

Final Evaluation Report

| Your Details | |
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| Full Name | Aignon Loubégnon Hyppolite |
| Project Title | Conservation of ectomycorrhizal fungal and their habitat: Challenges for sustainable management of biodiversity in Benin (West Africa) |
| Application ID | 30738-2 |
| Grant Amount | £6000 |
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| Date of this Report | 11.02.2021 |

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 |
|--|--------------|--------------------|----------------|--|
| 1) Analyse the distribution and diversity of ectomycorrhizal fungi and their partner trees | | | | 43 taxa divided into 20 genera in Koussoucingou gallery forest and 68 taxa divided into 20 genera and 12 families in Kota gallery forest were identified during the mycological season. These EcM fungi were associated with Fabaceae, Cesalpiniaceae, Dipterocarpaceae, Phyllantaceae, Mimosaceae, Casuarinaceae, Lauraceae and/or Myrtaceae species. |
| 2) Determine the most sensitive fungal habitats to facilitate their protection | | | | In both forests (Koussoucingou and Kota), the riversides are more productive and more diversified in fungal species due to the presence of EcM trees and humidity associated. |
| 3) Enrich the forests area degraded by ectomycorrhizal trees such as <i>Berlinia grandiflora</i> (Vahl.) Hutch. & Dalz. and <i>Isobерlinia doka</i> Craib & Stapf; | | | | In total, 2000 plants (1000 <i>Isobерlinia doka</i> and 1000 <i>Berlinia grandiflora</i>) have been kept in the nursery for 5 months before the reforestation for restoration of degraded habitats. |
| 4) Establish the dialogues with local population to ensure the preservation of fungal habitat for the long-term viability of ectomycorrhizal fungal species and their habitat. | | | | We discussed with the local community on the role and usefulness of fungi in the forests and good practices for wild fungi conservation as well as their habitat. |

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| 5) Propose a sustainable management plan for ectomycorrhizal trees to avoid their destruction during forest management works | | | | A management plan was archived over a period of 10 years for Koussoucoingou gallery forest. Kota present a management plan before our project. |
| 6) Establish an educational program for sustainable management and protection of biodiversity in Benin. | | | | Fungi education plan was established for association of women, local development groups, local NGOs, schools, tourists and forest administration. We invited them to protect during their activities, EcM trees encountered in each of the two forests taken into account by the project in order to promote the production of EcM fungi. |

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

The difficulties are notably linked to the COVID-19 pandemic. People were afraid to go out so as not to contract the virus during awareness activities. We then took health precautions and invited them to respect sanitary rules such as hand washing, wearing a mask and social distancing. Also, radio communication has helped us a lot to reach a large audience.

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

1) EcM tree diversity in Benin

| Family | Species | Habitat | References |
|----------------|---|---------------------------|---------------------------------------|
| Fabaceae | <i>Isoberlinia doka</i> Craib & Stapf | Woodland | Ducousso et al. 2003 ; Bâ et al. 2014 |
| | <i>Isoberlinia tomentosa</i> (Harms) Craib & Stapf | Woodland | Ducousso et al. 2003 ; Bâ et al. 2014 |
| | <i>Berlinia grandiflora</i> (Vahl) Hutch. & Dalziel | Woodland | Ducousso et al. 2003 ; Bâ et al. 2014 |
| Cesalpiniaceae | <i>Afzelia africana</i> Sm. ex Pers. | Woodland and dense forest | Ducousso et al. 2003 ; Bâ et al. 2014 |
| | <i>Burkea africana</i> Hook. | Woodland, Dense forest, | Yorou et De kesel 2011 |

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|------------------|--|---------------------------------|--|
| | | Savana | |
| | <i>Anthonotha crassifolia</i> (Baill.) J. Léonard | Woodland | Ducousso et al. 2003 ; Bâ et al. 2014, Adjakpa et al. 2011 |
| | <i>Anthonotha fragrans</i> (Baker f.) Exell & Hillc. | Woodland | Ducousso et al. 2003 ; Bâ et al. 2014 |
| | <i>Anthonotha macrophylla</i> P. Beauv. | Woodland | Ducousso et al. 2003 ; Bâ et al. 2014 |
| Dipterocarpaceae | <i>Monotes lutambensis</i> Verdc. | Woodland | Ducousso et al. 2003 ; Bâ et al. 2014 |
| | <i>Monotes kerstingii</i> Gilg | Woodland | Ducousso et al. 2003 ; Bâ et al. 2014 |
| Phyllanthaceae | <i>Uapaca togoensis</i> Pax | Woodland | Ducousso et al. 2003 ; Bâ et al. 2014 |
| | <i>Uapaca somon</i> Aubrév. & Leandri | Woodland and dense forest | Ducousso et al. 2003 ; Bâ et al. 2014 |
| | <i>Uapaca guineensis</i> Müll. Arg. | Gallery forest and dense forest | Ducousso et al. 2003 ; Bâ et al. 2014 |
| | <i>Uapaca heudelotii</i> Baill. | Dense forest | Ducousso et al. 2003 ; Bâ et al. 2014 |
| Mimosaceae | <i>Acacia auriculiformis</i> A. Cunn. ex Benth. | - | Ducousso et al. 2003 ; Bâ et al. 2014 |
| Casuarinaceae | <i>Casuarina equisetifolia</i> J.R. Forst. & G. Forst. | - | Ducousso et al. 2003 |
| Lauraceae | <i>Cinnamomum zeylanicum</i> Blume | - | Ducousso et al. 2003 |
| Myrtaceae | <i>Eucalyptus camaldulensis</i> Dehnh. | - | Ducousso et al. 2003 |

2) Description of new species to science

***Mallocybe africana* Aïgnon, Yorou & Ryberg**

Mallocybe africana is the first species of the genus *Mallocybe* from West African and Zambian woodlands dominated by ectomycorrhizal trees of Fabaceae and Phyllanthaceae. The new species *M. africana* is characterised by orange, brown fruitbodies, a fibrillose pileus, a stipe tapered towards the base and large ellipsoid basidiospores. It resembles many north and south temperate species of *Mallocybe*

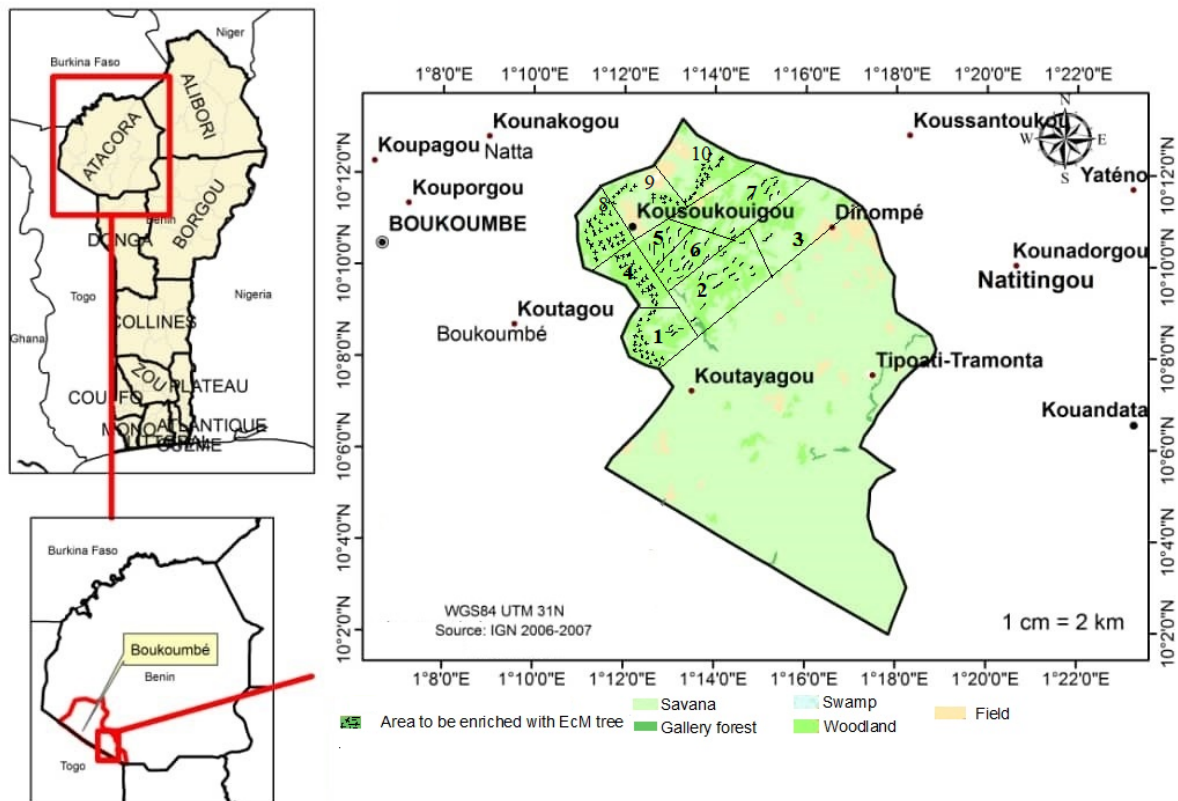
but is most closely related to the southeast Asian tropical species, *M. errata* (Aïgnon et al. 2021a).

***Inosperma africanum* Aïgnon, Yorou & Ryberg**

Common in West Africa, *Inosperma africanum*, is distinct from all species of *Inosperma* and truly outstanding by its vinaceous to red colouration. Characterised by pileus convex to plane, uniform, surface fibrillose, vinaceous to red, surface rimose, dry and stipe cylindrical, central, fibrillose, swollen and bulbous at the base (Aïgnon et al. 2021b).

3) Management plan

We present a management plan for the Koussoucouingou gallery forest which currently does not have one. The plan takes into account EcM fungi and fungal partner trees such as *Berlinia grandiflora*, *Isoberlinia doka*, *Isoberlinia tomentosa* (Harms) Craib & Stapf and *Uapaca togoensis* Pax and *Uapaca guineensis*.



Management plan of Koussoucouingou gallery forest

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

In this project, local communities played essential roles in yielding tangible and concrete results. Before and after the field activities, we spoke with the local chiefs of each village as well as forest managers. They have therefore helped us to sensitise

a large number of people on the importance of forests and the important role that fungi play. During the establishment of the seedlings and the reforestation, we had the help of the local people and they are ready to help us to maintain the reforested plants. School directors, foresters, village chiefs, hunters and mushroom collectors were very satisfied with the knowledge contributions and their implications in awareness-raising and reforestation and promised to continue to sensitise their neighbours on the importance of forest and mushroom conservation.

5. Are there any plans to continue this work?

I intend to continue this work because of the urgent to conserve mushrooms in natural habitat. Furthermore, I would like to orient the next actions towards more visible and concrete conservation activities such as mushroom production. Thus, it is desirable to contribute to the creation and implementation of alternative livelihood activities for local communities in the near future, in order to limit their dependence on forest products such as wood and charcoal production which constitute real threats to biodiversity. I am developing this proposal for a Booster Grant.

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

The results of the project are accessible on my profile <https://www.researchgate.net/>. Also, all results are shared with forest managers and environmental NGOs and, moreover, presented in national symposia of Laboratory of Ecology, Botany and plant Biology. In addition, *Mallocybe africana* Aïgnon, Yorou & Ryberg¹ and *Inosperma africanum*² Aïgnon, Yorou & Ryberg, two new species to science, have been identified, described and published respectively in Phytotaxa and Mycokeys.

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

February 2020 - February 2021. Project activities proceeded in normal time as predicted by the timeline. We anticipate and publish in open access two new species thanks to the project.

1. Aïgnon HL, Naseer A, Matheny BP, Yorou NS, Ryberg M. *Mallocybe africana* (Inocybaceae, Fungi), the first species of *Mallocybe* described from Africa. *Phytotaxa*. 2021;478(1):49-60. doi:10.11646/phytotaxa.478.1.3
2. Aïgnon HL, Jabeen S, Naseer A, Yorou NS, Ryberg M. Three new species of *Inosperma* (Agaricales, Inocybaceae) from Tropical Africa. *MycKeys*. 2021; 77:97-116. doi:10.3897/mycokeys.77.60084

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 |
|---|-----------------|---------------|-------------|--|
| Sequencing | 530 | 662 | +132 | We are described two new species for science |
| Expendable supplies for molecular analysis | 438 | 470 | +32 | We used CETAB dishes to store specimen samples for additional molecular analysis |
| Reforestation costs | 538 | 550 | +12 | Reforestation activities lasted longer than expected |
| Nursery following cost | 269 | 269 | | Na |
| Bags of tree nursery (respecting environmental norms) | 50 | 50 | | Na |
| Rent of two motorcycle field | 624 | 833 | +209 | The maintenance of the field motorcycles cost more than expected |
| Fuel | 1404 | 1525 | +121 | The price of fuel is high during the project period due to border closures. |
| Accommodation | 100 | 100 | | Na |
| Food | 1440 | 1220 | -220 | Food is cheaper in the villages and this has favoured us |
| Posters and brochures | 607 | 607 | 0 | Na |
| Totals: | 6000 | 6286 | +286 | I paid the difference myself |

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

The local communities who live near the forests are in extreme poverty and this is what justifies the increased deforestation observed. To slow this down, they must install significant development activities to enable them to survive without compromising the future generations. Thus, it is necessary to develop nursery activities, mushroom production which can bring them money immediately and lead them to forget the production of charcoal, the cutting and the sale of wood.

Regarding forest management, we will help them set up a management committee that will focus on forest protection. In addition, it is also essential to carry out a major reforestation campaign in order to restore a large, degraded area.

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?

I acknowledged Rufford Foundation in all publications and presentations, including the poster and reports. Also, at the university, I regularly share information on the activities of the Rufford Foundation with my colleagues.

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

For the success of this project:

Mustafa Imourou helped us to sensitize people to change their behaviour in terms of conservation of fungi and their habitats.

Ghislaine Yahoudehou and **Appolon Hegbe**, played a key role in the data collection and analysis of data on the diversity and distribution of species.

Feïçalath B. Seidou, who helped in the creation of the list of fungal partner trees.

12. Any other comments?

This grant has played a vital role in my career as researcher. I also acquired scientific and project management skills, but it's also contributed significantly to sensitising people on forest management and the importance of mushrooms. Many thanks to The Rufford Foundation.