

## Final Evaluation Report

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Your Details	
<b>Full Name</b>	OLOU Armel Boris
<b>Project Title</b>	Documenting the diversity of macrofungi and local knowledge for sustainable conservation of fragmented swamp forest of Lokoli in southern Benin
<b>Application ID</b>	36045-1
<b>Date of this Report</b>	21.11.2022

**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
Documenting the diversity of macro fungi in Lokoli swamp forest				<p>Five plots of 30 x 30 m were installed within each habitat (typical dense forest, moderately degraded dense forest, highly degraded dense forest). Using a GPS, the exact coordinates of these different plots were recorded. The survey within each plot consisted of systematically sweeping each plot in parallel strips 2 m wide and before collecting each specimen, the fruiting bodies were photographed in their natural environment. Thereafter, the occurrences, the number of fruit bodies, and the fresh biomass of each specimen were recorded. Fresh fruit bodies were identified whenever possible in the field; those that could not be identified in the field were collected, labelled, and air- or oven-dried at 40–50 °C. The dried fruit bodies were then preserved together with their labels in plastic bags with silica gel for macro- and micro-morphological examinations. Dried specimens were deposited at the mycological herbarium of the University of Parakou (UNIPAR; Thiers 2019).</p> <p>Mycological surveys within the plots yielded 148 specimens of which only 50 specimens representing 28 species were identified. However, Chao's diversity index indicates that the macrofungi richness of this plant formation could potentially amount to 102 species. Shannon's diversity index coupled with Piélou's J-equitability reveals that the number of fruiting bodies is equal between species, suggesting a high specific diversity.</p>

<p>Documenting the local knowledge on the use of mushrooms in Lokoli swamp forest</p>			<p>The surveys were conducted through administering structured questionnaires by interviewing 200 local residents in each target village (Lokoli, Koussoukpa and Dèmè). The respondents were farmers, traditional healers, traders, and forest owners. The questionnaire was designed by considering socio-economic variables and some questions, such as gender, age, level of education, distance of mushroom collecting from the respondents' home area, different uses of the species harvested and various threats to the species. The questionnaire also considered other aspects such as the level of domestication of the different species and the motivation for their conservation, the local and national market demand for edible mushrooms. A total of eight names in the Fongbé language corresponding to species were cited by local people as species they consume. The highest frequency of citation was recorded for <i>Candolleomyces tuberculatus</i> called Dékpohounto (dead foot mushroom of <i>Elaeis guineensis</i>) followed by <i>Termitomyces</i> sp 2 called Lisso. The number of known species differed significantly by occupation in general (<math>p &lt; 0.0001</math>). However, multiple comparisons revealed no significant difference in the number of species between certain professions. Thus, between farmers and traditional healers the number of mushroom species cited did not differ significantly. The same is true between teachers and other civil servants (public and private) as well as between learners, craftsmen and traders. But these three groups of ethnomycological knowledge level differ from each other. The ordinal logistic model type II analysis of variance indicates that the frequency of consumption of mushrooms is significantly influenced by the availability of these resources, the</p>
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			<p>accessibility of carpophores collection sites and the degree of appreciation of the species by the consumers (Table 2, see the main text of the final report). Indeed, all other things being equal, the probability that a species will be consumed at a certain frequency (low, medium, high) differs significantly according to the degree of abundance. The more abundant a species is, the more likely it is to be consumed more frequently (Figure 2a, see the main text of the final report). Furthermore, the probability of a species being consumed at a certain frequency (low, medium, high) differs significantly depending on whether its collection sites are easily accessible or not. The ease of access to collection sites increases the probability that the species will be consumed more frequently (Figure 2b, see the main text of the final report). On the other hand, the more popular a species is, the less likely it is to be consumed frequently (Figure 2c, see the main text of the final report).</p>
<p>Training of rural households in the mushroom cultivation</p>			<p>A total of 25 people were trained for this activity. The theoretical training was conducted in the local language to enable the participants to better understand the basic operations and concepts of mushroom cultivation. Firstly, each participant was provided with a nose mask to ensure strict compliance with the protection conditions against Covid-19. Then, the posters containing the necessary information were displayed and the well-illustrated leaflets (see main text of the final report) containing the same information were distributed to each participant. The trainers then unfolded the content of the posters, making sure that each concept was understood. Among other information and topics explained, we have: What is a mushroom? How to produce or cultivate a mushroom? Substrate and</p>

			<p>how to treat a substrate (sorting, heat treatment, packaging)? how to seed, incubate and harvest. This session ended with questions of understanding and answers to questions. Finally, a snack to refresh the participants was made (see the main text of the final report) and a group photo was taken (see the main text of the final report).</p> <p>The practical training took place on the following days with the collection of the lignocellulosic substrate (sawdust). It was also, under the participation of local people, chosen a space for the incubation of the crops. Thus, a space (see the main text of the final report) was quickly set up respecting the minimal rule for a mushroom farm (minimum luminosity, shade, not too high temperature). The collected substrate was then soaked and mixed with water for the formulation of the substrate bags for cultivation. After the formulation of the substrate bags, the demonstration on pasteurisation was done (see main text of the final report). After the pasteurisation was completed, the participants were shown the strategy for checking the moisture content of the substrate before seeding. The pasteurised substrate was cooled down before seeding. Participants were then trained on the seeding technique (see main text of the final report). All seeded substrates were placed in incubation. Finally, we demonstrated to the participants the monitoring technique (watering, control of substrate colonisation).</p>
<p>Communicating conservation strategies at the community level</p>			<p>Flyers and posters were used to communicate the importance of saving the swamp forest of Lokoli and show to the population how their pressure on this forest affects the fungal diversity. The group of 25 volunteers in mushroom cultivation training were used as our focal point in each village to mobilise population during the</p>

				awareness campaigns.
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**2. Describe the three most important outcomes of your project.**

The Lokoli swamp forest is reported to have a mycodiversity of 102 species of which 28 species are fully identified, and eight species are edible with *Candolleomyces tuberculatus* having the highest frequency of citation and called in Fungbe Dékpohounto (meaning: mushroom of dead feet of *Elaeis guineensis*). The ordinal logistic model type II analysis of variance indicates that the frequency of consumption of mushrooms is significantly influenced by both the availability of these resources, the accessibility of fruiting bodies collection sites and the degree of appreciation of the species by the consumers. A total of 25 volunteers were introduced to and trained in mushroom cultivation.

**3. Explain any unforeseen difficulties that arose during the project and how these were tackled.**

The mycological survey series was originally planned to be carried out in two phases: November to December 2021 and May to June 2022. Unfortunately, the funds were not quickly available due to a small problem in the transaction process and so the November to December 2021 collection phase did not take place. To address this, we have extended the second collection phase to 4 months i.e., May to August 2022. In addition, when the rains became heavy, some plateaus and their access roads were flooded, which explains the fact that at certain times not all plateaus recorded the same number of sampling frequencies. To compensate for this gap, transects were made and several fruit bodies were collected.

The most significant achievement of this project is the documentation of the fungi of a particular habitat never surveyed in terms of fungi and the training of 25 volunteers in the mushroom cultivation.

**4. Describe the involvement of local communities and how they have benefited from the project.**

Contrary to our initial assumption that the population of Lokoli would have little knowledge about the use of mushrooms, this project has made it possible to realise the wealth of knowledge of the population of Lokoli about the use of mushrooms. Thanks to this project, some populations with a lack of knowledge about mushrooms have been able to deepen their level of knowledge about mushrooms and their different uses. In addition, the training series on mushroom cultivation has allowed the population to touch the reality. The commercial opportunities in the edible mushroom sector in other parts of Benin were also revealed to the local population of Lokoli. The success of the series of mycological surveys (field guides to show suitable habitats, ethnomycological (translator), mushroom cultivation training (participants), and sensitisation (mobilisation of villagers) was possible thanks to the involvement and help of the local population during all these activities.

## **5. Are there any plans to continue this work?**

The Lokoli swamp forest is a unique and special ecosystem. Of the 102 possible species, only 28 species have been fully identified. This means that efforts need to be made to identify the remaining specimens to reveal new species to science and the first records in Benin. In the field it was observed that trees were being felled in the heart of the forest, which shows a need for reforestation of the forest with some typical trees such as *Milicia excelsa*, *Azelia africana*, *Khaya senegalensis*, and *Pterocarpus erinaceus* whose dead wood is favourable to the growth of saprotrophic fungi and the possibility of ectomycorrhizal fungi. Finally, the populations expressed the need to make mushroom cultivation an income-generating activity to reduce certain activities such as agriculture, tree debarking and the production of Raphia wine which have a negative impact on the biodiversity of Lokoli.

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

At the local level, the findings of this project will be presented to NGOs in the framework of biodiversity conservation, policymakers, and forest managers during the monthly seminar held at our laboratory. Pamphlets of Lokoli mushrooms will also be printed and given to the local guide for tourist use. At international level, Findings will be published in an international peer-reviewed journal, preferably open access to maximally share the results with a broad community of scientists. Further, electronic versions of posters and flyers on mushroom cultivation and awareness campaign will be published on our ResearchGate account, again freely accessible to everyone as well as the social networks of our laboratory such as Twitter, Facebook, and website. Last but not least, the data from this project will be used by a master's student in Natural Resource Management at the Faculty of Agronomy, University of Parakou to write and defend his master thesis.

## **7. Looking ahead, what do you feel are the important next steps?**

As mentioned above, the diversity of fungi in the Lokoli swamp forest is still incomplete and further sampling efforts are needed to collect some species before they disappear from the forest because of the pressure of local population on their habitats. In addition to this, several habitats in the Lokoli swamp forest are degraded by the felling of threatened trees such as *Milicia excelsa*, *Azelia africana*, *Khaya senegalensis*, and *Pterocarpus erinaceus*. A reforestation activity of degraded habitats will be crucial for the better preservation of the forest. During the implementation of this project, local people expressed the demand to be organised into groups and to have the necessary monitoring and consumables to make mushroom production an income-generating activity that could enable them to reduce their pressure on the forest. These different points show the need to further our work in this forest.

**8. 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?**

The Rufford Foundation logo was used throughout the activities of this project. First when the project was granted, we published this on our lab's Facebook page and the logo was of the foundation was highlighted. In addition to this, we edited posters for the ethnomycological surveys, and the logo was also used. Finally, on the t-shirts, flyers, and posters used during the mushroom cultivation training and awareness campaigns.

The foundation did not receive any publicity during the courses of our work, but we provided all the necessary elements in the main body text of the final report.

**9. Provide a full list of all the members of your team and their role in the project.**

**Mr Pierre:** He is a local guide who knows the SFL very well. He is native of Lokoli and speaks the local language. He was involved in the implementation of all project activities in the field.

**Romain Kpatiou:** Field agent. He collected data in the forest for 4 months.

**Abdoul Azize Boukary:** PhD student at the University of Parakou and works on mushroom domestication. He was one of the trainers during the mushroom cultivation.

**Hounwanou Basile:** PhD student at the University of Parakou. He was a key agent during the training and sensitisation of the local population.

**10. Any other comments?**

Our acknowledgments to The Rufford Foundation for the financial support to carry out this project on sustainable uses and conservation of biodiversity in Lokoli.