,000 individuals are currently present, with the largest population occupying the Cantanhez National Park (105,700 ha; northeast limit: 11°22'58"N,14°46'12"W; southwest limit: 11°2'18"N,15°15'58"W). These heavily fragmented coastal forests have been identified as one of seven priority areas in West Africa for urgent chimpanzee conservation efforts (Kormos *et al.* 2003. *West African Chimpanzees. Status Survey and Conservation Action Plan*. IUCN, Gland. 2003). Here we set the context for human-chimpanzee sympatry in Guinea-Bissau, and provide a platform from which further studies can expand. We review past findings that might affect current and future sympatric relationships, and integrate preliminary data on resource competition from one hitherto unstudied chimpanzee (*Pan troglodytes verus*) community inhabiting a forested-agricultural matrix in Caiquene and Cadique, central Cantanhez National Park. While local human cultural traditions provide a degree of tolerance and protection to chimpanzees in Cantanhez National Park, which is beneficial for long-term conservation initiatives, human-chimpanzee interactions have the potential to grow increasingly negative in character, especially as human populations expand and further pressure is exerted on the land.

**Key words:** Human-chimpanzee interactions; conflict; resource competition; Guinea-Bissau

## Introduction

Increasing human populations and the rapid conversion of forest to agricultural land mostly have a negative impact on nonhuman primates (hereafter primates) by reducing and isolating ranging areas and increasing the likelihood of spatial and ecological overlap. In certain situations traditional protection towards primates, through folklore or religious practices, as well as more recent conservation initiatives has meant that some species inhabit increasingly human-influenced environments in exceptional proximity to people (Fuentes and Wolfe 2002; Paterson and Wallis 2005). The nature of human-primate interactions varies but is often characterized by resource competition, for example over crops and wild resources, and increasing conflict (Kinnaird 1992; Hill 2005). A broad cross-disciplinary approach, such as that used in ethnoprimatological research, increases our understanding of the realities facing both humans and primates and the sustainability of their relationships (see Fuentes and Wolfe 2002 and Fuentes and Hockings 2010 for overviews).

Human-primate conflict is a critical issue when it threatens the economic and social security of rural people as well as compromising biodiversity conservation initiatives (Naughton-Treves 1997). Conflict levels are likely influenced by people's 'capacity' to tolerate problematic wildlife behaviors such as crop-raiding. This is linked to various socio-economic factors such as the commercial value of a crop type, and might also be linked to aspects of development (Hill and Webber 2010). There are, however, important aspects concerning attitude that influence human conceptualizations of conflict (Lee and Priston 2005; Naughton-Treves and Treves 2005). People base their perceptions and attitudes of primates not only upon facts and experiences, but also upon numerous social factors such as cultural norms, expectations, folklore and beliefs (Hill *et al*. 2002; Saj *et al.* 2006; Dickman 2010). In protected areas, where people are legally inhibited from



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employing traditional methods of dealing with problem wildlife such as hunting, competition over cultivated resources can easily escalate (Madden 2004; Webber *et al.* 2007).

Effective mitigation strategies are urgently required in order to resolve human-primate conflicts (Hockings and Humle 2009). Such measures are either indirect, through increasing tolerance of wildlife using techniques such as environmental education, or direct, by reducing the frequency of human-wildlife interactions and severity of wildlife damage, through land-use planning, for example (Hockings and McLennan under review). It is clear that a detailed understanding of the issues surrounding a potential conflict situation is the first step towards reconciling conflict between humans and primates (Woodroffe *et al.* 2005).

*Chimpanzees in anthropogenic habitats*

Chimpanzees (*Pan troglodytes*) in particular are of special importance in terms of their complex social and cultural relationship with humans, and are often attributed human-like characteristics (Kohler 2005). Likewise, they are widely used by conservation organizations as a charismatic umbrella species for conservation. Although chimpanzees are considered ripe fruit specialists (Goodall 1986; Wrangham *et al.* 1998), they show high levels of ecological and behavioral flexibility and are able to adapt to areas of secondary vegetation and human agriculture impinging on their natural habitat (Reynolds 2005; Yamakoshi 2011). They frequently conflict with the interests of local people, however, due to crop-raiding, and in some cases, by threatening people's personal safety (McLennan 2008; Hockings *et al.* 2009, 2010). In reality chimpanzees are particularly vulnerable to local extinction due to their now highly restricted ranges (many outside of protected areas), slow life history, and large body mass, and are extremely susceptible to a range of anthropogenic activities, including deforestation, agricultural expansion and hunting (Kormos *et al.* 2003).

Using a cross-disciplinary perspective, we here describe the context for human-chimpanzee sympatry and interactions in Guinea Bissau, and indicate directions for further studies. In particular, we review historical aspects relevant to our understanding of current relationships and integrate new data from one hitherto unstudied chimpanzee (*Pan troglodytes verus*) community inhabiting a forested-agricultural matrix in Caiquene and Cadique-Nalu (hereafter Cadique),central Cantanhez National Park. We conclude by discussing the conservation management of these apes and the potential for long-term coexistence in changing habitats.

*Human-influenced habitat in Guinea-Bissau*

The Republic of Guinea-Bissau lies on Africa's northwestern coast and covers an area of 13,948 km². The continental part of Guinea-Bissau can be divided into three regions: coastal lowlands, the interior plain, and the north-eastern highlands. Cantanhez National Park (CNP) is in the southwestern part of Guinea-Bissau, in the Tombali Administrative Region (see Fig. 1; northeast limit: 11°22'58"N, 14°46'12"W; southwest limit: 11°2'18"N, 15°15'58"W). Cantanhez was declared a National Park by presidential decree in 2008 and

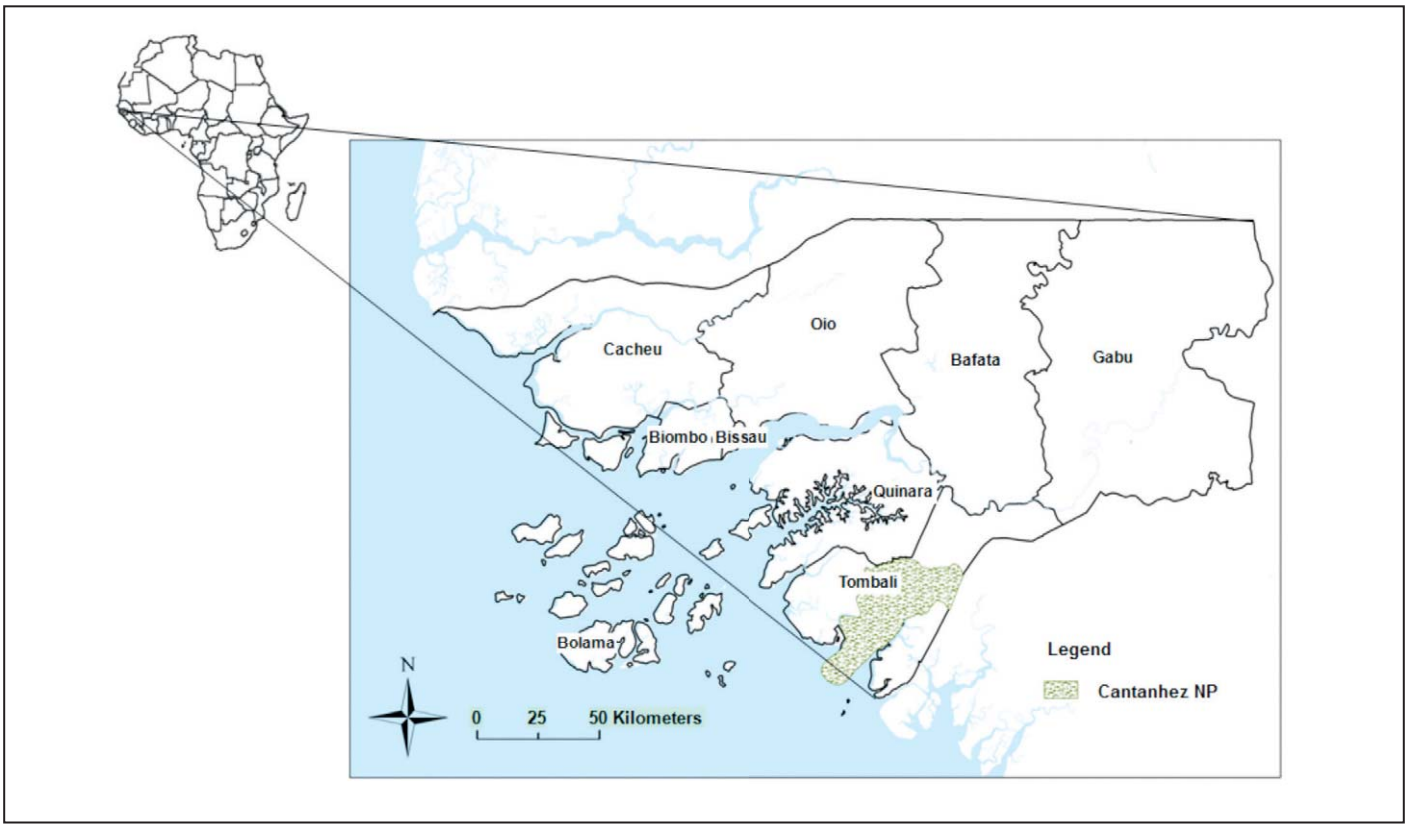



**Figure 1.** Location of Guinea-Bissau in west Africa and Cantanhez National Park in Tombali, Guinea-Bissau.


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following a general agreement between the central and local authorities and the local population for the need to take action to conserve the biodiversity of this area, in addition to the promise of income-generating schemes associated with ecotourism (Gippoliti *et al.* 2003).

Due to seasonal patterns of the intertropical convergence zone, rainfall in Guinea-Bissau is bimodal: there is a long dry season from November to May and a rainy season from June to October (Catarino 2004). An average of 1400–2500 mm of rain falls per year and temperatures are at their lowest in January (24.7°C) and their highest in July (28.0°C) (Gippoliti *et al.* 2003). CNP has a mosaic environment of forests, savanna and mangroves (Gippoliti and Dell'Omo 2003; Catarino 2004), and supports a large proportion of the country's remaining closed (or primary subhumid) forest (Oom *et al.* 2009). The World Wide Fund for Nature (WWF) has identified the Cantanhez Forest as one of the 200 most important ecoregions in the world, being as it is one of the last remaining fragments of humid forest in West Africa. These heavily fragmented coastal forests have been identified as one of seven priority areas in West Africa for chimpanzee conservation efforts (Kormos *et al.* 2003). Even though forests in Cantanhez have been officially classified as protected and as non-hunting reserves, the regulations are not enforced, and there is very little formal protection for the forests and wildlife there.

Human activities have resulted in areas of scrubland and cultivation, with roads and paths dissecting the national park. Using satellite imagery, Oom *et al.* (2009) identified a marked trend in forest degradation in Tombali from 1990–2007 (prior to the establishment of CNP), with a transition from closed to open forest and savanna-woodland. This loss of closed forest has been due to forest cutting for swidden (or 'slash-and-burn') agriculture for subsistence crops such as rice (*Oryza* spp.), cassava (*Manihot esculenta*) and beans (*Vigna unguiculata*), and the conversion of forest into cashew (*Anacardium occidentalis*) plantations. The proportion of dry land used for food production is continually increasing in CNP due to increasing numbers of people, many unfamiliar with more traditional coastal rice farming practices in mudflats or '*bolanha*' areas. Many are opting to grow cashew instead of cultivating rice in these difficult-to-farm areas.

Guinea-Bissau is the sixth largest exporter of unprocessed cashew nuts and many farmers now depend on the crop for cash income (Barry *et al.* 2007). Most of the cashews exported are grown and collected by small, rural farmers and their families (90,000 households), rather than large commercial growers (2,200 '*ponteiros*') whose large plantations cover less than 27% of the country's arable land. Forested and arable land is being converted for cashew production at a rate of approximately 4% per year (taken from Barry *et al.* 2007). Cashew orchards are abundant in CNP, and cashew trees are often planted following the cultivation of other subsistence crops. Cashew farming is less labor intensive than rice farming, and the earnings from cashew nuts are often used by local people to buy imported rice (Barry *et al.* 2007).

*Biological and anthropogenic diversity*

There are numerous ethnic groups in Guinea-Bissau, including Balanta (30%), Fula (20%), Manjaco (14%), Mandinga (13%), and Papel (7%) (Sousa and Frazão-Moreira 2010). The Nalu people are believed to have settled in the Cantanhez area by at least the 15th Century and are the last remaining 'traditional owners of the land' (Baran and Tous 2000). A number of different ethnic groups have entered the area since then, the most important of which are the Balanta, the Fula (who introduced the Islamic religion) and the Sosso (Carvalho 1949; Temudo and Schiefer 2003). About 70% of the population lives in rural areas (with an urbanization rate of approximately 3.2%), and the livelihoods of the majority depend on agriculture (CIA 2010). There are 110 villages (locally known as *tabancas*) in the 105,700-ha CNP, and a recent population census estimates 22,505 people living there, with a population density of approximately 20 people/km².

The wildlife of the CNP is very rich and includes seven primates (Gippoliti and Dell'Omo 1996); the western chimpanzee, colobus monkeys (*Procolobus badius temminckii* and *Colobus polykomos*), Guinea baboon (*Papio papio*), green monkey (*Chlorocebus aethiops sabaeus*), Campbell's monkey (*Cercopithecus campbelli*) and Senegal bushbaby (*Galago senegalensis*). Controlled seasonal hunting in the national park is permitted by law, but only by local people and for certain game species such as warthog (*Phacochoerus africanus africanus*) and duiker (*Cephalophus* spp.). Primates are officially fully protected there, but they are still illegally hunted for meat; mostly colobus and baboons. The young of certain species, mostly baboons, are often captured to keep as pets.

*Chimpanzee conservation in Guinea-Bissau*

Of the four recognized subspecies of chimpanzees, the western chimpanzee is the second most-threatened. It has been extirpated from at least two countries, and is on the verge of extinction in five others (Kormos *et al.* 2003). Chimpanzees are classified as Endangered on the IUCN Red List (IUCN 2008), and are thus legally protected in Guinea-Bissau. Although chimpanzees were declared extinct there in 1988 (Lee *et al.* 1988; Teleki 1989; Butynski 2001), subsequent reports estimated that between 600 and 1,000 individuals are currently present (Gippoliti *et al.* 2003). More recently, Torres *et al.* (2010) have shown that suitable forest habitats in CNP (also includes parts of the Cacine and Catio regions) decreased by approximately 11% (270 km²) from 1986 to 2003 and, depending on three different chimpanzee density estimates, this will have resulted in a decrease of between 157 and 1103 individuals. Using the lowest density estimate of 0.5 individuals/km², the current (2003) population of chimpanzees in CNP is predicted to be fewer than 400 individuals. Based on behavioral observations (sightings, vocalizations, road-crossing points) of chimpanzees, the location of chimpanzee sign (nests, feces, knuckle prints, feeding remains), local reports and natural and man-made barriers, we have estimated that several different chimpanzee communities are


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present in the forested areas of central Cantanhez (see Fig. 2; Hockings unpublished data); this is supported by preliminary genetic analyses (Rui Sá unpublished data). Using questionnaire data collected from local hunters, Brugière *et al.* (2009) suggested that chimpanzees are also present around all surveyed villages (n = 70) in southern Guinea-Bissau, more specifically between the Corubal River and the border with Guinea.

*Human-chimpanzee interactions in Guinea-Bissau*

Like other sites in Africa (for example, Bossou, Guinea: Hockings *et al.* 2006, 2009; Bulindi, Uganda: McLennan 2008), local people in Guinea-Bissau frequently come into contact with chimpanzees on roads, in cultivated areas, and around the edges of forest fragments. Although detailed data on human-chimpanzee interactions in Guinea-Bissau are lacking, interactions can be broadly categorized into several non-mutually exclusive areas, including disease transmission, cultural attitudes/perceptions towards chimpanzees and their habitat, and overlapping cultivated and wild resource use.

*Disease transmission*

Data on disease transmission between local people and chimpanzees in Guinea-Bissau are only now becoming available. Humans and chimpanzees in Cantanhez share various parasites, in particular *Blastocystis hominis* and *Trichuris trichura*, the prevalence of which indicates that degree of habitat disturbance might affect transmission and persistence of such pathogens in this area (Sá *et al.* 2009). The potential for bi-directional pathogen exchange (for example, Engel *et al.* 2002), its relationship with range overlap between humans and primates, and its effect on primate conservation in Guinea-Bissau certainly requires detailed research. Furthermore, the risk of disease transmission between researchers and chimpanzees (as documented by Köndgen *et al.* 2008 for chimpanzees at Taï National Park, Côte d'Ivoire) must be properly considered when deciding whether to habituate ape populations in Cantanhez for scientific research or tourism.

*Local cultural attitudes*

Cultural attitudes towards flora and fauna by some ethnic groups, including the Nalu, are also an important component of interaction, with certain forests and tree species (including *Ceiba pentandra*, *Parinari excelsa*, *Dialium guineense*, and *Treculia africana*) having symbolic and religious meanings that offer a degree of traditional habitat protection (Frazão-Moreira 2001, 2009; Sousa and Frazão-Moreira 2010). Likewise, chimpanzees—*Dári* in Creole—are not hunted for meat in this area due to local taboos (i.e., unwritten rules or prohibitions that regulate human behavior) as they are considered too similar to humans (Gippoliti *et al.* 2003; Brugière *et al.* 2009). In agreement, Costa *et al.* (2008) showed that

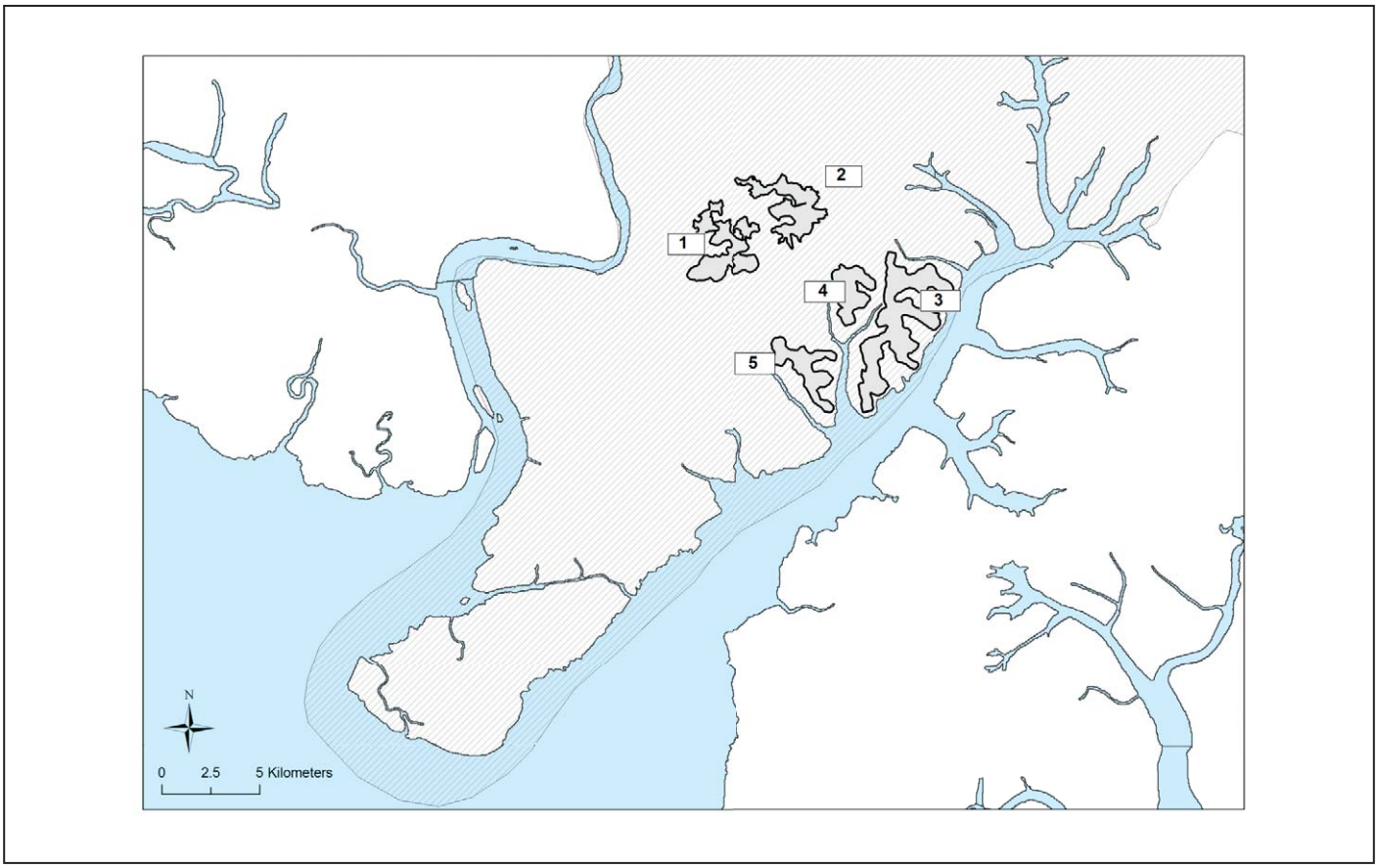



**Figure 2.** The forests of central Cantanhez National Park containing chimpanzees; (1) Cadique and Caiquene, (2) Lautchande, (3) Camocote and Cambeque, (4) Madina, and (5) Catomboi.



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chimpanzees in Cantanhez are classified as 'highly non-edible' among the Balanta ethnic group, owing to their resemblance to humans. Although chimpanzee meat is not consumed, there is some suggestion that other body parts still might be used in traditional medicine (Gippoliti *et al.* 2003), and an illegal pet trade in infant chimpanzees persists (Casanova and Sousa 2006).

A population of chimpanzees living in proximity to the villages of Caiquene and Cadique currently show little evidence of aggressive behaviors towards local people, and informal conversations with villagers suggest that chimpanzees are not considered a physical threat in this particular location (for the opposite situation see Hockings *et al.* 2010; McLennan and Hill 2010). Preliminary observations suggest that people mostly remain calm in the presence of the chimpanzees (Hockings unpublished data; see Fig. 3). To corroborate this, to date there have been no reports of attacks by chimpanzees on local people at this site, and this likely contributes to their indifferent or positive perceptions of chimpanzees in this area.

*Overlapping resource use – crops*

In terms of resource competition, 89% of interviewees from a questionnaire survey of local hunters in southern Guinea-Bissau reported that chimpanzees raided crops, especially maize (*Zea mays*) and sugarcane (*Saccharum* sp.) (Brugière *et al.* 2009). A range of subsistence foods as well as cash crops are cultivated by people in the villages of Caiquene and Cadique. Most fruit trees are in small patches close to people's houses, and the majority of cultivated areas contain the cash-crop cashew (Hockings and Sousa in press). Chimpanzees in this community eat at least 10 different crop species, including papaya (*Carica papaya*), cashew (*Anacardium occidentale*), cowpea bean (*Vigna unguiculata*), baobab (*Adansonia digitata*), mango (*Mangifera indica*) and orange (*Citrus sinensis*). Chimpanzees at Caiquene-Cadique eat the juicy cashew pseudofruit (hereafter fruit) at numerous locations throughout their home range. The nut is never consumed probably because it is enclosed by a potent skin irritant (Hockings and Sousa in press). The skin of the cashew fruit is fragile, making it less suitable than other fruits for transport and retail. As a result the fruits are rarely sold, and it is acceptable to take fruit from a farm for personal consumption if the nut is left. Farmers report that chimpanzees sometimes damage cashew trees by snapping branches to obtain the fruits more easily, but also point to a benefit of chimpanzee raiding as chimpanzees leave the nuts in manageable piles thereby making nut collection easier (Hockings and Sousa in press).

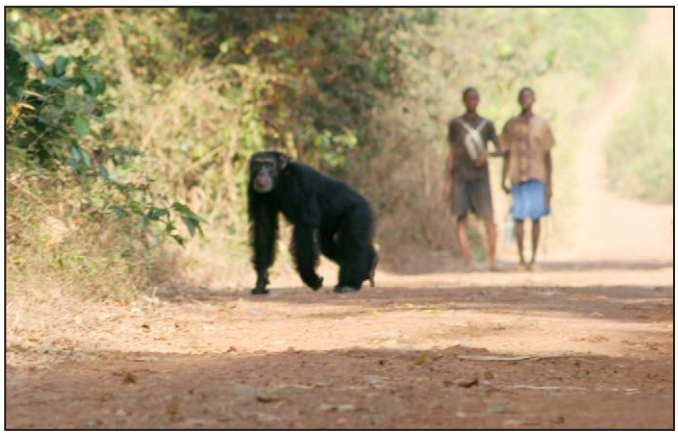


**Figure 3.** An adult male chimpanzee in Caiquene-Cadique crossing a road that bisects the chimpanzees' home range.

While the level of conflict over cashew, the country's major cash crop, currently appears quite low in Caiquene and Cadique due to differential use of cashew plants by humans and chimpanzees (Hockings and Sousa in press), the raiding of other crops such as oranges in parts of CNP are known to have resulted in retaliatory killings of chimpanzees by farmers.

*Overlapping forest resource use*

Local people in CNP use a wide range of forest resources for construction, medicinal and subsistence purposes (see Frazão-Moreira [2009] for a detailed review of resource use by Nalu people). Although it is too early to precisely catalogue the feeding behaviors of chimpanzees in CNP, we mention below some prominent wild foods that both chimpanzees and local people use in Caiquene and Cadique.

There are three species of palm tree in the chimpanzees' known range, namely *Elaeis guineensis* (oil palm), *Borassus aethiopum* (African fan palm) and *Phoenix reclinata* (wild date palm). As elsewhere in West Africa (for example, in Guinea: Humle and Matsuzawa 2004), oil palms are scattered on the edges of the forest (see Sousa *et al.* 2011) and local people harvest the fruits mainly to produce oil. Although chimpanzees eat the fruit, pith and flower (Sousa *et al.* 2011), the abundance of oil palms and their distribution on the edges of forests means that there is very little competition felt by the villagers. The African fan palm is protected, and its use by local people for construction materials is restricted but commonplace. The production of alcohol from this species is forbidden as it ultimately kills the tree, but some local people continue to use it for this purpose. Temudo and Schiefer (2003) suggest that because of this, the palm has almost completely disappeared from the Cantanhez area. Chimpanzees at Caiquene-Cadique eat the fruits of this palm (the fruits are around 500g each and have a large and fibrous pulp), although its importance in their diet is unknown. The wild date palm is found extensively in wetter areas bordering the mangroves. Although human use of this palm appears low, chimpanzees consume the pith and discard distinctive wadges. Consumption of the fruit has not yet been confirmed, but it is seasonally important for chimpanzees living in a forest-farm matrix at Bulindi, Uganda, where its consumption by chimpanzees is negatively related to their crop feeding (McLennan 2010).

Other chimpanzee food species identified include the fruits of *Parinari excelsa* and *Dialium guineense*, which are eaten infrequently by local people (children pick the fruits at the edges of forests and along roads, see Fig. 4), although the timber is used in construction. Chimpanzees at

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**Figure 4.** A child eating wild *Dialium* fruit in a cashew plantation.

Caiquene-Cadique frequently enter cashew plantations to eat fruits from wild shade trees such as *Parkia biglobosa.* Chimpanzees in this area also approach human settlements to raid beehives, and are reported to compete with local people for access to water wells in the dry season (Sousa unpublished data). There is a need for detailed ecological and behavioral investigations into human and chimpanzee plant consumption and extraction rates in CNP, and more widely in Guinea-Bissau. It is important to examine whether any wild foods are exploited by local people for commercial reasons, as occurs for example, at Fongoli in Senegal. Pruetz (2002) found that 17 naturally occurring plant species were eaten by both humans and chimpanzees in the Tomboronkoto region in Senegal. The fruit from the forest liana *Saba senegalensis* is a critical food source for chimpanzees at Fongoli in the dry season, but it also serves as a cash crop for humans during times of hardship. Such information will help to guide effective management in CNP, in an effort to ensure that unsustainable harvesting of wild fruits by humans does not reduce wild fruit availability to such an extent that chimpanzees will be forced to seek alternatives, perhaps increasing consumption of cultivated crops. Likewise, information on the economic importance of wild foods to local humans can be incorporated into sustainable management strategies.

## Conclusions

For the most part, chimpanzees inhabiting large protected areas are less likely to interact with people and compete over resources—crops are generally not available in protected areas and the chimpanzees' sizeable home ranges provide sufficient wild food. However, it is evident that chimpanzees in Cantanhez National Park and other parts of Guinea-Bissau are being forced to adapt to human encroachment and use of the forest. An inevitable consequence is a continuing rise in human–chimpanzee interactions, which have the potential to grow increasingly negative in character, especially as human populations increase and further pressure is exerted on the land. Conflict-mitigation strategies that target problematic wildlife behaviors such as crop-raiding are particularly complicated to establish for cognitively complex species, and require a good understanding of the species' behavior. When species have protected status, theoretically problem animals should only be deterred, translocated or tolerated, hence proactive management is required. Continuing research to understand these complex interactions and chimpanzee behavior will guide future land-use plans, for example through restrictive planting of attractive and high-conflict crops in the national park (see Hockings and McLennan under review).

Chimpanzees in Caiquene-Cadique occur at a density of approximately 3 individuals/km$^2$, classified as high density by Torres *et al.* (2010). This corroborates findings elsewhere that chimpanzee populations can persist in anthropogenic landscapes provided they are not persecuted through hunting or retaliatory killings (Pruetz *et al.* 2002; Duvall 2008; Hockings *et al.* 2009, 2010). In agreement with McLennan (2008), this enforces the conservation potential of such habitats. Furthermore, chimpanzees are able to move between forest fragments and the communities do not appear overly isolated in central Cantanhez. We have yet to understand at what point habitat isolation and degradation make chimpanzees unable to disperse, but the prospects for the long-term viability of chimpanzees in CNP will be greatly improved if dispersal opportunities are maintained between major forests. Immigration into isolated communities that inhabit forest-farm matrices appears problematic for some populations of chimpanzees. At Bossou in Guinea, for example, there has been no female immigration into the community since research began 30 years ago (Sugiyama 2004). Special efforts should be made to preserve key forested areas and ensure that connecting areas do not become impassable through the presence of densely populated villages, large cashew plantations or wide, busy roads.

In CNP, an approach to conservation that relies exclusively on the exclusion of local people is out of the question. The benefits to local communities living alongside potentially problematic wildlife such as chimpanzees must, therefore, surpass the costs, even within the borders of officially protected national parks (Hill *et al.* 2002). In face of burgeoning human populations, areas protected for wildlife and ecosystem functioning need to consider human welfare, and the result is a shift in favor of protected areas that allow for local resource use, with many initiatives aiming to link protected areas to local socioeconomic development (Naughton-Treves *et al.* 2005). Although habituation for tourism (and research, see Wrangham and Ross 2008) might be one answer, it is often considered inappropriate where apes and people live in very close proximity (MacFie and Williamson 2010; McLennan and Hill 2010). In reality, chimpanzee conservation in anthropogenic habitats requires "novel strategies such as alternative income-generating projects and enrichment planting, developed with the full involvement of local communities and


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delivered with a strong educational emphasis" (McLennan 2008, pp.52).

Managing protected areas in developing countries presents profound challenges, given widespread conditions of poverty, rapid population growth, and political instability. Primates, particularly chimpanzees, are among the most visible elements of the biodiversity of Guinea-Bissau and have a key role to play as 'flagship' species to attract attention to the need for conservation of some of the most important natural habitats of the country (Gippoliti *et al*. 2003; Sousa and Frazão-Moreira 2010). Long-term conservation success in such protected areas and elsewhere requires concerted efforts to balance the requirements of humans and other primates in their shared environments.

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