Using field data collected by local people to expand the knowledge of a large chimpanzee *(Pan troglodytes verus*) population in the Boé region of Guinea Bissau.

Abstract

An animal ecological study on the population and distribution of the West African Chimpanzee (*Pan troglodytes verus*) in the Boé region in Guinea Bissau was conducted to analyze possible seasonal distribution patterns and preferred nest choices. Based on field data collected by local investigators, It could be concluded that the Chimpanzee habitat comprises the entire Boé region, whereas also no seasonal distribution patterns were observed. The nest data were collected in a small area of the region, a typical mosaic landscape bordering a river. The located nests were mostly found in big trees, showing a higher density near the river. The majority of the possible nest sites are actually used and often even re-used, so the chimpanzees seize every opportunity for building a nest in high trees. Probably, there is a preference during the dry-season for nests in food trees especially of *Parkia biglobosa.* Management should focus in the entire Boé region to protect forests with big trees for nesting en foraging.

Introduction

The last decennia, the great apes are declining because of hunting, habitat fragmentation and habitat loss (Torres et al. 2010). This is also true for the chimpanzee *Pan troglodytes* in Africa (figure 1): the IUCN status is 'endangered' and the population is decreasing (Humle 2008). The reasons for the decrease are poaching, disease, habitat destruction and degradation (Ogawa et al. 2007, Humle 2008). The West African chimpanzee *Pan troglodytes verus* is declining even faster, and there is a real risk that the species will become extinct in Guinea Bissau (Kormos 2003, Humle 2008, Ndiaye et al. 2013). In Guinea Bissau, there are only two regions where the chimpanzees nowadays live with a healthy population, within quite different habitats (Kormos 2003, Kormos and Boesch 2003). The Coastal Cantanhez zone is covered mainly by tropical rainforest, while the Boé region is covered by a mosaic of savanna and gallery forests (figure 2) (Gippoliti and Dell'Omo 2003, Kormos 2003, Ndiaye et al. 2013). The Boé region is the northernmost part of a larger area called Fouta Djallon, which is for the largest part located in Guinea Conakry, where the total population of Chimpanzees is estimated at 3,300 (Kormos and Boesch 2003). The region is located in the Southwest of Guinea Bissau, 11°30 ' and 12°15 ' northern latitude and between 13°35 ' W and 14°30 ' western longitude, and its total

area is 3,289km^2 (Wit and Reintjes 1989). The annual rainfall is between 1,600-2,100 mm and it start

Figure 1. The Dispersion of the Chimpanzee (*Pan troglodyte)s* in Africa. The red rectangle indicates the study area. (Picture is from www.jangoodall.ca).

in May/June and lasts till October/November (Wit and Reintjes 1989, Sall et al. 2007). Most of the annual rainfall was previously measured in July, August and September (Sall et al. 2007). The average temperature is 28°C, with maximum of 39°C in April en 12°C in January (Wit and Reintjes 1989). Most land in the Boé region is covered by a laterite cap (Wit and Reintjes 1989, Silva et al. 2007). This hard rocky ground is unusable for agriculture. The narrow valleys that cut through the laterite have a low fertility (Silva et al. 2007). Only in places where the soil, which is acid, is more than one meter thick such as in a few places above the laterite cap and in the valleys, the forest can grow and the soils are suitable for agriculture (Wit and Reintjes 1989). In the valleys the slash- and burn agriculture is practiced for subsistence farming by local people. The valleys are at the same time the main habitat of the chimpanzees. Forest and savanna trees disappear as a consequence and it will take several decades to restore this forest to a suitable habitat for chimpanzees. However, it is known that chimpanzees also live in (old) agriculture areas and live sometimes close to humans (Silva et al. 2007)

Figure 2. Map of Guinea Bissau with the Boé sector in pink. (poster Chimbo foundation)

Unlike for other large mammals, like buffalos, bushbuck, hogs and duikers, hunting is not a major problem for chimpanzees in the Boé region of Guinea-Bissau, as the local Fula-population does see the Chimpanzee as “a human tribe that got punished to live in forest in an ancient past” (Kormos 2003, Brugiere et al. 2009). Therefore they will not hunt them for bush-meat. For the Boé-Chimpanzees, habitat loss and habitat fragmentation is a much bigger problem (Kormos 2003).

In the past, only a few studies were done on the presence of chimpanzees in the Boé region, situated in the southeastern part of this small West African country (Brugiere et al. 2009). In 2007, commissioned by the Chimbo foundation, an estimation was made of 710 chimpanzees in the Boé area (Silva et al. 2007). This study made a calculation based on information given by the local population in 21 villages and extrapolated it to the whole area . Another survey in 2009 contains interviews in 13 villages with hunters to see what the presence is of chimpanzees and what the northern edge in Guinea-Bissau of the habitat of the chimpanzee is (Brugiere et al. 2009). The

number of villages that were surveyed limits necessarily the conclusions of the survey for the whole of the Boé (Brugiere, Badjinca et al. 2009).

The Quebube River, Where the tree preference of chimpanzees was tested, stands for a typical habitat for chimpanzees in the Boé region. The Quebube valley contains gallery forest, dry forest, (old) agricultural fields and wooded savannas. The hypothesis here is that good nesting places are rare in the Boé, so every suitable place will be used.

Material en methods

Distribution

In January 2010, the Chimbo foundation started a survey network by involving local people in village committees. In 2012, there were 25 village committees involved in the Chimbo foundation's program (Table 1). Twice a month, the local investigators go to the bush to survey their village area for signs of chimpanzee presence. The committees filled in standard forms and these are stored in the Chimbo offices in Beli. In this study, which started in February 2012, these data were digitized and analyzed. Because many committee members lack the necessary map reading skills, the various locations are only described by the villagers, not mapped. During our visits to 14 of the 25 villages, fieldtrips were made and GPS data were collected. In addition, the committees were interviewed to check the reliability of the data on the filled-in forms. A military coup, however, made traveling impossible for a while, so 6 of the 25 committees were interviewed in Beli and only during in the last three days the final 8 interviews toke place in the villages themselves. The locations where the local people had spotted the chimpanzees were indicated by pointing the direction, compared it to a compass, and estimating the distance to the area.

The only known detailed (1:50.000) map of Guinea-Bissau was made by the Portuguese in 1958 during colonial times. This map was scanned at high resolution and afterwards geo-referenced in ArcGIS. The locations where the chimpanzees were seen, were plotted on the map for each month, so in total 12 maps were created.

Habitat types

Different suitable habitats were distinguished to classify the nest locations: gallery forest (mostly degraded), dry forest, wooded savanna and fallow land (Silva et al. 2007, Koops et al. 2012). The habitat type with the largest extension in the Boé, the 'boual', where no trees can grow because of the lateritic stone substrate, does not qualify as a potential habitat type for nest choice of the chimpanzees (Silva et al. 2007).

Gallery forest (G) is mostly common near the rivers and streams. There is almost constant water supply to the ecosystem. Species diversity is greatest towards the river. The river bank and the river itself have specific riverine species. Only at small parts there is no human activity, mostly around the origin of the river, a sacred place for the people.

Dry forest was found further from the river channel, often on plateaus. There is less contact with the

water. The habitat type is more common in the eastern part of the Boé region, which is hillier than the western and central parts.

Wooded savanna forms a more open landscape, where trees only grow randomly in small pockets often on cracks in the laterite cap. Together with the 'boual' and the different gallery forest types it forms a mosaic. The vegetation largely consists of savanna grasses.

Fallow land is former agriculture land. The fields are cultivated in a rotation of 1 year crop growing and 7 to 10 years fallow, when the land is abandoned to recover from crop growing. When preparing the land for a new crop, it is burned by the local people. The fallow-vegetation is composed of dense, low growing woody plants with mainly small trees and vines. It was hard to cross these areas, heavily impacted by man over the years.

Table 1. The Villages where surveys have been done by village committees related to the Chimbo foundation.

Place	Distance Beli km)	UTM lat	UTM lon
Balandugo/Tarige	20,78	0636933	1310083
Beli	0,00	0616162	1308945
Boulouba	17,86	0607438	1293476
Bugafale	34,43	0586142	1314198
Bundocuro	26,36	0596080	1291905
Ca Quidima	19,97	0597188	1302816
Capebonde	13,65	0621315	1296049
Cheche	32,18	0585554	1318759
Dandula	25,80	0636562	1324761
Dandum	33,18	0585508	1296327
Dinguirai	11,08	0624229	1301366
Guilege	45,54	0576228	1287131
Limbi Afia	19,93	0599650	1297829
Lugajole	8,85	0624212	1305727
Madina do Boé	31,93	0585974	1298665
Mária	22,38	0594314	1313643
Misside Boussoura	53,45	0569475	1283013
Munhini	9,92	0616959	1299110
Pataque	6,66	0612876	1314672
Quissem	18,47	0631420	1319319
Senta Sera	21,07	0631328	1294293
Sutomaca	15,68	0600708	1311354
Tabadara	28,21	0625546	1335546
Vendu Cham	23,80	0592616	1312182
Vendu Leidi	24,62	0638719	1299030

Survey methods

Due to time constraints as explained above, it was not possible to run transects systematically. The walks in the field were like reconnaissance walks (Huijbregts et al. 2003), but we went regularly off the paths to count Chimpanzee nests. In the southern section of the river Quebube system, all nests were counted. To the north of the river, however, a longer walking distance in a saw tooth structure was necessary in order to ensure not to miss any nest along the path. The walks were done with three of four people, including a local man with good tree-knowledge and a translator.

Sampling nests

Chimpanzees make their nests in small or big groups together or scattered over different trees. The nest groups were given a number and a corresponding GPS coordinate in UTM. Nest groups were considered "different" when there was a minimal distance of 50 m between two nests of the same age (Koops et al. 2012). After two months of practice, it was possible to distinguish four separate age classes for the nests (fresh, recent, old, very old), as is common in great ape research (Ndimuligo 2008, Pruetz et al. 2008). For each nest group, the habitat type (gallery forest, fallow land, wooden savanna and dry forest) was recorded. The nest groups were placed in ArcGIS 10 on the digitalized map from 1958.

For each nest the following data were collected: nest height, tree species, canopy cover, aspect of the site, and position of the nest. The nest height was divided in six classes (0-5m, 5-10m, 10-15 m, 15-20m, 20-25 m, and >25m), estimated in the field. The tree species were identified by local people in the local language. The local name was then translated into the scientific name using the list in the book 'Planta Vasculares e Briófito da Guiné-Bissau' (Catarino L. et al. 2006). The Canopy cover was divided in classes:0-20%, 20-40%, 40-60%, 60-80%, and 80-100% coverage. The aspect was also given: plain (v), hillside (h) or plateau (p), where plateau is plain area on a hill. Finally the nests were labeled as in top (t), middle (m), and bottom (b) depending on the position in the tree.

Other signs

During the walk other signs of the presence of chimpanzees were also recorded. Coordinates of drumming trees[1] and footprints were recorded and fresh feces were taken to the base camp for food analysis. In addition the presence of other big mammals was noted down to get a better picture for the area as a whole.

[1] Drumming is form of long distance communication, slamming on the buttresses of big trees, which is done by adult males (Arcadi et al. 1998).

Data analysis

In total, 1,799 nests were recorded and analyzed to see if there is a preference for nest height, tree species, food/non-food trees, distance to the water, canopy coverage of the tree or habitat type. Data management and analysis was performed using R i368 2.15.1. The Poisson distribution was tested for these factors. To see if the total and seasonal distribution gave the same distribution, the data was tested with a Chi-square test.

Results

The field data as reported by local people were digitized. The locations where chimpanzees were seen, were plotted on a simplified map based on the old but very detailed 1958 Portuguese map of Guinea Bissau. Chimpanzees were found across the whole Boé area according to the field observations made by local people (Figure 3). The chimpanzees also live close to villages and settlements. Nests were even found as close to the houses as 100 meter, for example in Dinguirai. The surveys were not done in the northern part of the Boé area, because of the absence of villages here. In the center (South-West of Beli) there is also an area which is not surveyed by any village committee. The committees were walking to the field and the maximum distance of 8 km, with an exception of 4 points which were done by bike.

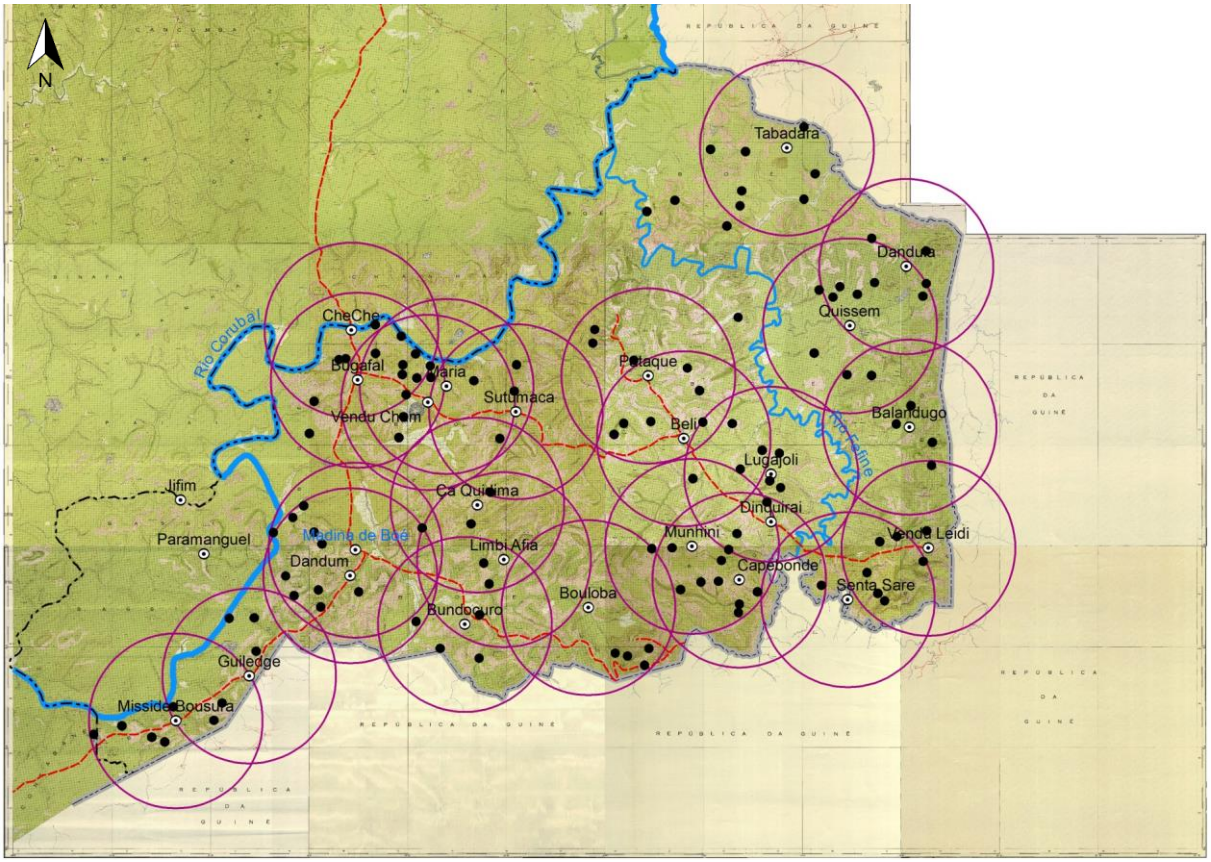

Figure 3. The total dispersion of the West-African chimpanzee in the Boé area is given according to the field observation by the 25 villages committees from November 2009 till December 2011. The maps are scans of the 1958 Portuguese map. The circles indicate a range of 8 km from a village, the maximum distance of the village committee surveys field surveys. The villages of the committees are white dots with an 8 km offset in purple. The black dots are direct observations of chimpanzees by the village committees. The blue lines are rivers, in bold Rio Corubal and normal Rio Fefine. The Boé is defined by the land border in dark grey and sector border in dotted gray line. The red interrupted line is the unpaved provincial road.

The field surveys were done twice a month by each of 25 the village committees. The locations, if recognizable, were plotted on the map of Boé. By 30% of the location for chimpanzee presence the

place was not indicated on the survey forms or could not be identified on the map with the given name by local people and the information from the interviews.

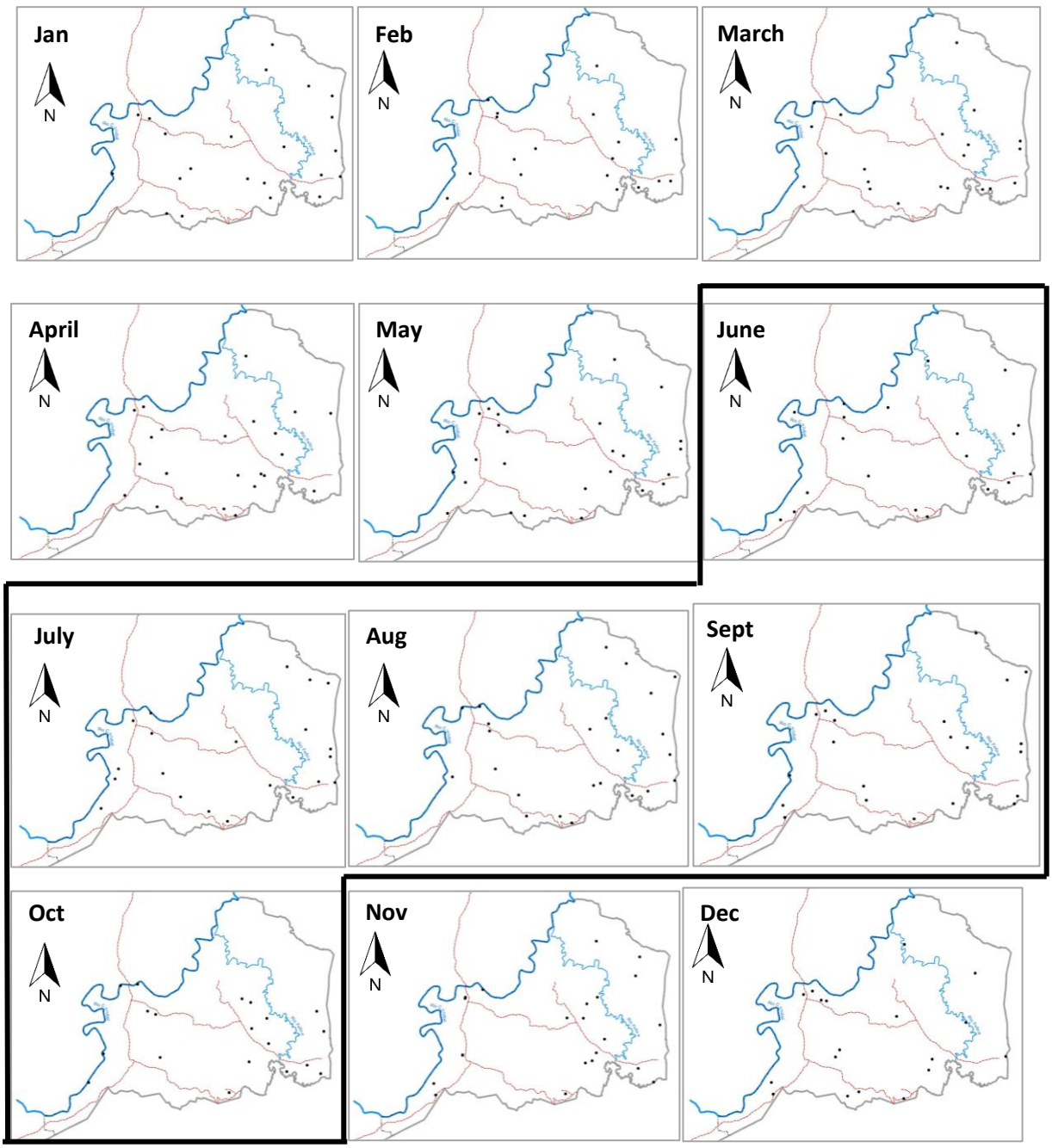

Figure 4. The presence of chimpanzees in the Boé region plotted per month of 2011. The black spots are areas were the Chimpanzees were seen by the village committees and the location was reconstructed (based on the forms). There is a maximum of two surveys per village committee per month. The black dots are direct observations of chimpanzees by the village committees. The blue lines are rivers, in bold Rio Corubal and normal Rio Fefine. The Boé is defined by the land border in dark gray and sector border in dotted gray line in. The red interrupted line was the unpaved provincial road. The months of the rain-season are surrounded by a black square.

Chimpanzee sightings by village committee members were not the only data that were analyzed. In a small area around villages other signs of their presence provided important information regarding the habitat of the West-African Chimpanzee. Nests are the most common signs of chimpanzees and important for chimpanzee research for densities and presence.The standard procedure of walking

random transects was not used because of a lack of time and knowledge of the area. This would have required more information about the area, nest construction, nest decay rate, to record chimpanzee densities and numbers according to IUCN survey guidelines (Kühl 2008).

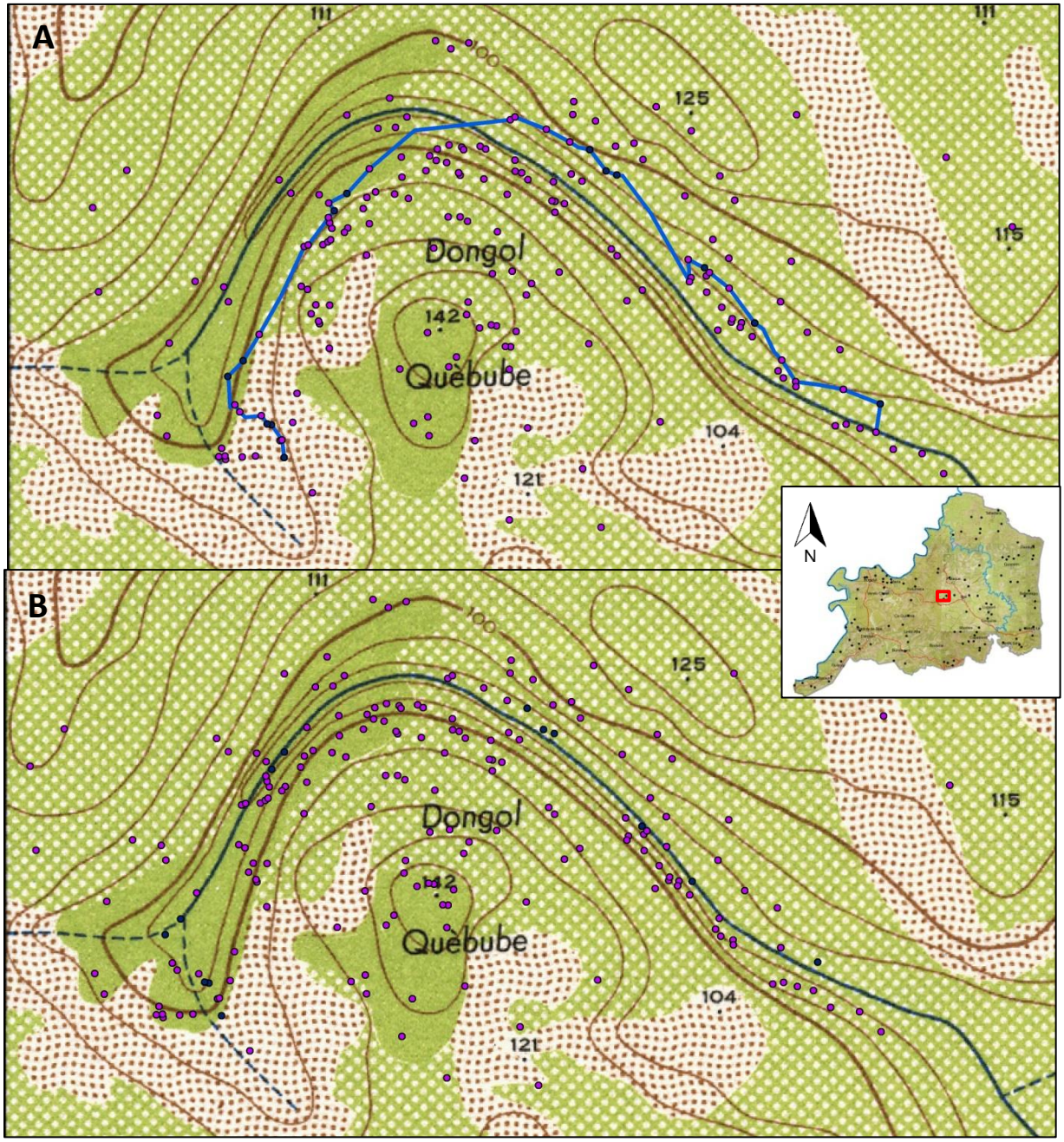

Figure 5.The locations of the nests in the Quebube area in the Boé are plotted. A) this map is based on the original Portuguese map. B)this map is corrected for location in the field of the river. Difference was 110 meter in UTM scale. The dots indicated in both graphs nest groups of the same age (fresh, recent, old of very old. The map in the background is Quebube is from the scanned paper map of 1958. The area in dark green is uncultivated forest (gallery forest, sacred place by the source of the river), in light green cultivated forest (contain mosaic of forest, fallow land, wooden savanna) , brown dotted is boaul (savannah), brown line is a contour for elevation.

During the research period a total count of chimpanzee signs in a small area of 10 km2 along the Quebube River was made. In total 1,799 nests were observed and plotted, divided into different nest-age groups (fresh, recent, old, very old). A relatively high number of nests were found in the southern part of the river habitat compared to the northern part. Most of the nests were located in the valleys, including the edge of the valley, to the Quebube River (Figure 5). In some places only on the edge of the valleys nests were found because of cultivated fields. Most dark green parts are nowadays degraded gallery forest. Some parts were developing in new Gallery forest but these were only small areas. The forest in uncultivated parts on the plateau was cut down and is now dense scrubland with a few big trees. These few big trees contained almost always chimpanzee nests.

Table 2. Trees in different habitats were chimpanzee nests were found. There were three classes of presence, common, not common and rare. In the bottom also the number of species which are only known by their local name are given. Also unknown species ranged by nests and number of threes.

	Gallery forest			**Dry forest**			**Wooded Savannah**			**Fallow land**		
	common	not common	rare	common	not common	rare	common	not common	rare	common	not common	rare
Parkia biglobosa	x			x			x			x		
Khaya senegalensis	x			x			x			x		
Prosopis africana	x			x			x					
Cola cordifolia	x											
Dialium guineense		x			x		x			x		
Sorindeia juglandifolia		x			x				x			
Parinari excelsa			x			x			x			
Afzelia africana		x			x				x			
Pterocarpus erinaceus	x					x	x				x	
Spondias mombin			x									
Ficus sur			x									
Elaeis guineense			x									
Sterculia tragacantha		x										x
Carapa procera	x											
Anisophylla laurina			x			x			x			x
Spathodea campanulata			x			x						x
Detarium spec.			x									x
Only local name species		3	17			2			3			4
Unknown species (nest/tree)	19 / 11			2 / 2			1 / 1			5 / 5		

Nest height along the Quebube was estimated in April and May 2012. A total of 1,799 nests were found in the area of Quebube. Nest height ranged from ground nest to nests as high up as 25 meter. Nests were found in 35 different tree species including food trees and non-food trees, but the most were made in *Parkia biglobosa, Khaya senegalensis* and *Prosopis Africana* (Table 2). These trees were also the most common in this area (Figure 6). Most species occur in Gallery forest including 20 species were only the local name available was. In every habitat type, one species was not presence in the gallery forest, so this makes a total of 23 local name species. Most of these trees are rare but three a not common in Gallery forest.

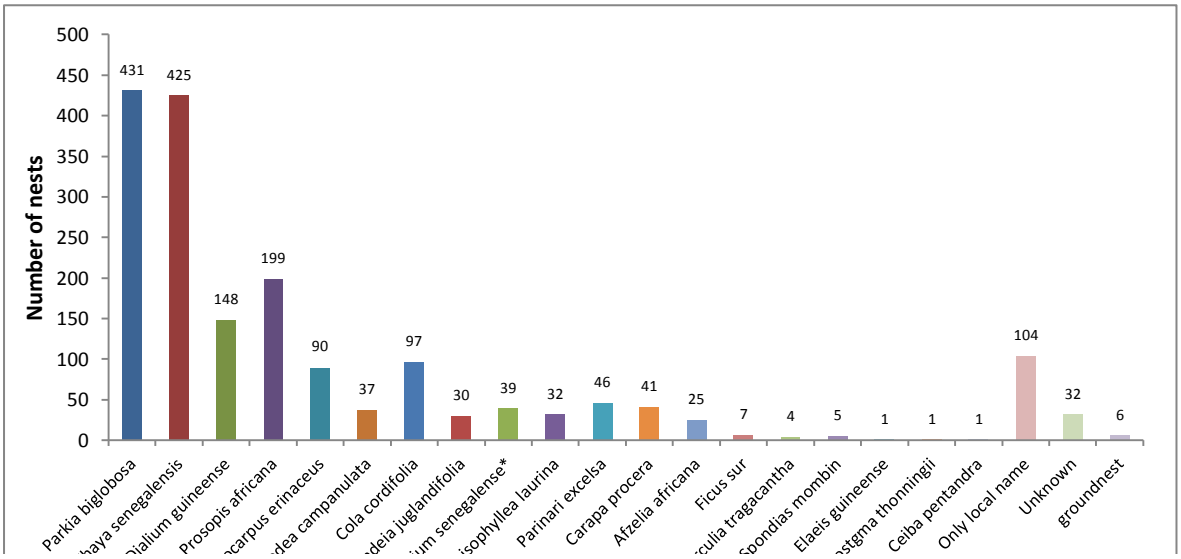

Figure 6. The 1,799 chimpanzee nests divided into different tree and shrub species. The nest data were collected in April/May 2012 around the river Quebube in the Boé area of Guinea Bissau. The species were translated from the local names to the scientific name with Catarino's 'Plantas Vasculares e Briófito da Guine-Bissau' (Catarino L. et al. 2006). The 23 species of which only the local name was known were given in the bar 'Only local name'. Trees whose names even local people did not know were labeled 'unknown'. * *Detarium senegalense* could be *D. microcarpon*.

There is a wide spread variation in trees where chimpanzees made their nests. The two trees in which almost half of the nests were present, are *Parkia biglobosa* and *Khaya senegalensis*. Both trees were the most common big trees in the area. *P. biglobosa* is also an important food supply for both chimpanzee and man. The village committees' forms also indicated that this faroba was an important source of food for the chimps. For a short period of the year, *Dialium guineense* is important for food and nesting. Although *Prosopis africana* was mentioned in the forms only a few times, it represents 11% of the nests sites. *Pterocarpus erinaceus* may grow close to the river but also on wooded savanna and higher ground. The chimpanzees eat the flowers of the *P. erinaceus.* According to the literature, it serves as a food source for chimpanzees from December to February because of the flowering time (Catarino L. et al. 2006). In contrast, the *Cola cordifolia* was mainly found close to the river Quebube. It was rarely mentioned as food supply by the village committees. Only one nest was

found in a palm (*Elaeis guineense*). In Cantanhez, Chimpanzees commonly make nests in oil-palms. In the Boé- area it was only on the riverside with some oil-palm trees by the head of the river where occasionally, so these chimpanzees may make their nest in oil-palm trees (Gippoliti and Dell'Omo 1995). In total 6 ground nests were found, one of which was fresh.

The total of 1,799 nests included fresh, recent, old and very old nests. To make an overview of nesting sides in the dry season (November– May), only the recent and fresh nests were counted, arriving at a total of 183 nests. As can be seen in figure 8, most nests in the end of the dry-season were made in *P. biglobosa*. This was 19% of all found nests in *P. biglobosa*, compared to the other species it is also relative the most recent nests. All of the nesting trees species had recent nests except for *C. cordifolia.* There was a significant in distributions, if you expect the same distribution with dry-season nests (figure 7) as the total number of nests (figure 6).), in a Chi-Squared test ($p<0{,}001$),

The maximum number of recent nests in one group is 16 in this survey. Two nest groups contain trees with 7 recent nests. In the group with 16 nests were two trees, *Carapa procera* and *Parkia biglobosa ,* each containing 7 nests. This was a record in this survey for the largest number of nests trees of one recent nest group.

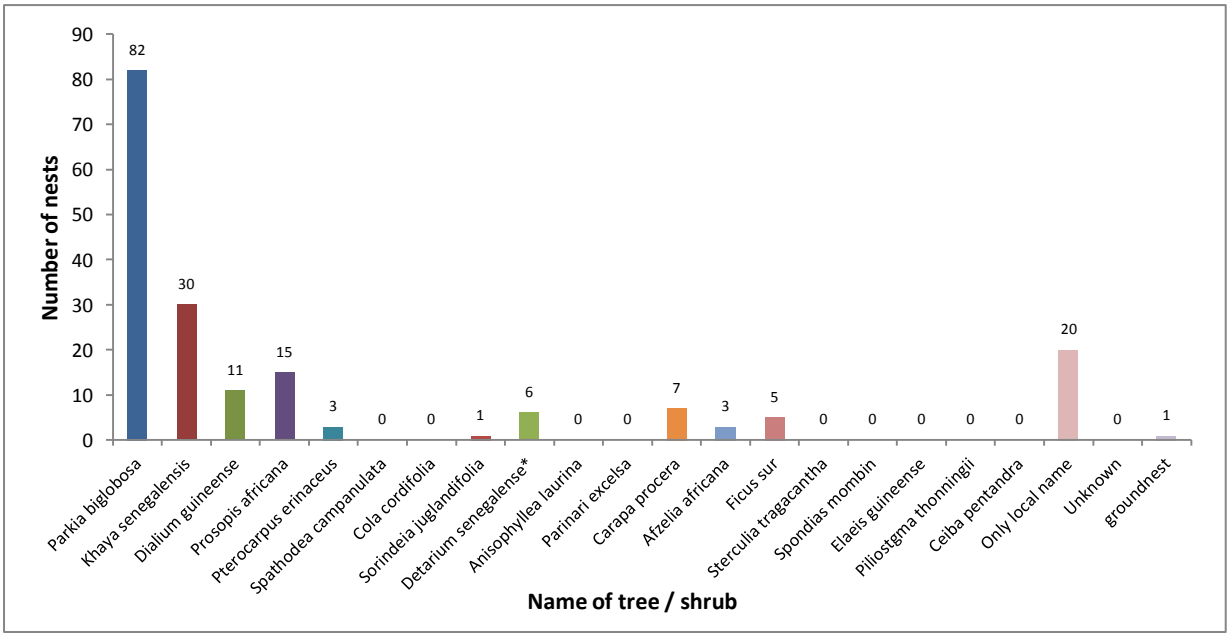

Figure 7. The 183 chimpanzee nests divided into different tree- and shrub species. It only contains nests which are less than three weeks old, so fresh or recent nests. The nest data were collected in April/May 2012 around the river Quebube in the Boé area of Guinea Bissau. The species were identifies from the local names to the scientific name with Catarino's 'Plantas Vasculares e Briófito da Guine-Bissau' (Catarino L. et al. 2006). The 5 trees of which only the local name was known were labeled 'Only local name'. * *Detarium senegalense* could be *D. microcarpon*

To test if the chimpanzees had a preference for one of the height classes, data on the 1,799 nest were subjected to a Poisson test (Figure 9). The data were organized per height classes of one tree in the boxplot. The Poisson test was significant which means that nest heights above 10 m have a significantly arger number than nest heights lower than 10 m, as shown in figure 8. The median, central number in the series numbers in one class, by nests build above 10 m meter is two instead of one by nests build less than 10 meter high.

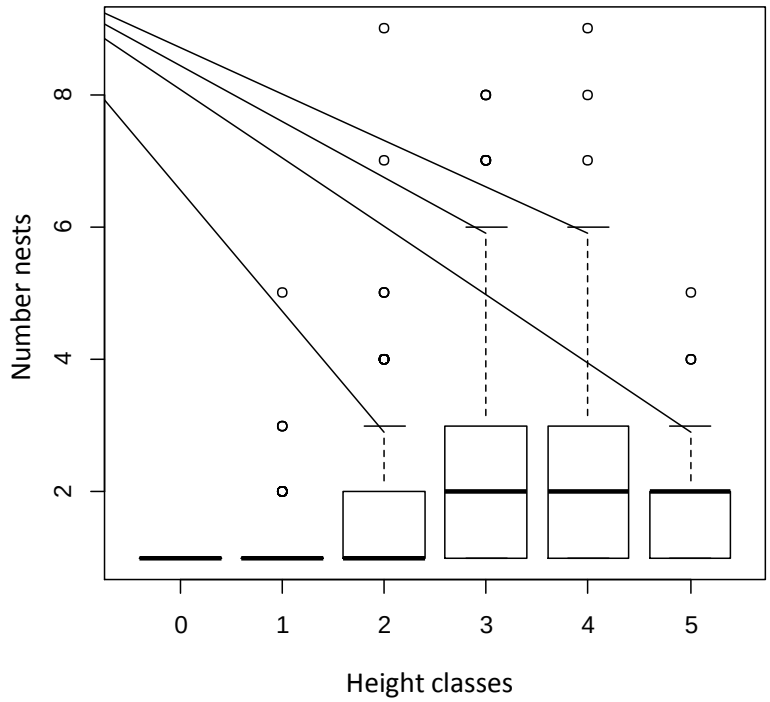

Figure 8. A boxplot for the number of nests in the y-axis plotted to the height of the nest in the 6 classes (0=ground nest, 1.=0-5m, 2.=5-10m, 3.=10-15m, 4.=15-20m, 5.=>20m). The median is given as a big black bar, the third quartile is upper box, the sample maximum and the possible outliers as a point. The total number of nest is 1,799 and the nest data were collected in April/May 2012. The boxplot is made by R. p<0,05

The aspect (valley, hillside or plateau) of the ground is not significantly different for the number of nests (figure 9a). Similarly, the canopy cover did not influence the number of nests (figure 9b)

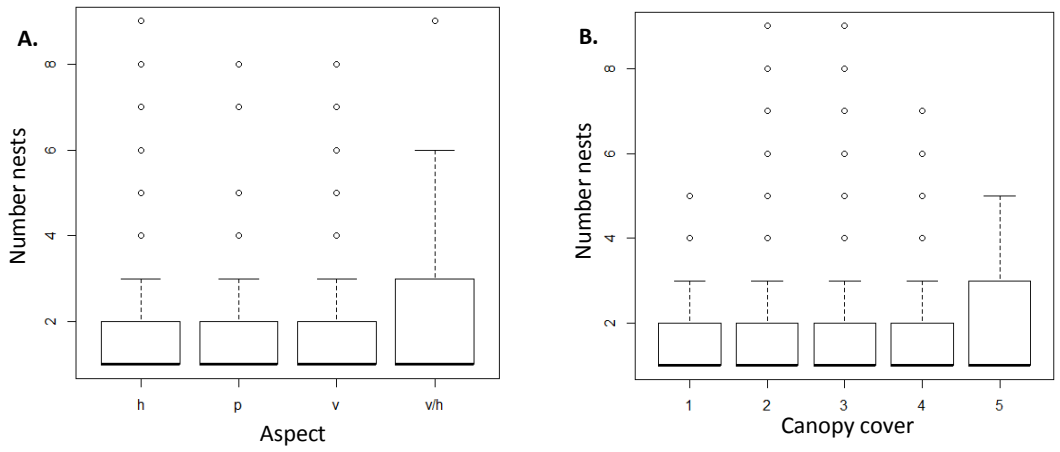

Figure 9. A. boxplot for the number of nests in the y-axis plotted to the aspect in 4 classes (h=hillside, p=plateau, v=flat area, v/h=edge between flat area and hillside). B. A. boxplot for the number of nests in the y-axis plotted to the canopycover in 5 classes (1=0-20%, 2=20-40%, 3=40-60%, 4=60-80%, 5=80-100%). The median is given as a big black bar, the third quartile is upper box, the sample maximum and the possible outliers as a point. The total number of nest is 1,799 and the nest data were collected in April/May 2012. The boxplot is made by R. p>0,05

Other animal species were registered during the survey in Quebube, including five primate species. The patas monkey (*Erythrocebus patas)* and green monkey (*Chlorocebus sabaeus aethiops)* were both seen on four different days and almost every time in groups. Guinea baboon (*Papio papi,*), sooty mangabee (*Cercocebus atys*) and black and white colobus (*Colobus polykomos*) were observed only once. Ungulates that were seen twice are bushbuck (*Tragelaphus scriptus*) and the red flanked duiker (*Cephalophus rufilatus*). The Maxwells duiker (*Philantomba maxwellii*) was seen once in the savanna. Two different hogs, red river hog (*Potamochoerus porcus*) and the warthog (*Phacochoerus africanus*), were observed on the wooded savannah on two different days. The Egyptian mongoose (*Herpestes ichneumon*) was a hardly seen in the past and walked very close to us during a fieldtrip. Trap cameras captured animals like leopard (*Pantera Pardus*), yellow backed duiker (*Cephalophus silvicultor*) civet (*Civettictis civetta*) and North African porcupine (*Hystrix cristata*).

Discussion

The West-African Chimpanzee was seen by every village committee according to the local field surveys and interviews. Therefore, it can be concluded that the chimpanzees use the entire Boé area as their habitat (Figure 3). They live in the gallery forest but also in agricultural areas used by local people, and sometimes quite close to the villages, which is in accordance with the literature (Brugiere et al. 2009).

A different dispersion over the seasons could not be demonstrated by the monthly analysis as shown in Figure 4. The entire Boé region was used year-round. The mosaic structure of the landscape makes that the chimpanzee groups needs big home ranges. The chimpanzees of the Boé region must travel larger distances for food supply and shelters than chimpanzees in tropical rainforest.

The highest concentration of nests where found near rivers and streams in gallery forest. The nest groups here, however, were hard to detect due to the high concentrations. These areas are the last small places in the Boé region where the land is not and has never been used by humans. These fragmented parts are present on the map of 1959. The population of Guinea Bissau – and the Boé is no exception – has grown dramatically in recent decades (Kormos 2003). More agricultural land is needed and the extent of uncultivated land is decreasing.

The gallery forest is an important habitat for the nesting and foraging of chimpanzees as mentioned before. The survey in Quebube around the river resulted in 1,799 nests identified, of all four nest-age classes and these nests were found in 35 different trees. Big trees such as *Parkia biglobosa, Khaya senegalensis*, and *Prosospis africana* shelter most nests, but smaller trees like *Dialium guineense* and *Pterocarpus erinaceus* may also take a substantial part of the chimpanzee's nest in Quebube (Figure 6). Comparing this tree data to a list from Guinea Conakry (Kormos 2003), the most important species, *Erythrophleum suaveolens,* was not mentioned as a nesting place in Quebube. Also, the runner up, *Elaeis guineense,* was only seen once as a nest site in Quebube. This oil palm is not uncommon in Quebube – and the Boé in general - so this difference in tree preference may be a cultural difference between chimpanzee groups (Catarino L. et al. 2006). Other species in Guinea Conakry which were shown in Kormos 2003 are also present in de Boé region. The mosaic landscape from savanna, woodland and forest in Boé region is comparable with areas in Guinea Conakry. The important role of *Parkia biglobosa* en *Khaya senegalensis* may be site specific. Quebube is one small part of the Boé . In other parts with rivers or on the hills in the western part of the Boé, they may be less abundant. Nevertheless, these two trees were regularly seen in de whole of the Boé. Also, the bigger trees contained more than one nests most of the time. So it seems that there is no preference

for a special tree but only for a certain size of the tree. Previous findings have concluded that the diameter of trees must be at least five cm for chimpanzees to be a potential nesting site (Wrangham 1996). Trees like *Spanthodea campunulata, Pterocarpus erinaceus* and *Dialium guineense* are often elongated trees with a small diameter in Quebube and contain in 75 percent only one nest per tree. In the common tree species like *Khaya senegalensis*, and *Parkia biglobosa* the occurrence of one nest per tree is respectively 35 and 40 percent.

The seasonal distribution (Figure 7) of nests in trees was different if you compare it to overall distribution (Figure 6). The pattern of the recent nests is significantly different from the overall pattern of all nest-age classes. In the dry season chimpanzees seem to have a preference for the *Parkia biglobosa* trees, in this tree were 45 percent of fresh and recent nests found, and almost 20% of total nests found in *P. biglobosa* were fresh or recent (figure 8). This might be related to the seasonal characteristic of *P.biglobosa* that has leaves during the survey in April and May 2012, and also bears fruits in this period. These fruits were eaten substantially by chimpanzees according to the foraging signs and fresh poo. The findings of the current study are different from previous research from Wrangham, where he mentioned that chimpanzees rarely nest in feeding trees (Wrangham 1996). A more recent study by Bwindi Chimpanzees concludes that nesting feeding trees may have a seasonal effect or even nesting close to feeding trees (Stanford and O'Malley 2008).

Furthermore, the height of the nest is important for the chimpanzees (Figure 8). Most nests are found higher up in a tree. This could be a result of the presence of leopards, which is a natural predator of the chimpanzee (Boesch 1991, Koops et al. 2012). Leopards have been caught on videotape using trail cams of the Chimbo foundation. Maybe mosquitos have also an effect on the heights of nests (Wrangham 1996). There might be a tendency to get a nest as high as possible to be save for predators. (Pruetz et al. 2008, Koops et al. 2012) This tendency is likely to influence issues related to family life and group size, which cause an social effect too.(Boesch 1991). The 6 ground nest do not support the theory and may cause a social and cultural effects too. The limited availability of large trees in the Boé may also influence the height of the nests (Koops et al. 2007). Local people tell that ground nests are used to give birth. In the literature ground nests were used by chimpanzees as resting place during the day (Koops et al. 2007).

As a result of the growing human population there is more need for food. The original vegetation of gallery forests has been extensively exploited and cut-over. During the survey in Quebube the valleys had substantial parts of degraded gallery forest and fallow land. This is the result of chopping trees for cultivations and it decreases the number of potential nesting sites. During the surveys it was seen that almost every big tree contains one or more nests and these sites were recycled. Different nest

ages were found in the same tree and even build upon each other, which is rarely mentioned in the literature (Kormos 2003).

These points indicate that the pressure on nesting sites might be high and conservation of uncultivated areas with big trees is needed. The field surveys of village committees demonstrate that in the entire Boé chimpanzees are seen regularly. This means that the entire Boé is chimpanzee habitat and must be controlled to prevent further degradation. It is a challenge with a growing local population to prevent the disappearing of forests and find a balance with the cultivation of the lands.

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