

Final Evaluation Report

Your Details	
Full Name	BADOU Akotchayé Sylvestre
Project Title	Participatory-based conservation of fungi natural habitats in the Wari-Maró forest reserve in northern Benin
Application ID	26916-1
Grant Amount	£4,998
Email Address	sbadou@ymail.com
Date of this Report	13/09/2019

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
Collecting data on beneficial fungi and the state of their habitats in order to propose scientific means and to protect these vast but relatively fragile habitats.				
Produce and publish a set of feasible measures, communicate them and explain them to stakeholders at national level (local populations and authorities, policy makers, forest management services, etc.).				

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

During the execution of the activities of my project we did not encounter any difficulty. On the contrary, we had the facilities of the local people and the forest authorities in charge of the conservation of the Wari-Maró Forest Reserve.

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

- Dynamics vegetation cover from 1998 to 2018 of the Wari-Maró Forest Reserve

The vegetative cover of the Wari-Maró Forest Reserve from 1998 to 2018 has experienced a significant regression because of the different anthropogenic pressures on the natural habitats of the higher fungi (Tables 1). We note that, in 1998, the total area occupied by agglomerations is 8.94 ha and 18 years later, i.e. in 2018, it occupies 13.86 ha, an increase of approximately 4 ha (Table 1).

At the same time, the areas occupied by woodland / wooded savannahs, dense forests and gallery forests in 1998 are 77194.48 ha or 69.48% respectively; 5186.91 is 4.67% and 10331.60 is 9.30% (Table.1). While in 2018 the areas occupied by woodland / wooded savannahs, dense forests and gallery forests are respectively 20489.03ha and 18.44%; 1056.49ha or 0.95% and 2184.82 ha is 1.97% (Table.1). We also observe that nearly 75% of the vegetation cover of the different natural habitats disappeared between 1998 and 2018.

If we maintain the same intensities of current human pressure for the coming years on the natural habitats of the Wari-Maró Forest Reserve, by 2042 all clear forests, dense forests and gallery forests will be transformed into savanna herbaceous or even disappear in the study area (Table.2). Therefore, it urges to curb the anthropic pressures on the natural habitats of the superior mushrooms. This may be possible through the establishment of income-

generating activities that contribute to the sustainable conservation and management of natural habitats of higher fungi.

Table.1: Rate of evolution of vegetation cover from 1998 to 2018

Units of occupation	1998		2008		2018	
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)
Agglomeration	8.94	0.01	10.55	0.01	13.86	0.01
Field mosaic and fallow	363.52	0.32	1157.65	1.04	2149.64	1.93
Savannah with trees and shrubs	17310.09	15.58	54499.19	49.06	84089.79	75.69
Woodland and wooded savannah	77194.48	69.48	47644.85	42.89	20489.03	18.44
Dense forest	5186.91	4.67	1982.34	1.78	1056.49	0.95
Galery forest	10331.60	9.30	4759.11	4.28	2184.82	1.97
Body of water	497.24	0.45	582.50	0.52	265.11	0.24
Rock outcrop	202.61	0.18	459.19	0.41	846.63	0.76
Total	111095.38	100,00	111095.38	100.00	111095.38	1003.00

Table.2: Projection map of the vegetation cover of the forest reserve for the year 2042

Units of occupation	2042	
	Area (ha)	Proportion (%)
Agglomeration	15.33	0.01
Field mosaic and fallow	1214.15	1.09
Savannah with trees and shrubs	108220.55	97.41
Woodland ant wooded savannah	344.75	0.31
Dense forest	337.21	0.30
Galery forest	87.83	0.08
Body of water	119.04	0.11
Rock outcrop	756.53	0.68
Total	111095.38	100.00

- **Natural production of edible fungi according to the age of natural habitats dominated by *Isoberlinia doka***

During the mycological season from June to August 2019, all plots included, we collected 72 species of edible fungi in the Wari-Maró Forest Reserve.

For this purpose, in plots P1 (10 Year), P2 (15 Year), P3 (20 Year) and P4 (25 Year) all respectively dominated by *I. doka*, we recorded respectively 48; 53; 43 and 40 species of edible fungi in the Wari-Maró Forest Reserve. Similarly, a total of 72.18 kg / ha of fresh biomass of all top edible fungi species in all plots was recorded in the

Wari-Maró Forest Reserve (Fig.6). In plots P1 (10 Year), P2 (15 Year), P3 (20 Year) and P4 (25 Year) we recorded respectively 47.89 kg / ha; 205.2 kg / ha; 136.25 kg / ha and 109.57 kg / ha of fresh biomass.

Then, in the plots P1 (10 Year), P2 (15 Year), P3 (20 Year) and P4 (25 Year), we collected respectively 555; 9191; 9362; 7622 of carpophores in the Wari-Maró Forest Reserve.

Finally, we can deduce that the maximum fallow period to restore the productivity of natural habitats to higher fungi is 15 years in the Wari-Maró Forest Reserve. Beyond this period (15 years) the productivity of higher fungi decreases.

- **State of conservation of natural habitats of fungi**

The natural habitats of the higher fungi in the Wari-Maró Forest Reserve are degraded. Human activities such as shifting cultivation, illegal logging, charcoal production, firewood and grazing are major activities in the natural habitats of the higher fungi. The consequences of these activities on biodiversity in general is the disappearance of certain ectomycorrhizal (EcM) trees such as *Azelia africana* and even the regression of the abundance of forest species such as: *Isoberlinia* spp, *Uapaca togoensis*, *Berlinia grandifolia* ... etc. To restore the proper functioning of degraded natural habitats.

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

For better project results, we have worked with village groups to form a local committee (responsible for ensuring the strict application of the new guidelines for the sustainable exploitation of wild fungi). These village groups are active women who sell edible mushrooms in the local markets of the study area, farmers and loggers. Similarly, we have also collaborated with members of the forest administration and its decentralised structures, the structures promoting ecotourism and in particular NGOs specialized in the conservation and sustainable management of biodiversity, with whom we have listed the various directives good sustainable management of natural habitats of wild fungi. We have also worked closely with the Benin Directorate General for Water and Forests, the IUCN Commission of Benin, the National Focal Point of the CBD, the National Association of Loggers of Benin, the Community Union of Agricultural Producers of Benin the region of our study area.

Some members of village groups served as local guides in the field to choose mycological data collection sites. In the same way, they helped us carry out our various monitoring activities on the different plots installed in the Wari-Maró forest reserve.

Sensitisation was carried out in agreement with the local populations where indigenous women and men were chosen as translators to spread the message in the local languages which are: Nagot, Bariba and Fon.

Sensitisation and awakening sessions have been carried out with students from technical agricultural schools, schoolchildren and students to reach all levels of society. The validation of the conservation and sustainable management measures was adopted in agreement with the village chiefs, the farmers, the loggers, some members of the forestry administration including myself as project manager.

5. Are there any plans to continue this work?

Yes, this work must be continued in the years to come. The points that still need to be addressed to strengthen our conservation efforts in the study area are:

- Continue reforestation activities to further enrich the Wari-Maró forest reserve in ectomycorrhizal trees in order to restore the natural habitats of degraded top fungi.
- Establish a value chain for higher fungi in riparian villages to provide income-generating activities that contribute to the conservation and sustainable management of natural habitats.

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

The results from our project will be used to support mycological teaching and research in the Faculty of Agronomy of the University of Parakou in Benin. Already, I intervene during the practical work and directed in ecology and characterisation of the natural habitats of the superior mushrooms. I will pass on effectively the know-how acquired to the young students and to my colleagues the results resulting from our project. An important asset is that I am already attending Prof. Nourou S. YOROU (Director of the Research Unit in Tropical Mycology and Plant-soil-Fungi Interactions) (MyTIPS) during his mycological teaching at the level of the Faculty of Agronomy of the University of Parakou. The monthly scientific seminars and communication organised by our laboratory will be used to make our acquired results known; annual scientific conferences and symposia organised by the University of Parakou. In addition, the scientific publications and books that will be generated.

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

The activities were carried out according to the periods indicated in the project. Above all, monitoring activities were carried out from mid-May to September 2019. Awareness activities were also carried out in June 2019.

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
Digital camera Canon 1400D with 60mm macro lens, and accessories	900	900		A Canon 1400D brand high resolution camera / camera with a 60mm macro lens, a field bag, a stand, two feed bacteria were paid.
Computer, printer and software	1130	1130		Office and computer tools, poster prints were made to carry out our data collection and investigation. We paid Paper Line brand Ram papers.
Maps, office supplies, printing costs (posters), media (radio)	718	710	-8	Posters were produced and printed on A0 format to carry out awareness raising activities on conservation measures and sustainable management of natural habitats of Higher fungi.
Transport to the study area	1100	1100		Local travel expenses: a prospecting trip = one way + return + trip to the study area. A prospecting trip to the Wari-Marô Forest Reserve in northern Benin is 1,100 km away. A total of 1100 km is necessary for excursions. The trip to Benin costs about £ 1 per kilometer. A total amount of £ 1,100 was spent for the trip.
Cost of Food	400	400		The cost of food is essential for the team in the field. As a result, each project member in the field received a fixed sum per day. The total amount is £ 400.
Local labor costs	750	750		Cost of local labor (1 local guide): a forest guide and two local population members were recruited for the identification of study sites and placement of plots; 15 days (May 15 to May 31, 2019). A daily cost of £ 25. So, a total of £ 750 was spent.
TOTAL	4998	4990	-8	

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

The next step after this project is to set up a value chain of edible fungi in the study area. Through the value chain, we plan to install fungi farms to bring local populations selling edible fungi into local markets to create more revenue for all participants in the sustainable conservation of natural habitats of higher fungi. These fungi farms will allow local populations to grow edible fungi locally.

Likewise, we plan to enrich the natural habitats of the higher fungi with EcM trees in order to restore the ecological balance of the habitats of the Wari-Marou 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?

For the success of our awareness, we have produced posters on which are displayed the logo of Rufford Foundation. Similarly, during Prof Nourou Soulemane's lectures, we presented our preliminary results in which the Rufford Foundation logo was displayed to the undergraduate and graduate students in Agronomy at the Faculty of Agronomy of the University of Parakou of Benin.

All posters are displayed with the Rufford Foundation logo in our Tropical Mycology and Plants-Soils-Fungi Interaction Unit of the Laboratory of Ecology, Botany and Plant Biology.

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

To achieve the different objectives of the project, here are the skills I worked with:

- **BADOU A. Sylvestre**

Project Manager, he has been empowered to ensure the implementation of conservation measures and sustainable management of natural habitats of higher fungi in agreement with the various actors in the study area. It has also been useful in the field of geographic information systems for using ArcGIS and QGIS software. This helped us update the data on the size of degraded habitats. In the same way, he helped us download the satellite images on the net, processed them to obtain the satellite map of the vegetation cover of the study area from 1998 to 2018.

- **OLOU Boris**

He was empowered to identify and record data on the current status of natural habitats of higher fungi in the study area. He has been an active element in outreach activities.

- **FADEYI Olivia**

It was useful to identify collection sites with high potential in edible fungal resources to carry out our monitoring activities. It has also been useful for establishing a good sustainable management plan for the fungal diversity of the study area. She actively

participated in the monitoring activities from June to October in the various fixed plots that were installed.