

# First quantitative survey delineates the distribution of Chimpanzees in the Eastern Central African Republic

Aebischer Thierry<sup>ab</sup>, Siguindo Guy<sup>b</sup>, Rochat Estelle<sup>c</sup>, Arandjelovic Mimi<sup>d</sup>, Heilman Amy<sup>d</sup>, Hickisch Raffael<sup>e</sup>, Vigilant Linda<sup>d</sup>, Joost Stéphane<sup>c</sup>, Wegmann Daniel<sup>a</sup>

<sup>A</sup> Department of Biology, University of Fribourg, Chemin du Musée 10, CH-1700 Fribourg, Switzerland

<sup>B</sup> Chinko Project, 544 Rue de la Victoire, Bangui, BP 3193, Central African Republic

<sup>C</sup> School of Architecture, Civil and Environmental Engineering (ENAC), École Polytechnique Fédérale de Lausanne (EPFL), CH-1015 Lausanne, Switzerland

<sup>D</sup> Max Planck Institute for Evolutionary Anthropology, Department of Primatology, Deutscher Platz 6, DE-04103 Leipzig, Germany

<sup>E</sup> WildCRU University of Oxford, Department of Zoology, Tubney, GB-ENG, UK

Corresponding author: Daniel Wegmann, University of Fribourg, Chemin du Musée 10, CH-1700 Fribourg, Switzerland. Tel.: +41 26 300 89 49. E-mail: [daniel.wegmann@unifr.ch](mailto:daniel.wegmann@unifr.ch).

## Supplementary Text

### *Community structure*

We recorded a total of 1,656 photographs showing chimpanzees from Communities C1, C2 and C3 in 126 series of three to 63 pictures each (median nine pictures). From these we identified at least 62 distinct individuals based on i) morphological features such as fur color, scars, stature and facial features, ii) because they were recorded on the same picture or during a sequence of pictures of a group passing a camera trap, or iii) because they were recorded concurrently in distant locations. These individuals, often recorded multiple times in different camera traps, also suggest the described communities are distinct, since none of the identified individuals were observed outside of the area assumed to be inhabited by their community.

The most north-western community (C1) was observed by seven out of eight camera traps placed in a continuous area during both trapping sessions. Similarly, Community C2 was observed regularly by eight of nine camera traps placed in a continuous area about 6 km to the southeast (Fig. 3 and Supplementary Fig. A1). Despite the proximity between these communities, none of the five camera traps placed in between recorded any chimpanzees during either session. Furthermore, despite direct sightings of individuals and nests in both inhabited areas, no such observations were made between the two localities (Fig. 3 and Supplementary Fig. A1). Finally, independent chimpanzee recordings by camera traps in both areas occurred on the same day (Fig. 3).

While the area even further to the southeast was only surveyed during the second camera trapping session, similar evidence supports at least three additional communities in that

region. During only nine days of survey, Community C3 was observed through direct evidence on walked transects as well as regularly by six of ten camera traps in a small area of 2.9 km<sup>2</sup>, 8.5 km to the southeast of Community C2 (Fig. 3 and Supplementary Fig. A1). While the area directly in between the Communities C2 and C3 was not surveyed, we note that independent camera traps observed chimpanzees of both communities in their respective territory concurrently (Fig. 3). The remaining two Communities C4 and C5 we detected even further (10 - 20 km) to the south-east inhabited areas with very limited camera trapping effort (two days) and were only documented through fresh nests and acoustic observations (Fig. 3 and Supplementary Fig. A1). However, concurrent observations of individuals from these and previously described communities at the same time but different and distant locations and the large distance of 15 km between sightings of Communities C4 and C5 within 2 days suggest these were distinct.

We note that some additional observations could not be clearly assigned to one of these five communities as they were geographically isolated. These include several fresh nests discovered east of the relatively wide Vovodo River (20 m between nearest branches of trees from opposite sides), suggesting additional communities inhabit the area there.

#### *Community composition*

We recorded a total of 1,656 photographs showing chimpanzees from Communities C1, C2 and C3 in 126 series of three to 63 pictures each (median nine pictures). From these we identified at least 62 distinct individuals based on i) morphological features such as fur color, scars, stature and facial features, ii) because they were recorded on the same picture or during a sequence of pictures of a group passing a camera trap, or iii) because they were recorded concurrently in distant locations. These individuals, often recorded multiple times in different camera traps, also suggest the described communities are distinct, since none of the identified individuals were observed outside of the area assumed to be inhabited by their community.

For Communities C1 and C2 we considered several series of pictures showing the passing of a large number of individuals likely encompassing the majority of or the entire community at a locality. For example, camera traps on the southern edge of the territory of Community C1 observed a large number of individuals crossing open savanna woodland towards another forest patch multiple times (Supplementary Fig. A3). Similarly, Community C2 was observed multiple times on major forest paths to walk from the north of their territory to the south and vice versa. Individuals of Community C3 were never captured in such a series.

We thus determined minimal community size and composition through the pictures or picture series showing parties with the largest number of males, females, juveniles or infants concurrently at the same location. Our estimates must thus be considered rather conservative and likely underestimating true community sizes. This is particularly true for Community C3 as it was only surveyed for seven days, in contrast to the first two communities that were each surveyed for about 55 days.

Using this approach, we estimated that Community C1 consisted of at least 19 individuals: four adult males, six adult females, six juveniles and three infants. Community C2 consisted of at least 29 individuals: nine adult males, nine adult females, one subadult, four juveniles and six infants. Finally, Community C3 consisted of at least 14 individuals: four adult males, four adult females, four juveniles and two infants. The presence of juveniles and infants suggests that these groups were successfully reproducing. This is further supported by camera trap events of multiple adult females carrying infants (two, six and one females in C1, C2 and C3, respectively) or being in estrus (one and two in C1 and C2, respectively). However, we note an apparent lack of subadult individuals in all groups, but also a difficulty to distinguish subadults from adults from the limited pictures alone.

Based on our camera trap pictures, chimpanzees were active for about 13 hours between 05:00 and 18:00 from dawn to dusk. No clear activity pattern during the day could be observed and no differences between chimpanzees clearly identified as males and other chimpanzees were detected.

### *Territory size*

Despite the heterogeneous landscape, our observational data suggest that chimpanzee communities in the Chinko region use rather limited territories, at least over a period of several weeks during the dry season. This is best illustrated with Community C2, which was only observed within a densely surveyed area of 3.5 km<sup>2</sup> and there on 43 out of 58 days surveyed within nearly three months. This area was situated within a major closed canopy forest (CCF) cluster of about 10.5 km<sup>2</sup> that we surveyed with nine camera traps within the cluster and two additional close by, of which eight regularly recorded chimpanzees of Community C2. While it can not be ruled out that this community left that small area during the surveyed period, no chimpanzees were recorded by any of the 12 camera traps distributed in neighbouring forest patches and savanna woodland around and within 6.5 km from the observed activity centre. In addition, the longest period without record within the core zone was three consecutive days. In summary, and given our direct and acoustic

localisations, the distribution of nests and the placement of camera traps and their recordings indicate a territory of less than 30 km<sup>2</sup> during the survey period with a center of activity of less than 3.5 km<sup>2</sup>.

While our data for Community C1 do not allow for an equally accurate territory estimate, they also support the conclusion of it being rather small. All camera trap records, direct observations and fresh nests of that community, for instance, are from an area of only 9.6 km<sup>2</sup> using a minimum convex polygon. However, three camera traps distributed on 40 ha in the center of this area showed no evidence for the presence of individuals of Community C1 for 28 consecutive days, suggesting that this group uses additional areas regularly. Indeed a camera trap placed in open savanna woodland half-way towards a neighboring forest patch recorded a large number of individuals moving through multiple times in both directions during both camera trapping sessions (see above). Furthermore, both old and fresh nests could be found in this second forest patch and it is therefore likely that the territory of Community C1 was about 40 km<sup>2</sup> or less than 15 km<sup>2</sup> when only considering suitable habitat (CCF, see below).

Only very limited data are available for Community C3 as their area was only surveyed for seven days. During that time, however, the group was observed regularly in three connected forest patches of about 5.0 km<sup>2</sup>. The density of fresh nests and sightings in two km<sup>2</sup> within those patches and the absence of fresh nests around it suggest this was the center of activity of this group at that time. However, four km north of this region, a high density of older nests as well as camera trap records of two juveniles suggest that this area is also regularly used by either the same or more likely another neighboring community (Supplementary Fig. A1). Given all this evidence as well as the distribution of forest patches in the area and the location of the other communities, the most likely territory of Community C3 is smaller than 20 km<sup>2</sup>.

Given the isolated nature of the forest patch occupied by Community C4 the territory of these chimpanzees did most likely not exceed 40 km<sup>2</sup>.

Unfortunately we did not manage to collect sufficient data on Community C5 to make any statement on their territory size.

## Supplementary Tables

### A1. Summary of camera trap effort.

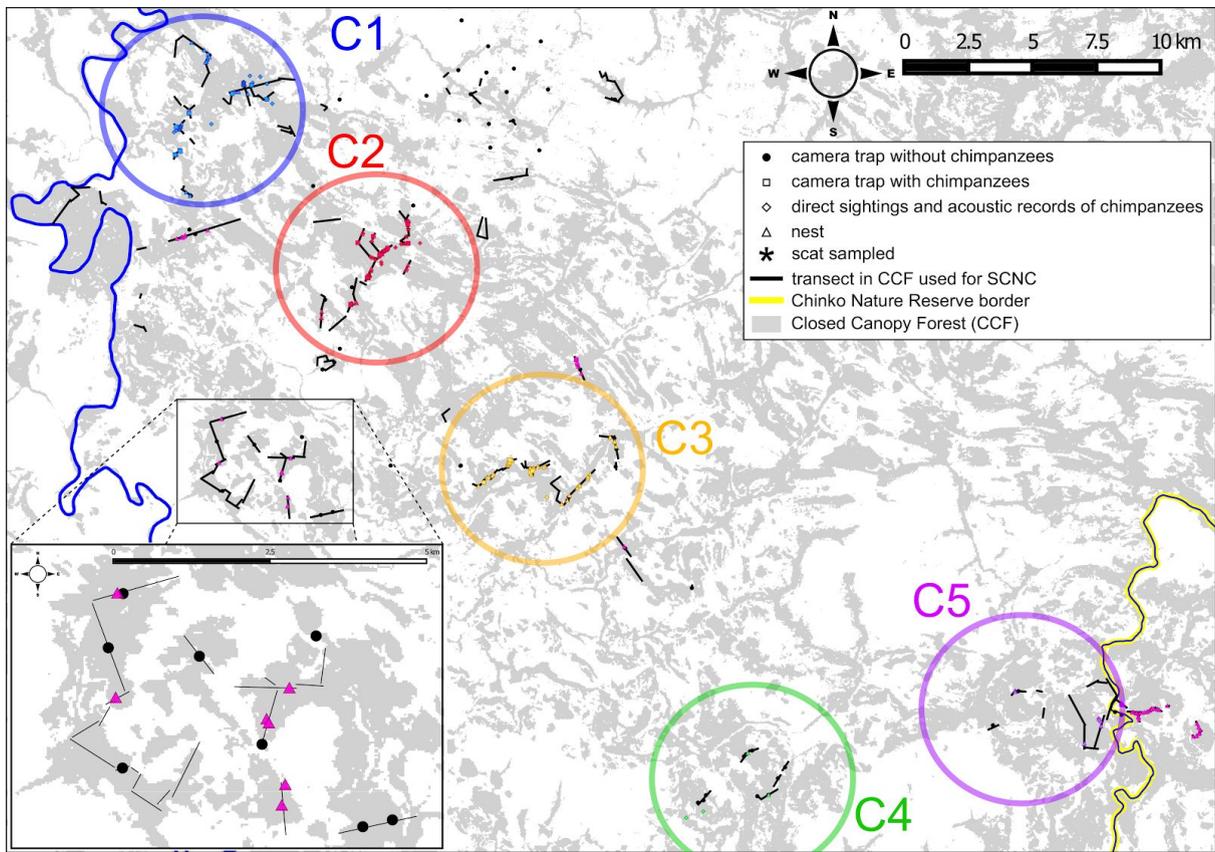
Effort	locations	# cameras per habitat <sup>a</sup>				CCF 1km2 cells	picture series	chimp recordings
		CCF	OSW	DLG	WMG			
≥2 days	94	67	17	5	5	58	126	1656
≥8 days	61	38	13	5	5	35	114	1458
≥21 days	25	13	6	5	1	13	79	1086
≥42 days	24	13	6	4	1	13	79	1086
≥49 days	12	7	3	2	0	8	73	1023

<sup>a</sup>CCF: Closed Canopy Forest; OSW: Open Savanna Woodland; DLG: Dry Lakéré Grassland; WMG: Wet Marshy Grassland

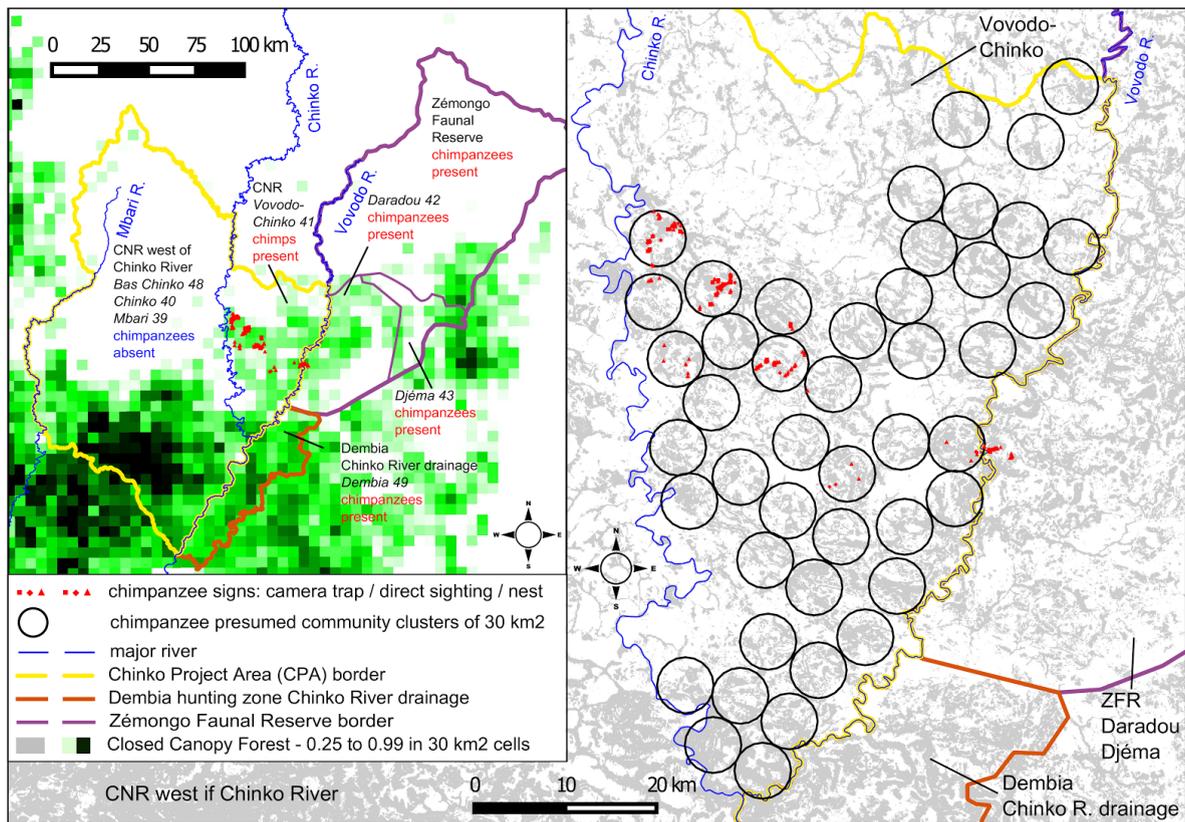
### A2. Details on individual camera traps

Please see extra extra data file.

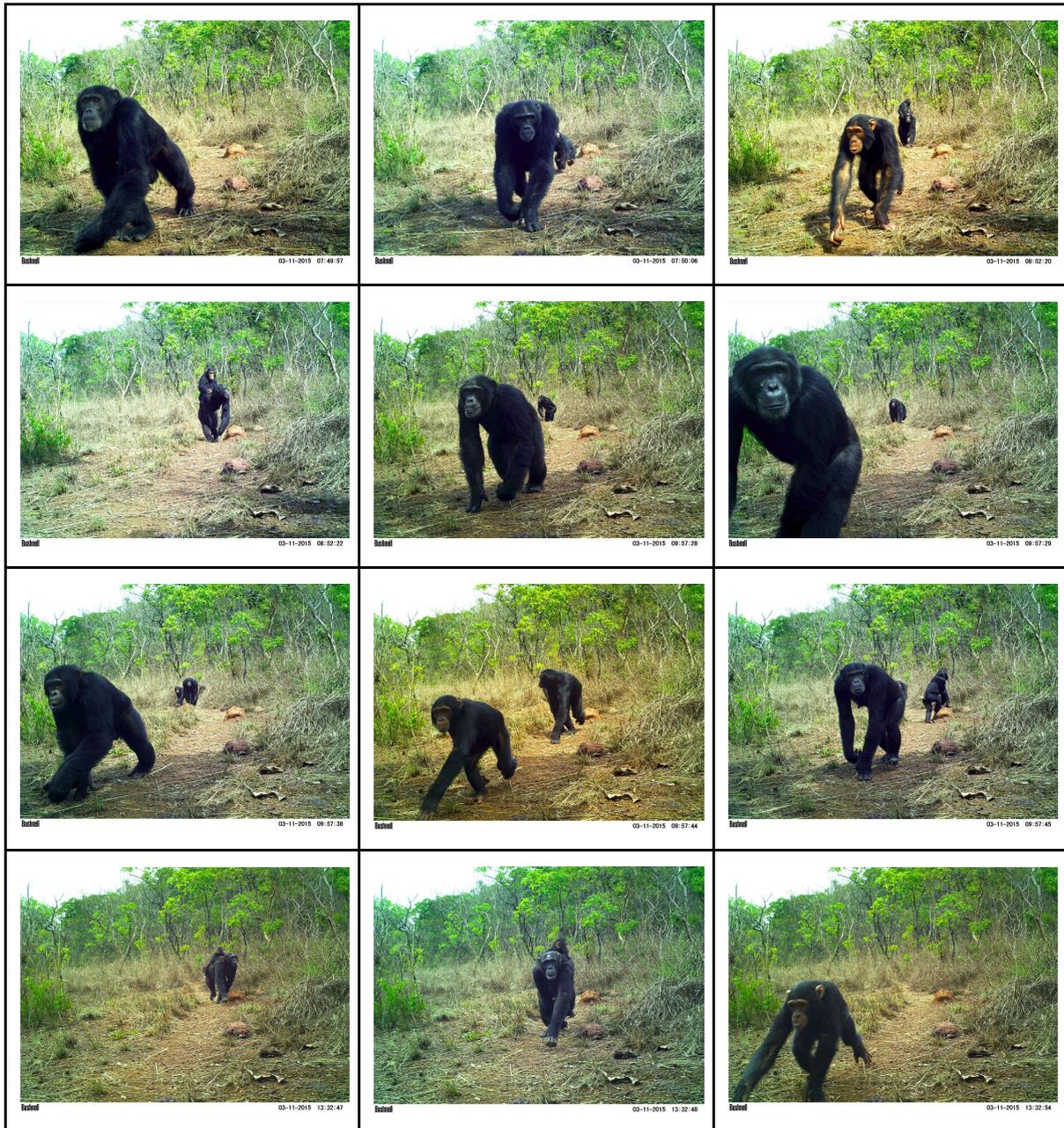
## Supplementary Figures



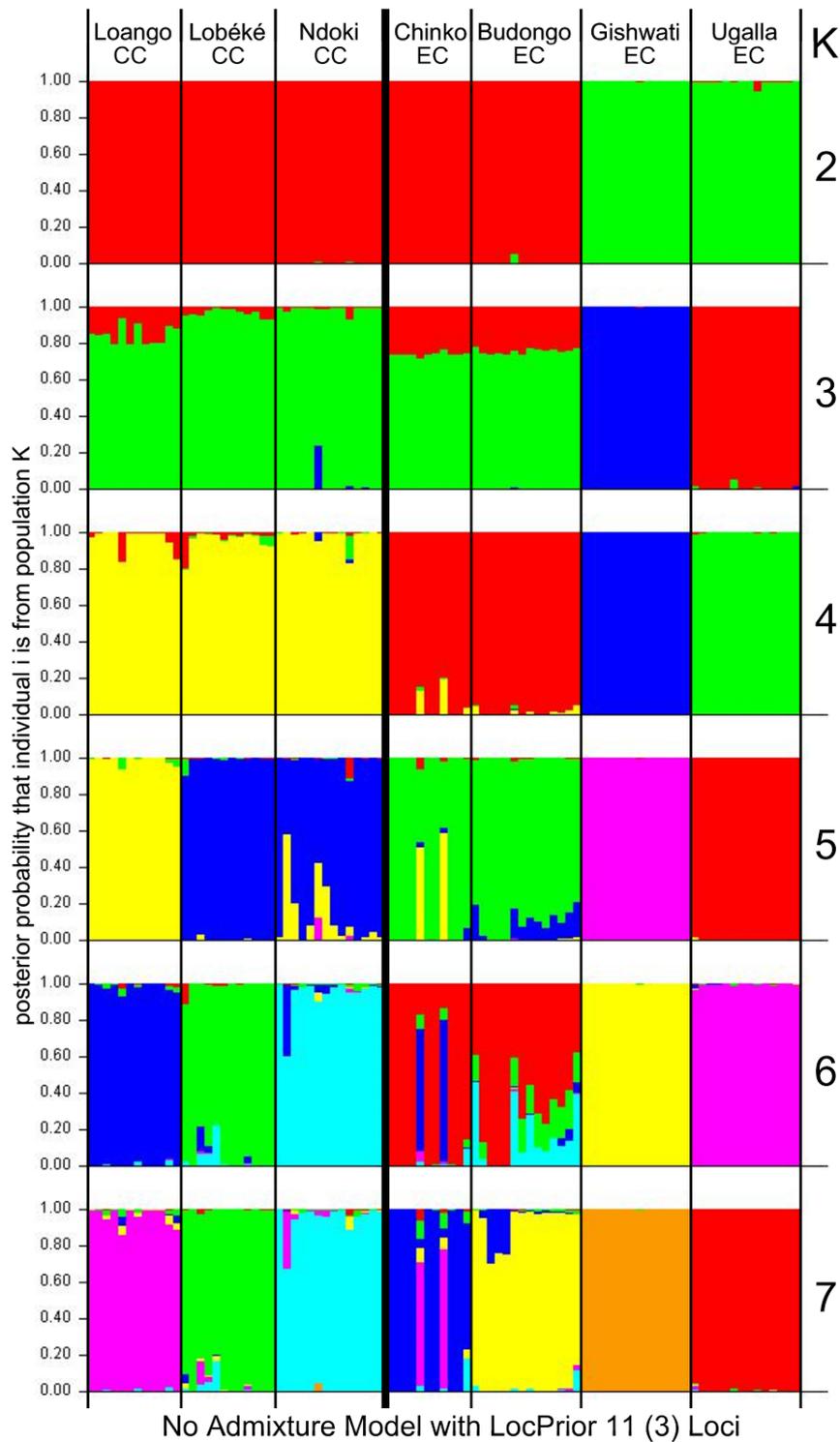
**A1.** Walked transects in CCF (black lines) and all camera trap locations (black dots) east of the Chinko River. Direct sightings and acoustic records of chimpanzees (diamonds), camera traps with at least one chimpanzee event (squares) as well as fresh nests <7 days (large triangles) and old nests >7 days (small triangles) are shown in different colours representing putative communities of chimpanzees. Observations shown in magenta could not be attributed to any of these communities.



**A2.** Possible territories of independent chimpanzee communities based on observed territory sizes of about 30 km<sup>2</sup> and the distribution of CCF in the region.



**A3.** Example pictures of a serie that captured individuals of group C1 passing through the savanna woodland from one forest patch to an adjacent one (camera trap 2014-22 6.1990N 24.2479E).



**A4.** STRUCTURE plots indicating affiliations of genotypes from eight different populations. Loango, Lobéké and Nouabale-Ndoki represent Central Chimpanzees, Budongo-Bugoma, Gishwati and Ugalla are Eastern Chimpanzee populations. Chinko genotypes cluster with Budongo for several values of K indicating that this population belongs to supposed eastern *P.t. schweinfurthii* subspecies.