Final Evaluation Report

Your Details	
Full Name	Soro Nicodenin Angele
Project Title	Role of bees in the survival of savanna Chimpanzees (*Pan troglodytes verus*) in the Comoé National Park (Côte d'Ivoire)
Application ID	24051-1
Grant Amount	£4,906
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1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Determine bees' diversity per habitat type across two chimpanzees' home-ranges.				Sub-transects of 100 m were delimited within the regular parallel transect network (16 transects/side of Comoé river). Intervals of 25 m were delimited along sub-transects of 100 m starting from the origin points. Method of yellow pan traps was used for bees' sampling. Sixty-seven bees were sampled.
Establish a distribution map and estimate the density of active beehives by habitat type across two chimpanzees' home-ranges				In three habitat types, we established 16 100 x 100 m plots (16 ha) in which search of arboreal social bees' nests was done. Visual searches were conducted (with binoculars when needed), with special attention to large trees with diameter at breast height (DBH) ≥ 15 cm in which social bees nests tend to be concentrated in west Africa (Darchen, 1972; Tornyie & Kwapong, 2015). The geographical coordinates of each beehive was recorded using a GPS, then a sample of bees from each nest was collected to be identified.
Determine the bees' species which produce the honey exploited by chimpanzees and their relative frequency of exploitation.				We used honey collection tools as indicators of bee nests exploited by chimpanzees. Therefore to determine which social bees produced honey consumed by the chimpanzees, direct observations of tools was made below bees' nests into each visited plot. In general, after eating honey, chimpanzees leave the tools into nests entrance or on the ground below trees that hold exploited nests. Tools are the sticks found under a beehive presenting at least one modification (brush tip made by chimpanzees using their teeth).

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled.

Initially in the methodology, it was planned to cover six parallel 2 km transects within every visited habitat type (gallery forest, dry forest, secondary forest) for searching beehives. Using this method it was practically impossible to find beehives. The used alternative method was to set up 16 plots of 100 x 100 m in each of the habitats, focusing the observation of more nests.

3. Briefly describe the three most important outcomes of your project.

a) Our study reveal that five bees' species are exploited by chimpanzees for their honey: stingless bees (*Meliponula ferruginea, Meliponula togoensis, Meliponula bocandei, Hypotrigona gribodoi*) mostly exploited by chimpanzees and honey bees (*Apis mellifera*). *M. ferruginea* was mostly exploited by chimpanzees (38.89 %). On the other hand, *A. mellifera* and *H. gribodoi* were less exploited.

b) A total of 114 nests were found in 48 ha (2.4 nests/ha). Dry forest had the highest nest density (4.2 nests/ha) followed respectively by secondary forest (1.9 nests/ha) and gallery forest (1.1 nests/ha), suggesting that the dry forests are preferred habitats of the chimpanzee of the Comoé National park.

c) Bees' species nest in trees cavities with DBH range from 15 to 87.3 cm. Chimpanzees have no particular choice for bees' nests when we consider the DBH of nesting trees but they tend to exploit *A. mellifera* nests with low height.

4. Briefly describe the involvement of local communities and how they have benefitted from the project.

We hired two young men from a village at the southern entrance to the park. We trained them to become research assistants thanks to this project. This will give them future opportunities of jobs with future projects. We did also two awareness sessions in the neighboring villages of Kakpin and Gansé to raise awareness about the importance of bees for conservation of chimpanzees in the Comoé National Park.

5. Are there any plans to continue this work?

Yes, we have a plan to continue this work. This work has shown that chimpanzees eat honey of five bee species, *Meliponula ferruginea, M. togoensis, M. bocandei, Hypotrigona gribodoi* and *Apis mellifera* in the Comoé National Park. Because chimpanzees are known to be primarily frugivorous this rises two central ecological questions: (i) are the five bee species involved in pollination of trees that produce fruit for chimpanzees?; and (ii) are these bee species also involved in cashew pollination? Cashew is the mainly crops around the Comoé National Park. To

address these questions we will continue this work by targeting three specifics objectives:

(1) Assessing through melissopalynology, the involvement of the five bees species in the pollination of trees which produce fruits consumed by chimpanzees.

(2) Evaluating the effect of pollination on cashew orchards around the Comoé National Park.

(3) Assessing through interviews, the traditional knowledge of farmers about honeybees and stingless bees around the park.

6. How do you plan to share the results of your work with others?

We have already written a scientific article that we will soon submit to an international newspaper. The results of this work will also be presented to national and international conferences. I already participated to the first conference of the Entomological Society of Côte d'Ivoire from 13 to 14 December 2018 at the Nangui Abrogoua University. During this conference we presented some of our results and won the best oral communication award of our session.

7. Timescale: Over what period was the grant used? How does this compare to the anticipated or actual length of the project?

The resources provided by the grant were used according with the initial Project scheme.

8. Budget: Provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Salary for the research technician	840	840		
Subsistence in the field	378	378		
Subsistence in Comoé research station	1,440	1,440		
Transportation Abidjan-station-Abidjan	160	160		
Transportation to the park during activity	252	252		
10 package of entomological pins n°	87	87		

5				
10 package of entomological pins n°3	58	58		
5 Entomological collection boxes	70	70		
Ethanol	66	66		
5 Glass vials	104	104		
1 Compass	18	18		
1 Petri dishes (pack of 500)	60	60		
1 measuring tape	16	16		
2 Entomological net	28	28		
400 Pan traps	243	243		
2 Tents	182	182		
1 Field camera	239	239		
2 Garmin GPS	665	665		
Total	**4,906**	**4,906**		Other funding was obtained from Comoé Chimpanzee Conservation Project. The extra expenses were covered by personal means.

9. Looking ahead, what do you feel are the important next steps?

The next step is to publish our results in an international journal and seek funding that will serve to:

(1) Assess through melissopalynology, the involvement of the five bees species in the pollination of trees which produce fruits consumed by chimpanzees.

(2) Evaluate effect of pollination on cashew orchards around the park.

(3) Assess through interviews, the traditional knowledge of cashew farmers about honeybees and stingless bees around the park.

10. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

We presented some of our results at the first conference organised by the Entomological Society of Côte d'Ivoire from 13 to 14 December 2018 at the Nangui Abrogoua University. During this conference we used the Rufford Foundation logo in our presentation. This logo will also be use in the dissertation and the public defense of my PhD when completed.

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

The team was composed of:

Soro Nicodénin Angèle - PhD student: Principal researcher.

Prof. Yéo Kolo - Director of Lamto Ecology Station: Scientific director of this work.

M. Alain Pauly - Taxonomist of bees at Royal Belgian Institute of Natural Sciences: Confirmed the identification of bees that was collected during this project.

Juan Manuel Lapuente Pérez - Head of the Comoé Chimpanzee Conservation Project: Consultant concerning Comoé chimpanzees' home-ranges and their behaviour.

Two assistants who help us with fieldwork.

12. Any other comments?

I am very grateful for your support to this project. Thank you very much for your help!

I hope I have the opportunity to still benefit from the Rufford Foundation for the rest of this work.