Chimpanzee Rapid Survey Assessment

Bandajuma-Liberia Border Road

Technical Report

3rd - 17th February 2017
Sierra Leone
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Summary

Funded by the European Union (EU), Compagnie Sahelienne D’Enterprises (CES) is undertaking the construction of a paved road from Bandajuma (Sierra Leone) to Jendema (border of Liberia) since 2016 in order to improve the connection between these two countries. This type of infrastructures are known to have a negative impact on wildlife due to habitat loss and fragmentation, logging with a potential increase in illegal hunting for bush-meat or live trade. The subsequent habitat degradation is often associated with wildlife crop raiding resulting in human-wildlife conflicts increasing the risk for the survival of Critically Endangered species such as the western chimpanzee (*Pan troglodytes verus*). This survey was designed to identify the chimpanzee crossing points along the road from Bandajuma to Jendema in order to recommend mitigation measures that to reduce the negative impact on this species and its habitat. The survey was carried out between the 3rd and the 17th of February 2017. Here we present our findings and impact mitigation recommendations and encourage the constructors to follow the proposed measures.

Introduction

A Chimpanzee Rapid Survey was carried out between the 3rd and the 17th of February 2017 along the road between Bandajuma and Jendema in Sierra Leone by the Liberian border. The main objective of this rapid survey was to identify chimpanzees’ crossing points in order to generate recommendations aimed at reducing the negative impact on wildlife of the construction and utilisation phase of this new road.

Sierra Leone is home to the western chimpanzee which is listed as Critically Endangered by the Species Survival Commission (SSC) of the International Union for Conservation of Nature (IUCN) (Humle et al., 2016). Chimpanzee habitat in non-protected areas are constantly being fragmented by human activities which can limit chimpanzees’ ranging patterns, access to natural feeding grounds, nesting areas and water sources and compel chimpanzees to share landscapes with humans. Human activities, such as road development, can impact negatively on animal communities and ecosystems and exacerbate threats to chimpanzees (e.g. habitat loss and fragmentation, disease transmission, hunting and negative perceptions of chimpanzees) and other wildlife locally (Humle et al., 2016). Most animals, including chimpanzees, tend to follow established ranging patterns in their daily and seasonal movements. Chimpanzees in particular, typically have a core ranging area (where they spend more than 70% of their time) within a larger home range, which encompasses the whole area they utilise annually. Chimpanzees are known to cross roads within their home range (Hockings, 2011; Cibot et al., 2015). There is no evidence to date that when a road intersects chimpanzees’ core or home range, that individuals reduce the usage of an area or potentially cease using it altogether as a result (Hockings, 2011; Cibot et al., 2015). However, road crossing can affect their behaviour and also result in individual mortality as a result of...
collision with vehicles (McLennan & Asiimwe, 2016) and only a single study to date has focused on chimpanzees crossing a wide paved road (Cibot et al., 2015). Therefore the impact of wider paved road on chimpanzee movements and behaviour still remain relatively unknown.

Mitigation measures have been proposed in order to prevent road killings of chimpanzees and other wildlife (e.g. McLennan & Asiimwe, 2016; Cibot et al., 2015); these include speed bumps, road signs, and reforestation of sensitive areas that provide safe corridors facilitating ranging patterns and provide additional habitat for the species and other local wildlife.

**Previous research (Garriga, 2016)**

Since 2016, the Tacugama Outreach team has been carrying out a programme with local communities involving both research and implementation of livelihood activities as an alternative to bush-meat hunting and deforestation in one of the sections of the mentioned road around the village of Waima (Waima axis, northern part of Section 2 that was surveyed in this study). Between February and December 2016, Tacugama Chimpanzee Outreach Programme (TCOP) team performed semi-structured interviews with farmers on villages of that area and recorded abundant evidence of chimpanzees by the road. In addition, TCOP team undertook reconnaissance walks and set camera traps in specific locations based in interview responses. One of the study areas fell under the sections 2 of the Bandajuma – Jendema road, covering 18 km² of an habitat characterised by an agricultural mosaic highly degraded by human activities with small patches of secondary forests. Camera traps and recces (reconnaissance walks) records showed the presence of 18 mammal species, including the critically endangered Western Chimpanzee (*Pan troglodytes verus*) and the vulnerable Bourlon’s Genet (*Genetta bourloni*). Chimpanzees were photographed in four out of twenty locations; one of these locations was set along Section 2 of the current survey (see Figure 1 below). The minimum number of identified individuals around Waima was 6: two adult females each with one offspring, one sub-adult female and one adult male. Chimpanzees were captured in one of the camera locations set by the road Bandajuma-Jendema. The same individuals were photo-captured on the other side of the road, providing evidence that chimpanzees cross the current road and many local people reported seeing chimpanzees crossing it.
The survey findings indicated that chimpanzees are using permanent crossings along this road. This was corroborated by some workers clearing large trees with chain saws along the road near Waima Community Forest; they reported seeing 6 chimpanzees crossing the road on the 5th November 2016. The current unpaved road with potholes limits vehicle speed, which allows chimpanzees and other wildlife to cross with relative security at certain points. However, once paved, the road will become a serious danger to chimpanzees and other wildlife, as vehicle speed and usage will be significantly higher.

Methods

As planned, the field work was carried out in 17 days, 2 for the travel to and from Freetown and 15 days to perform the survey. Work was conducted using a combined team of TCS researchers and local guides composed of one expat field coordinator, 4 local field assistants and 2 local trackers hired at each road section The 99 km road was divided into 5 sections of approximately 20 km.

Project team:

- Main researcher:
  - Natalia Casado Bolanos, bachelor in Journalism, Universidad SEK, bachelor in Cultural and Social Anthropology, Universidad Nacional de Estudios a Distancia and Master in Nature Conservation and Management, Universidad de Cadiz.

- Technical advisor:
  - Rosa M. Garriga, graduated in Veterinary Medicine, Universitat Autònoma de Barcelona, Master in Wildlife Medicine, University of London and currently in the third year of her PhD in the Universitat Autònoma de Barcelona.
- Field assistants:
  - David Momoh, Joseph Marah, Bockarie Ambrose and Alako Kamara.

Due to the length of the road and the marked variation in encountered signs of chimpanzee evidence across sections, the data were analysed in sections in order to produce a clearer overview of the results. We combined two different research methods:

- Semi-structured interviews of the local communities
- Reconnaissance walks (recces) along the road.

We spent three days in each of the road sections. The first day, we performed interviews in the villages along the section and the second and third days, we carried out recce walks for that road section (Fig. 2).

<table>
<thead>
<tr>
<th>Section No.</th>
<th>Section length (km)</th>
<th>Name of first and end village</th>
<th>No. of villages interviewed</th>
<th>No. of recces</th>
<th>Length of Recces (km)</th>
<th>No. U-shaped surveys</th>
<th>Length of U-shaped surveys (km)</th>
<th>Total length walked (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22.2</td>
<td>Ngombahun-Largo</td>
<td>10</td>
<td>2</td>
<td>19.2</td>
<td>10</td>
<td>4</td>
<td>23.2</td>
</tr>
<tr>
<td>2</td>
<td>22.6</td>
<td>Largo-Konna</td>
<td>11</td>
<td>2</td>
<td>22.6</td>
<td>7</td>
<td>3.7</td>
<td>26.3</td>
</tr>
<tr>
<td>3</td>
<td>24.7</td>
<td>Konna-Giema II</td>
<td>4</td>
<td>2</td>
<td>24.7</td>
<td>3</td>
<td>2.7</td>
<td>27.4</td>
</tr>
<tr>
<td>4</td>
<td>14.2</td>
<td>Giema II-Kpowebu</td>
<td>7</td>
<td>2</td>
<td>14.2</td>
<td>5</td>
<td>2.1</td>
<td>16.3</td>
</tr>
<tr>
<td>5</td>
<td>15.3</td>
<td>Kpowebu-Jendema</td>
<td>4</td>
<td>2</td>
<td>13.5</td>
<td>0</td>
<td>0</td>
<td>13.5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>99</td>
<td></td>
<td>36</td>
<td>10</td>
<td>94.2</td>
<td>25</td>
<td>12.5</td>
<td>106.7</td>
</tr>
</tbody>
</table>

Fig. 2. Summary of ecological and social surveys with the total number of villages interviewed in each section (all villages along the axis of the current road were interviewed) and the length of the recces performed.

1. Interviews

The first day in each road section, both teams carried out two semi-structured interviews in each village located along the section road.

The semi-structured interviews were designed to determine the local presence of chimpanzees and the sites where they occur and/or cross the current road. The interviews also aimed to gather socio-economic information on:
1) The socio-cultural profile of participants.
2) The types of crops cultivated locally and the causes of crop losses.
3) The local occurrence of wildlife by means of a field guide and the type of crops that identified wildlife are reported to consume.
4) The three species of animals that are considered the cause of most of the crop damage.
5) The measures of protection employed locally to deter wildlife from feeding on crops.
6) People's perceptions of chimpanzees.
All this information will be used to identify compensatory livelihood projects that can be implemented in the villages affected by the construction of this new road infrastructure.

2. Reconnaissance walks (Recces)

The second and third day in each section, both teams undertook recce walks along the road on both sides at a rate of approximately 10km per day (one team on each side of the road) in order to look for signs of chimpanzees and other key species. The recce walks followed the alignment of the new road, already demarcated with survey lines.

At every single identified chimpanzee trail meeting the road, we conducted U-shaped walks, approximately 100m deep (perpendicular to the road) and 100m long (parallel to the road) (Fig. 3). If there was a confirmed crossing point, a U-shaped recce was performed on both sides of the road. The U-shape direction, either going right or left after the 100 perpendicular meters was decided depending on habitat type, signs encountered and what might be most suitable for chimpanzees.

![Fig. 3. U-shaped walks protocol followed at chimpanzees trails along the road.](image)

The crossing points were classified in two types:

- **Confirmed Crossing Points (CCP):** Areas of the road where the teams found clear chimpanzee trails on both sides and the villagers also confirmed the location as crossing points, i.e. having witnessed chimpanzees crossing the road at those points.

- **Potential Crossing Points (PPC):** Areas where chimpanzee signs were found on a 100m buffer from the road but clear crossing points and trails could not be identified. These areas are considered potential because they show clear signs of chimpanzee activity and, additionally, the villagers have witnessed chimpanzees crossing at these points. The crossing points could have been missed either because the trail evidence was destroyed by the borrow pits or by the survey lines made by the constructors or the area was dominated by human activity and trails, which could also potentially be utilised by chimpanzees.
If the distance between independent CCPs was less than 200m, the CCPs would be considered as a cluster, i.e., a hot-spot for crossing chimpanzees.

The work was distributed for each team as follows:

- 1 team leader with a GPS receiver and datasheet recording
- 1 observer looking up for nests
- 1 observer looking down for trails, footprints and other signs.

In addition, the field coordinator alternated between the two teams for 8 of the 10 days as an extra observer looking for nests on both sides and for footprints on the sandy borders of the road. She also undertook 15.2km of recce walks during 2 days in the largest forest patch recorded along the road, where the presence of chimpanzees was confirmed by villagers. This community forest, called Werikenda Forest, is located in section 4 between the villages of Gonohun and Wonde and that extends over 7km² to the west.

The basic following data were collected along each recce: location, recce number, GPS number, recorder, team members, weather, date, total length walked (based on GPS track). For each observation, the following data were collected: Type of sign (nest, footprint, faeces, feeding remains), coordinates (X-Y), elevation, approximate distance to the sign, number of signs, age of the sign, habitat type, tree species (if applicable), photo number and description of key findings.

An encounter rate per km for each section was then calculated based on the chimpanzee signs found per km walked along the road and the U-shaped reccees. When the same sign was found within 3 meters, it was counted as a single observation event (i.e. few clustered fruits were considered as 1 event, 2 faeces counted as 1 event or 2 footprints as 1 event). This conservative approach allowed us not to overestimate chimpanzee occurrence and compare between the sections more systematically.

**Results**

1. **Interviews**

The teams carried out 63 semi-structured interviews during 5 days in 36 villages located along the road. Information from these interviews was used on the recce walks to help identify chimpanzee crossing points. Nine villages (25%) indicated that there were no chimpanzees in their area: Sefula, Turela 1, Baraka, Kanela, Giema II, Jene, Kpatema, Kpowebu and Fairo. Fifty-four villages (75%) declared to see chimpanzees in groups
around their area, with an average of 6 individuals per group. Twenty eight of these villages (51.8%) reported chimpanzees crossing the road at certain known locations (Fig. 4 and Fig. 5).

Fig. 4. Villages interviewed along the road reporting chimpanzee presence or absence.
2.- Reconnaissance walks

During 10 days, both teams walked a total of 106.71km between Ngombahun (first village after Bandajuma) and Jendema. Ninety nine kilometres were walked along the road and 7.71km were extra recces (U-shape walks) to survey areas around potential chimpanzee crossing points. In addition, the field coordinator undertook 15.2km of reconnaissance walks inside of Werikenda Community Forest, located on the western side of the road between Gonohun and Wonde (section 4) (Fig. 6).

A total of 25 chimpanzee crossing points were detected along the road; 18 were confirmed (CCP) and 7 others were considered as potential crossing points (PCP).
Fig. 6. Recce walks carried out along the road and Werikenda Forest during 10 days.
We recorded a total of 86 chimpanzee indirect observations along the 5 road sections; the encounter rate of chimpanzee signs per kilometre showed evidence of chimpanzees in all but section 5; there is a tendency for a decline in chimpanzee signs as the road approaches the Liberian border. Section 1 showed the highest encounter rate followed by section 2 and 4 (location of the Werikenda community forest) (Figure 7 and Figure 8).

**Fig. 7.** Encounter rate of chimpanzee signs per kilometre in each section of the road.

<table>
<thead>
<tr>
<th>Section No.</th>
<th>Total no. of signs</th>
<th>Encounter rate/km</th>
<th>Road development activity (Y/N) or no. of borrow pits et else..</th>
<th>Recorded signs of anthropogenic pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>39</td>
<td>1.76</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>21</td>
<td>0.93</td>
<td>NO (only survey lines)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>0.53</td>
<td>NO (only survey lines)</td>
<td>1 Gun-shell and 1 snare</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>0.92</td>
<td>NO (only survey lines)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0.00</td>
<td>NO (only survey lines)</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 8.** Summary table of the encounter rates of chimpanzee signs along the five sections of the road.
Crossing Points (Figure 18)

A. ROAD SECTION 1. From NGOMBAHUN to LARGO villages.

On the 3rd February the teams interviewed 18 people from 10 villages. On the 4th and 5th February they walked a length of 23.2 km (i.e.: 19.2 km along the road and 4 km U-shaped recce). The road construction works were ongoing on this section and the 30 m width was already cleared with borrow pits every other side every kilometre. Nevertheless, in this section we recorded the highest encounter rate (1.76 chimpanzee independent signs per kilometre walked) and the highest number of chimpanzee nests (16 nests recorded). A total of 7 chimpanzee confirmed crossing points and 3 potential crossing points were found in this first section of the road (Figure 9 and Figure 10).

![Map of chimpanzee findings and crossing points on the section 1 from Ngombahun to Largo.](image-url)
Fig. 10: (A) Chimpanzee trail as evidence of CCP3 between Ngombahun and Mamboma; (B) Chimpanzee nest on a palm tree found between Ngombahun and Mamboma; (C) Chimpanzee nest near CCP4 between Niagoreh and Futa; (D) Chimpanzee dung on the side of the road near Ngoye river; (E)(F) PCP1: chimpanzee nests recorded from the road before Konia.
B. ROAD SECTION 2: From LARGO to KONNA villages

On the 6th February the teams interviewed 20 people in 11 villages. On the 7th and 8th February they carried out a total of 26.3km of recce walks (i.e.: 22.6km along the road and 3.7km U-shaped recce). Part of the TCS biodiversity study area falls between Masaila and Giawama, where the team found CCP9 and CCP10 during this survey and a camera trap by the road captured 4 different chimpanzee individuals in November 2016. A total of 5 chimpanzee confirmed crossing points and 2 potential crossing points were found in this section of the road (Figure 11 and Figure 12).
Fig. 11. Map of chimpanzee findings and crossing points on the section 2 from Largo to Konna.
C. ROAD SECTION 3: From KONNA to GIEMMA II villages.

On the 9th February the teams interviewed 6 people in 4 villages. On the 10th and 11th February they carried out 27.4km of recce walks (i.e., 24.7km along the road and 2.7km U-shaped recces). The team identified 1 confirmed crossing point and also 2 potential crossing points on section 3 (Fig. 13 and Fig. 14).

The encounter rate along this section is lower than in the previous, with 0.53 observations per kilometre. The chimpanzee signs were found only along the first 7km of the section, including an unusual ground nest and two arboreal nests located just above the road itself (Figure 14). This area is located only 6km from the Gola Rainforest National Park (GRNP), North-East of Vaama. A 3km oil palm plantation managed by Natural Habitat dominated the second recce walk further along this section.
Fig. 13. Map of chimpanzee findings and crossing points on the section 3 from Konna to Giema II.
D. ROAD SECTION 4: From GIEMA II to KPOWEBU villages

On the 12th of February, twelve people were interviewed in 7 villages. On the 13th and the 14th of February, the team walked a total of 16.3 km (i.e.: 14.2km along the road and 2.1km in U-shaped recces). The team found 5 confirmed crossing points along this section (Figure 15 and Figure 16). The encounter rate was higher on this section because there is a large community forest called Werikenda Forest. This forest is located between the villages of Gonohun and Wonde and extends over 7km² to the west. Considering the possible value of this forest, the field coordinator undertook recce walks in this forest with a local guide. During the 15.2km walked in this mature secondary forest, we recorded a total of 53 wildlife indirect observations (of which 10 were chimpanzee signs) and 1 direct observation of a group of sooty mangabeys (Cercocebusatys), listed as vulnerable on the IUCN red list. There were no observations of chimpanzee nests on trees but the local guide and community people were confident to say that chimpanzees can nest on the ground in this area during the dry season. This apparent high frequency of ground nesting requires further investigation. Another remarkable finding was the record of footprints of the endangered giant pangolin (Smutsia gigantean), among other indirect observations of Campbell’s monkey (Cercopithecus campbelli), brush-tailed pangolin (Atherurus africanus), black
duiker (*Cephalophus niger*), maxwell duiker (*Philantomba maxwellii*), red river hog (*Potamochoerus porcus*) and Liberian mongoose (*Liberictiskuhni*).

Fig. 15. Map of chimpanzee findings and crossing points on the section 4 from Giema II to Kpowedu and wildlife observations in Werikenda Forest.
E. ROAD SECTION 5: From KPOWEBU to JENDEMA villages.

On the 15th of February, seven people were interviewed in 4 villages. On the 16th and the 17th of February, the team walked a total of 13.5 km (i.e.: all along the road). No chimpanzee signs were found along this stretch of the road (Fig. 17). The encounter rate dropped therefore to 0 chimpanzee observation per kilometre as the road reached Jendema.
Fig. 17. Chimpanzee signs and crossing points were not found on the section 5 from Kpowebu to Jendema.
<table>
<thead>
<tr>
<th>Section No.</th>
<th>Crossing point no.</th>
<th>Nearest village to crossing point</th>
<th>Coordinates UTM</th>
<th>Evidence for chimpanzee crossing</th>
<th>Other signs of chimpanzee presence (within 100 m)</th>
<th>Other info (e.g. crossing seasonal or not, or reason for people think chimpanzees cross)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CCP1</td>
<td>Ngombahun</td>
<td>836286 870694</td>
<td>B Y</td>
<td>ESPECIALLY DRY SEASON IN SEARCH FOR FOOD</td>
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<tr>
<td>1</td>
<td>CCP2</td>
<td>Ngombahun</td>
<td>836150 870846</td>
<td>B Y</td>
<td>ESPECIALLY DRY SEASON IN SEARCH FOR FOOD</td>
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</tr>
<tr>
<td>1</td>
<td>CCP3</td>
<td>Mambona</td>
<td>835886 871233</td>
<td>B Y Y</td>
<td>ESPECIALLY DRY SEASON IN SEARCH FOR FOOD</td>
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</tr>
<tr>
<td>1</td>
<td>CCP4</td>
<td>Futa</td>
<td>836738 876797</td>
<td>B Y Y</td>
<td>DRY SEASON. NEAR AN OIL PALM PLANTATION AND AN OLD CASSAVA FARM</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CCP5</td>
<td>Futa</td>
<td>836709 879052</td>
<td>B Y Y</td>
<td>DRY SEASON. NEAR AN OIL PALM PLANTATION AND AN OLD CASSAVA FARM</td>
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</tr>
<tr>
<td>1</td>
<td>CCP6</td>
<td>Jandama</td>
<td>835687 881773</td>
<td>B Y</td>
<td>DRY SEASON. NEAR AN OIL PALM PLANTATION AND AN OLD CASSAVA FARM</td>
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<tr>
<td>1</td>
<td>CCP7</td>
<td>Gbongay</td>
<td>833003 884938</td>
<td>B Y</td>
<td>RAINY SEASON. NEAR AN OIL PALM PLANTATION AND AN OLD CASSAVA FARM</td>
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<tr>
<td>1</td>
<td>PCP1</td>
<td>Konia</td>
<td>836135 874927</td>
<td>NA Y Y Y</td>
<td>ALL YEAR</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>PCP2</td>
<td>Konia</td>
<td>83750 883889</td>
<td>NA Y Y</td>
<td>ALL YEAR</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>PCP3</td>
<td>Gbongay</td>
<td>835762 873005</td>
<td>S Y</td>
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<tr>
<td>2</td>
<td>CCP8</td>
<td>Masaila</td>
<td>828362 890385</td>
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<tr>
<td>2</td>
<td>CCP9</td>
<td>Masaila</td>
<td>824149 890832</td>
<td>B Y Y Y</td>
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</tr>
<tr>
<td>2</td>
<td>CCP10</td>
<td>Giawuma</td>
<td>823828 890869</td>
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</tr>
<tr>
<td>2</td>
<td>CCP11</td>
<td>Turela 1</td>
<td>819358 892547</td>
<td>B Y</td>
<td>ALL YEAR. TO ACCESS OIL PALM PLANTATIONS IN SEARCH OF FOOD</td>
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<tr>
<td>2</td>
<td>CCP12</td>
<td>Turela 2</td>
<td>815026 896782</td>
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<td>ALL YEAR. TO ACCESS OIL PALM PLANTATIONS IN SEARCH OF FOOD</td>
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<tr>
<td>2</td>
<td>PCP4</td>
<td>Sefula</td>
<td>820596 891933</td>
<td>NA Y Y</td>
<td>ALL YEAR. TO ACCESS OIL PALM PLANTATIONS IN SEARCH OF FOOD</td>
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</tr>
<tr>
<td>2</td>
<td>PCP5</td>
<td>Kandela</td>
<td>815361 895096</td>
<td>NA Y</td>
<td>ALL YEAR. TO ACCESS OIL PALM PLANTATIONS IN SEARCH OF FOOD</td>
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</tr>
<tr>
<td>3</td>
<td>CCP13</td>
<td>Vaama</td>
<td>811702 902704</td>
<td>B Y Y</td>
<td>GROUND NEST FOUND. SNARE FOUND NEAR GOLA RAINFOREST NATIONAL PARK (GRRNP).</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>PCP6</td>
<td>Bambakoh</td>
<td>810662 905177</td>
<td>NA Y</td>
<td>GROUND NEST FOUND. SNARE FOUND NEAR GOLA RAINFOREST NATIONAL PARK (GRRNP).</td>
<td></td>
</tr>
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<td>3</td>
<td>PCP7</td>
<td>Vaama</td>
<td>814593 899919</td>
<td>NA NA Y</td>
<td>RAINY SEASON. LOCATED ON A SIDE OF WERIKENDA FOREST</td>
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</tr>
<tr>
<td>4</td>
<td>CCP14</td>
<td>Gonoohun</td>
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<td>RAINY SEASON. LOCATED ON A SIDE OF WERIKENDA FOREST</td>
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</tr>
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<td>Turela 3</td>
<td>790936 898862</td>
<td>B Y</td>
<td>NEAR WERIKENDA FOREST</td>
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</tbody>
</table>

*Evidences of chimpanzee crossing: Trail (B: trail at both sides, S: trail at single side, NA: Not available); Interview confirmation of chimpanzee crossing the road (Yes: Y; No: N); CCP: Confirmed crossing point; PCP: Potential crossing point.

Fig. 18. Summary table of the chimpanzee crossing points with nearest villages, coordinates and additional observations.
Discussion

Most road projects will inevitably lead to some loss of biodiversity but this can be minimised by full use of impact avoidance, mitigation and compensation measures (Byron, 2000). In this case, the construction of the road was already in progress by the time the TCS team was authorised to start the chimpanzee rapid survey and some areas were already damaged before any recommendation could be given, especially section 1. The constructors opened survey lines perpendicular to the road on both sides of the entire length of the road, which made difficult the search for chimpanzee trails.

Risk and concerns

The following facts, risk and concerns have been noted:

1. Section 1 has the highest encounter rate followed by section 2. It was already cleared and widened, and borrow pits had been dig in both sides of the road without considering the chimpanzee crossing points.
2. There are 4 critical areas with a high encounter rate: from Konia to Futa (section 1), Waima axis (section 2), Vaama axis (section 3) and Werikenda Forest (section 4). All these areas showed higher evidence of chimpanzee activity compared to other areas (Figure 19).
3. This survey was conducted during the dry season and activity patterns and usage of the road may vary across seasons.
4. Many villages that were interviewed as part of the socio-economic survey reported to not have been approached in terms of compensation related to loss of their crop fields or plantations affected by the road development.
5. Increased accessibility to Liberia through road pose risks to chimpanzee populations through increased bush-meat hunting and consumption, and logging in areas previously not seriously impacted by anthropogenic pressures. Therefore, there is a need of sensitization within the communities.
6. The staff that works on the construction of the road was not sensitized about the importance of the conservation of protected species such as the western chimpanzee, which can lead to an increase of the consumption of bush-meat, illegal chimpanzee trade and disease transmission.
Conclusions and recommendations

Referring to the numbered bulleted facts, risk and concerns outlined above, we recommend the following:

1. The lengths of the road damaged by borrow pits should be rehabilitated, especially in areas with chimpanzee activity.
2. The areas with high chimpanzee encounter rate should ideally have speed bumps at the beginning and at the end with several signs highlighting the danger of collision with the critically endangered western chimpanzee. It is highly recommended to carry out a more in-depth survey in these critical areas to gain a better understanding of the impact that the road will have on these groups of chimpanzees. There are 4 critical areas that require special consideration:

   a. Konia to Futa: this 4km length of the road has already been damaged but borrow pits should be reforested and speed bumps and multiple warning signs should be placed along this stretch of road.

   b. Waima axis: previous studies have indicated high levels of chimpanzee activity between Masaila to Giawama with evidence from camera trap photos, alongside indirect signs of activity. We recommend to avoid placing borrow pits along this stretch of the road. We also highly recommend placing speed bumps and warning signs for passing vehicles all along this axis.

   c. Vaama axis: There is an area of activity before Vaama, probably because of the proximity to Gola Rainforest National Park (GRNP), that will also require speed bumps and signs; borrow pits should be avoided. Despite the paucity of forest in this area, chimpanzees appear to use this human-degraded habitat. How and why chimpanzees persist in this area warrants further investigation; we therefore highly recommend further survey work in this area.

   d. Werikenda forest: this large community forest extends on the western side of the road. It would be ideal if the road could divert as much as possible to the east to avoid passing along the forest edge. Borrow pits on the western side of the road from Gonohun to Wonde should be avoided. This forest needs to be surveyed as it is probably home to important species such as the western chimpanzee and the giant pangolin. At the same time, the construction of the new road could threaten the continuity of this forest and the livelihoods of the 5 communities that own and manage it, as the increase in traffic to and from Liberia might render this area more vulnerable to illegal logging and hunting activities. We therefore highly recommend that measures of sensitization be put in place, as well as a community programs to assist these local communities to effectively and sustainably manage their forest.

3. The survey should be repeated in the rainy season and a longitudinal monitoring scheme should be implemented every year across both seasons during and after the construction of the road to determine the impact that the construction and the utilisation of the road have on chimpanzees. Therefore, we recommend following a monitoring scheme of the chimpanzee crossing points and its usage, the road collision and kills and the monitoring of bush-meat hunting and trade along this axis.

4. The consequences of a highway for these communities can have a negative impact without a proper land use management strategy. The road may affect water system and erosion, which may affect
agricultural activities at the road edge. A good drainage system must be in place and advice concerning land use planning must be provided at community level for livelihood alternatives and capacity building.

5. A bush-meat sensitisation and education campaign should be implemented to sensitize all the communities along the road about the risk of consuming bush-meat to avoid zoonotic diseases like Ebola.

6. It is recommended to create awareness among the constructors to introduce the importance of wildlife and the risks of bush-meat. The road constructors are an easy target for wildlife traders that want to sell either bush-meat or baby chimpanzees as pets.

7. Road signs should provide awareness messages about the protection status of the western chimpanzee and its protection

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