

Final Evaluation Report

Your Details	
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Project Title	Conservation of natural habitats of Termitomyces in Okpara forest reserve north part of Benin
Application ID	28216-1
Grant Amount	£4,999
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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
A set of geographical coordinates of each termites' mounds on the transect line and a series of satellite images of the area will be acquired to assess first the actual distribution area of termitaries that constitute the probable favourite natural habitat of Termitomyces species of study area and then the actual and previous land use in the forest of Okpara.				These maps showed the extent of forest degradation and possibly allowed for calculating trends for the next 5 to 10 years.
Opportunistic transects line (500*20m) will be processed will the help local people				Opportunistic transects were achieved from July to August due to rainy season. In fact, due to high amount of rain during July I was obliged to extend the prospect period from July to August. The amount of rain didn't allow me to harvest a lot of <i>Termitomyces</i> species as previously expected. The soil was too wet, and this didn't allow to meet the right conditions of fruiting body.
Quantitative data on the reasons why termitary are destroyed such as data on the dynamic of <i>Khaya</i> <i>senegalensis, Diospyros</i> <i>mespilliformis</i> and <i>Tamarindus indica</i> trees to quote few will be collected.				Quantitative data on habitat dynamics such as rate of pruning, debarking, diameter, canopy cover, the presence or not of saplings of <i>Khaya senegalensis</i> , <i>Diospyros mespilliformis</i> and <i>Tamarindus indica</i> trees and type of human activities conducted. They served as indicators for assessing the state of degradation of the termite's mound site.



Raising awareness séance						
will be held	d to sho	ow to				
local peop	ole to	which				
extend the	Okpara	forest				
reserve	has	been				
damaged						

Through raising awareness local people touch with their hand how serious and damaging are their activities on the termites' mounds and their associated fungi.

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

I did not see a lot of *Termitomyces* species due to the high amount of rain. It's known the more it rains the more the soil is wet and the more the soil is wet the less symbiosis fungi such as *Termitomyces* species can be met. The data collection was supposed to start in August but due to the high amount of rain I was not able to launch this step as set in the project before. I was obliged to reschedule this data collection up to the mid-August. From May to October, amount of rain was too much this year to allow good fruiting body of symbiosis fungi such as *Termitomyces* species.

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

- Different activities that are undertaken into Okpara forest

The different photos showed different activities that are undertaken and that have negative effect on the natural production of *Termitomyces* species into the Okpara forest reserve.







A-Goat eating leaves of *Strychnos spinosa*; B-Termites mound destroyed in the search of rat; C-Termites mound destroyed by a cow rubbing on it; D and E-Charcoal into forest; F-Field of corn into forest.

The observation of the above photos showed the different activities that are met in the Okpara forest reserve. Photo A and F show that there is a presence of humans in the forest. Goats climb termite mounds to eat leaves of the tree and by doing so it destroys it and its associated fungi. Before processing to the field of corn the peasant needs space and to get space, he will need to clean the area and in doing so he destroys termite mounds and it associated fungi too.

The photo B show that the termite mound is a shelter of the big rat. As it known people love so much the meat of this animal mainly during dry season; this period that is known as a period of hunting in the north part of Benin. During that period people hunt any kind of animal and in doing so people destroy termite mounds in the search of the big rat that is living in the termite's mound. But sometimes people destroy termite mounds because of the queen of the termite mound that is according them very tasty to eat. So, through this action people also stop the process of destroy the associate fungi of the termites' mound.

The photo C show that breeders use to pass through the forest to feed their cattle. When the body of a cow is scratching it use to rub on termites' mound and in doing so it destroys it and associated fungi.

The photos D and E show that people cut down trees to make charcoal in order to sell or to use it to make fire to cook their food on. In doing so they destroy termite



mounds and their associated fungi. This phenomenon take place into the forest because of the increasing demand of the human being need that is linking to the increasing of the population.

- Effect of the habitat fragmentation on natural production of *Termitomyces* species.

Analysis revealed that human activities have a significant effect on the state of termite mounds (table 1). It's also revealed that DBH has no effect on the state of termite mounds. We can assert that there is a correlation between human activities and the state of termite mounds. The estimate value of human activities is negative by contrast to the termite mounds state which is positive. This suggest that there is negative relationship between termite mound state and human activities in other word on the natural production of *Termitomyces* species. As far as we know that those termites' mounds shelter *Termitomyces* species. This confirm what we found on field through the above pictures.

Table 1. Effect of human activities on the natural production of remitorityces species							
	Estimate	Std. Error	z value	Pr (> z)			
(Intercept)	2.52122	1.14562	2.201	0.0278 *			
H_actiyes	-6.94546	1.32627	-5.237	1.63e-07 ***			
Dbh	-0.03108	0.01955	-1.589	0.1120			

 Table1: Effect of human activities on the natural production of Termitomyces species

The analysis revealed that model 7 (table 2) was the best models for termites' mounds ($\Delta AIC=0$). We found that it is only human activities that has negative effect on the termites' mound state.

Table 2	: Selection	of the	best	model.

Code	Model	AIC
m1	glm (formula =State ~ H_acti + Dbrk + Prun + Dbh +	12.990882
	H_acti: Dbrk + H_acti: Dbh +Dbrk: Prun + Dbrk: Dbh	
	+ Prun: Dbh, family = binomial)	
m2	glm (State ~ H_acti + Dbrk + Prun + Dbh + H_acti:	10.990882
	Dbrk + H_acti: Dbh + Dbrk: Dbh + Prun: Dbh, family	
	= binomial)	
m3	glm (State ~ H_acti + Dbrk + Prun + Dbh + H_acti:	8.990882
	Dbrk + H_acti: Dbh + Dbrk: Dbh, family = binomial)	
m4	glm (State ~ H_acti + Dbrk + Prun + Dbh + H_acti:	6.990882
	Dbrk + H_acti: Dbh, family = binomial)	
m5	glm (State ~ H_acti + Dbrk + Dbh + H_acti: Dbrk +	5.009665
	H_acti: Dbh, family = binomial)	
m6	glm (State ~ H_acti + Dbrk + Dbh + H_acti: Dbh,	3.412140
	family = binomial)	
m7	glm (formula = State ~ H_acti + Dbh, family =	0.00000*
	binomial)	

*mean that is the selected model



- Okpara forest reserve land use change over the period that range from 2008 to 2018 and from 2018 to 2042

The below figures present the dynamic of the vegetation cover of the Okpara forest reserve from 2008 to 2018 (table 3) and from 2018 to 2042 (table 4).

From 2008 to 2018 Okpara forest reserve has undergone great variation of its different vegetal formations. The rate of urban area ranges from 0.07% in 2008 to 0.14% in 2018. The extent of urban area doubled in 10 years. Mosaic of field and fallow covers ranges from 34.50% in 2008 to 42.60% in 2018 (table 4). Tree and shrub savannah cover range from 31.13% in 2008 to 53.6% in 2018. Woodland and wooded savannah covers range from 28.37% in 2008 to 2.84% in 2018. Gallery forests covers range from 5.81% in 2008 to 0.80% in 2018. We noticed that urban area, mosaic of field and fallow, tree and shrub savannah increased from 2008 to 2018 by contrast to woodland and wooded savannah and gallery forests that decreased from 2008 to 2018. This is suggesting that human activities increased from 2008 to 2018 in the Okpara forest reserve. Those activities are having a negative effect on the presence of termite mounds.

If we guess now that this rate of the variation between 2008 and 2018 into different vegetal formation will be constant or perhaps more by 2042, vegetal formations such as woodland and wooded savannah and gallery forests will almost disappear or be inexistent (table 4).

	2008		2018		Total	
Soil occupancy unit	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)
Urban area	18,57	0,07	36,25	0,14	17,68	0,07
Mosaic of field and fallow	9060,98	34,50	11189,05	42,60	2128,07	8,10
Tree and shrub savannah	8177,70	31,13	14081,47	53,61	5903,77	22,48
Woodland and wooded savannah	7452,24	28,37	744,92	2,84	-6707,32	-25,54
Gallery forests	1525,17	5,81	209,68	0,80	-1315,50	-5,01
Water body	32,43	0,12	5,72	0,02	-26,71	-0,10
Total	26267,09	100,00	26267,09	100,00	0,00	0,00

Table 4: Rate of evolution of vegetation cover from 1998 to 2018

Table 5: Projection map of the vegetation cover of the forest reserve for the year2042.

	2018		2042		Total	
Soil occupancy unit	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)
Urban area	36,25	0,14	19,04	0,07	-17,21	-0,07
Mosaic of field	11189,05	42,6	10412	39,64	-777,05	-2,96



and fallow						
Tree and shrub	14081,47	53,61	15784,26	60,09	1702,79	6,48
savannan						
Woodland	744,92	2,84	3,51	0,01	-741,41	-2,83
and wooded						
savannah						
Gallery forests	209,68	0,8	46,91	0,18	-162,77	-0,62
Water body	5,72	0,02	1,37	0,01	-4,35	-0,01
Total	26267,09	100	26267,09	100	0	0

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

I have involved local people when processing to the choice of transect line sites. In fact, it is with the help of the local people who clearly know well the forest I have achieved the choice of transect lines sites. Local people know very well where termite mounds are located.

Through the current project we notice that *Termitomyces* species are very appreciated in the project area. They are mainly used primarily to replace meat during rainy season. We also realised that this project helps local people to deepen their notion on *Termitomyces* species, on what kind of species of *Termitomyces* are edible or not and the importance to conserve those species for they have great value for them.

During the process of this project we have been in a close relationship with the delegate and people who know very well the study area during our various visits to collect *Termitomyces* species. This allow them to really see to which extend their activities are negatively shaping the natural production of *Termitomyces* species.

Local people came out in a great number during raising awareness session and this clearly showed how people were interested in the project and also allowed us to reach a wide audience.

5. Are there any plans to continue this work?

Yes, there are plans in mind for the next step of this work.

As during the process of the current project, we did not pick up a lot of *Termitomyces* species so this work needs to be done again to harvest a high diversity of *Termitomyces* species in order to get a representative diversity of *Termitomyces* species in the Okpara forest reserve.

We will need to scale up an integrative monitoring and protection framework to address priority threats and to reinforce the conservation status of *Termitomyces* species in Benin.



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

As a research assistant, I will use the results of current project to enrich the lecture that I am giving at the agronomy faculty of Parakou (University of Parakou). I will also present this project results during the annual meeting of the Research Unit in Environmental Mycology and Plant-Soil-fungi Interactions, Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou. I will present the results of the current project during workshops or conferences that will be organised or hosted by the University of Parakou and in the whole part of country as well. In addition, the scientific paper that will be produced will be the best way share the results to reach a wide audience.

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

The grant was used from July 2019 to February 2020. I have changed a bit the period of prospect step from July to August, it was supposed to last 1 month but instead of that it last almost 2 months. Otherwise I will say that in general the timescale doesn't change so much from the previous timescale set during the writing of the project.

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
Community consultation and committees and local travel expenses	£1000	£1100	+£100	The price of fuel has increased during the fieldwork period
Computer, printer and software	£1140	£1140		NA
Digital camera Canon 70D with 60mm macro lens, and accessories	£900	£900		NA
Maps, office supplies, printing costs (posters), media (radio)	£759	£759		NA
Food	£450	£450		NA
Local guides	£750	£750		NA
Total	£ 4999	£ 5099	+£100	



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

During the achievement of the current project, we did not harvest a lot of *Termitomyces* species so this work needs to be deepened again to harvest a high diversity of *Termitomyces* species to get the representative diversity of *Termitomyces* species in the Okpara forest reserve

I also feel like scaling up an integrative monitoring and protection framework to address priority threats and to reinforce the conservation status of *Termitomyces* species in Benin by assessing the importance of current indigenous knowledge, the resource use model and local strategies for long-term conservation fungal resources.

I feel like implementing a participatory conservation training with schools, decisionmakers, environmental NGOs, land chiefs, village chiefs and forest officers to reinforce the conservation status of *Termitomyces* species in Benin through the identification of key persons with knowledge of the cultural, social and economic context of the fungal and plant communities in Okpara forest reserve.

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?

Yes, I have used The Rufford Foundation logo during the sensitisation session. I have also kept informed local people that this work was quite possible through the fund of Rufford Foundation grant. I have used this logo recently during our monthly meeting at the Research Unit in Environmental Mycology and Plant-Soil-fungi Interactions, Laboratory of Ecology, Botany and Plant Biology to present my results to bachelor student that aim to embark in biology conservation field.

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

TCHAN I. Kassim, he has 6 years of experience in collecting data on the characterization of natural habitats of higher fungi. He is responsible for the management of mycological databases of the laboratory. He will be a key element for the implementation of sustainable conservation measures of natural habitats of higher fungi in the study area. He also has good experience in the field of geographic information systems for the use of ArcGIS and QGIS software. This will help us update the data on the size of degraded habitats.

SEIDOU Feissalath, she has 4 years of solid experience in ethnomycology and sociology of natural resources. She also has significant experience in monitoring and preserving mycodiversity. She will be very helpful when communicating with the stakeholders.

12. Any other comments?

I would like to highlight that during the raising awareness session local people recognised the negative effect of their different activities and promise to change



their mind and start to adopt good practices to conserve the termites' mounds and their associated fungi.

I would like also to say a special thank to Rufford Foundation for funding this project.