

Final Evaluation Report

Your Details	
Full Name	Enagnon Bruno Lokonon
Project Title	Rural communities-based approach for the sustainable conservation of <i>Caesalpinia bonduc</i> (L.) Roxb in Central and Northern Benin
Application ID	33386-2
Grant Amount	£6000
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Date of this Report	28 February 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
Update local knowledge of <i>C. bonduc</i> in Central and Northern Benin				An ethnobotanical survey was conducted with 252 people in five localities of central and northern Benin. Local knowledge, perception and strategies for the species conservation were successfully recorded and accessed.
Update the current distribution of <i>C. bonduc</i> in Central and Northern Benin				Geographical coordinates of all individuals of <i>C. bonduc</i> were recorded through 15 transects established in central and northern Benin. A total of 192 occurrences were recorded during the fieldwork and 49 were retained from GBIF (www.gbif.org).
Model the suitable habitats of <i>C. bonduc</i> in Central and Northern Benin				Five algorithms including random forest, boosted regression trees, maximum entropy, generalised linear models and generalised additive models were used to model the current and future distribution of <i>C. bonduc</i> through present day combined with two future forecasts: low-RCP4.5 and high-RCP8.5 emission scenarios. The results have been published as Wouyou et al. (2022).
Train local people on of <i>C. bonduc</i> Production in nursery				A total of 53 people have been trained through farmer field schools on seed collection, choice of nursery site, site preparation, seed pre-treatment and germination, seedling potting, watering and planting. Two training workshops have also been organised and about 175 people representing NGOs, nurserymen, and local farmers associations have been trained on the advanced techniques of production of <i>C. bonduc</i>
Plant the produced seedlings				About 2100 seedlings have been distributed and have been planted in agroforestry parklands, home gardens and botanic gardens.

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

The main difficulties encountered during the project include the unavailability of *C. bonduc* seeds. We were thus obliged to buy seeds of the species. We bought also hydroalcoholic solutions and masks to participants of the workshops and farmer field schools due to COVID-19 disease. The global budget has been adjusted taking into account these unforeseen expenses.

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

- The first important outcome of this project is related to the determination of suitable areas for reintroduction and cultivation of *C. bonduc* in the wild. Occurrence data have been firstly collected from central and northern Benin and have been sent to open access portal GBIF (Global Biodiversity Information Facility) representative in Benin for making it available. Moreover, these data obtained from central and northern Benin have been added to those recorded from southern Benin during the first RSG project. Species distribution modelling has been applied to the data through five algorithms including random forest (RF), boosted regression trees (BRT), maximum entropy (MaxEnt), generalised linear models (GLMs) and generalised additive models (GAMs). The aim was to determine the suitable areas for the cultivation of the species in Benin. The current and future distribution of the species using present day combined with two future forecasts: low-RCP4.5 and high-RCP8.5 emission scenarios have been modelled. A paper entitled "Predicting the potential impacts of climate change on the endangered *Caesalpinia bonduc* (L.) Roxb in Benin (West Africa)" has been written and published in Heliyon journal as Wouyou et al. (2022). From the results, it is found that the highly suitable areas for the cultivation of *C. bonduc* in Benin are mainly located in southern and central Benin. Moreover, MaxEnt and BRT predicted reduction in the highly suitable areas of the species in Benin based on the two future scenarios considered.
- The second important outcome concerns the different trainings organised in favour of the local people. A total of 53 people have been trained through farmer field schools on seed collection, choice of nursery site, site preparation, seed pre-treatment and germination, seedling potting, watering and planting. Two training workshops have also been organised and about 175 people representing NGOs, nurserymen, and local farmers associations have been trained on the advanced techniques of *C. bonduc* production in nursery.
- The third important outcome of this work is related to the update of local knowledge of *C. bonduc* in central and northern Benin. The surveys show that the species is widely used in traditional medicine. The species has been reported to treat among others sexual weakness, child head disease and stomach ache. About 46.83 % of the respondents think that the species has disappeared in the wild while 28.17 % of them think that the species has decreased. The main causes of disappearing and decreasing of the species

are roots overexploitation (53.97 %), and agricultural expansion (15.08 %). About 41.00 % and 37.00 % of the respondents think that there is respectively a very urgent and urgent need for conservation of the species in central and northern Benin. The most used strategies for conservation of the species are harvesting reduction (53.17 %), and seedlings protection (27.38 %).

4. What do you consider to be the most significant achievement of this work?

5. Briefly describe the involvement of local communities and how they have benefited from the project.

Local communities from central and northern Benin were closely involved in this project through ethnobotany survey, farmer field school and training workshops. Their full involvement in these stages of the project was a key element for our achievement. Like for the first project, the involvement of the local communities has exceeded my expectation.

The participants in the farmer field school were trained in seed collection, choice of nursery site, site delimitation and fence installation, seed pre-treatment and germination, sowing seeds in pots and aligning pots on a board, seedling watering and seedling planting. During the workshops, they have been educated on the risks of extinction of the species and the associated loss of benefits to people. They have been trained on how to grow the species in nurseries and replant in agroforestry systems. They have also been sensitised on seedling protection in the agroforestry systems.

The participants benefit from the project by receiving produced seedlings that they planted in their agroforestry systems and/or home gardens. Moreover, the training they received can help them to install nurseries and produce seedlings of *C. bonduc* or other species that they can sell to generate incomes.

6. Are there any plans to continue this work?

Through the first two projects, the most suitable areas for the cultivation of *C. bonduc* in Benin have been identified. This constitutes an important step for future activities related to the reintroduction of the species in the wild. Soon, I plan to start the activities related to the species reintroduction in the wild in Benin if I received a financial support.

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

- The results related to the distribution of *C. bonduc* in Benin have published Heliyon journal, an open access scientific journal available for everyone.
- The activities of the project have been published in the newspaper "Le Rural", the Benin's first weekly newspaper of agricultural and rural information.
- Occurrence data will be available on the open access portal GBIF (Global Biodiversity Information Facility).

- A technical report has been produced on the species and is currently available on my Rufford Small Grant web page and on Researchgate.
- Pamphlets have been prepared on the different steps of production of the species in nurseries and shared with local communities.
- The summary of the activities and pictures are also shared through Facebook.
- I also plan to share the current findings with others through participation in scientific activities (conferences and webinars).

8. 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 January 2021 to February 2022 (11 months). The anticipated length of the project was 11 months. The planned activities have been successfully completed during this period.

9. 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
Room renting	300	300		Totally consumed
Accommodation and food	800	800		Totally consumed
Workshops transport per diem	400	400		Totally consumed
Pamphlets	100	100		Totally consumed
Planting cost	1000	1000		Totally consumed
Assistants for nursery activities	500	500		Totally consumed
Guides (Ethnobotanical survey)	400	350	-50	We negotiated a lower price with the guides
Fuel for motorbike	800	800		Totally consumed
Motor-bike rental	600	500	-100	We have negotiated a lower price with the owners
Travel to reach all research sites	600	600		Totally consumed
Communication: internet, phone	150	150		Totally consumed
Questionnaire sheets and field guide	100	100		Totally consumed

Tree species labelling	250	200	-50	The price of labels has fallen
Hydroalcoholic solutions and masks		150	+150	Hydroalcoholic solutions and masks were used as controlled measures against COVID-19
Purchase of seeds	0	50	+50	Seeds have been bought to complete those collected from fields.
Total	6000	6000	0	

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

Through this project, I noticed the low germination rate of *C. bonduc* due to its hard seeds. Thus, for large-scale production, it is essential to know the best germination techniques and also to see the impact of the provenance of the seeds on the germination and development of young plants. This preliminary study will make it possible to obtain the best germination techniques and the best provenances of the seeds. The combination of provenances and germination techniques offering the best growth parameters will be important for the reintroduction of viable and vigorous seedlings in the wild. These are the activities I intend to carry out in the future.

11. 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?

Everywhere we presented the project through newspaper or Facebook, the Rufford Foundation Logo was used. In addition, during training activities, 300 pamphlets where logo was used were shared. The logo was also used in the technical report published on Researchgate.

Moreover, the financial support was also acknowledged in the scientific paper published in Heliyon journal as Wouyou et al. (2022).

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

The team is composed of:

Lokonon Enagnon Bruno, I am the principal investigator of the project.

Charlemagne Gbemavo, PhD, Researcher at the Laboratoire de Biomathématiques et d'Estimations Forestières, University of Abomey-Calavi and at the Université Nationale des Sciences, Technologies, Ingénierie et Mathématiques (UNSTIM). He is a specialist in biometry and forest modelling. He gave advice for modelling current and future distribution of *C. bonduc* and data processing.

Gafarou Agoundé, MSc. He is specialized in natural resources management. He was a field assistant and was involved in data collection.

Fabrice Sodoté, MSc. He was involved in nursery and plantation activities.

The non-governmental organization named "SOS Biodiversity" and its director **Mr Sunday Kakpo** were involved in all activities of the project, in particular the communication and the sensitization.

13. Any other comments?

I would like to take this opportunity to thank The Rufford Foundation for giving me the opportunity to implement this project. This work helps me in building my career and allows me to contribute to the sustainable management of native species in Benin.