Final Evaluation Report

Your Details	
Full Name	Loyapin Bondé
Project Title	The overharvesting of Non-Timber Forest Products is great threat to West African savannas conservation: Urgent to develop sustainable use strategies
Application ID	27752-1
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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
Exploring local knowledge and perception on destructive methods used for NTFP harvesting				Individual interviews based on socio-professional profile of people (children, women, herders and old persons) were conducted in three villages of the study area. In total, 104 people were interviewed. The results indicated that children and women perceived NTFP species to be abundant in their current status while herders and old persons perceived that these species were in decline. This suggests that specific awareness message considering socio-professional profiles of people needs to be developed for an effective conservation impact in the field. For instance, environmental education needs to be taught to young people to influence their attitudes toward long-term conservation of plant species and habitats. Results also showed that 82.3% of respondents declared that harvesting methods had no significant impact on spatial and temporal distribution of the species, revealing that most people are still using forest resources in traditional considerations and deliberately ignore the impact of destructive methods on NTFP species and their habitat in favour of meeting their own needs. Overharvesting index (OI) calculated from three pressure parameters showed that eight species are overharvested by people which are represented by *Pterocarpus erinaceus* (OI = 122.1%), *Saba senegalensis* (OI = 100%), *Lannea microcarpa* (OI = 97.4%), *Khaya senegalensis* (OI = 82.3%), *Tamarindus indica* (OI = 73.4%), *Parkia biglobosa* (OI = 69.8%), *Vitellaria paradoxa* (OI= 69.1%)

				and *Pterocarpus lucens* (OI =53.6%). Except *Vitellaria paradoxa*, all overharvested species are primarily harvested using branch pruning.
Assess the effects of uncontrolled branch pruning on tree architecture and habitats degradation				Data on tree architecture and habitat degradation were collected in 120 plots distributed in three land use types (cultivated fields, fallow areas and natural savannas). We found that at plot level, 23.76% of tree species are pruned for NTFP harvesting leading to the reduction of land cover at 90.45 m² per ha. Overharvested species presented a very low tree density. The following tree density (N) were found for each overharvested species: *Pterocarpus erinaceus* (N = 3.11 trees/ha), *Saba senegalensis* (N = 1.05 tree/ha), *Lannea microcarpa* (N = 8.61 trees/ha), *Khaya senegalensis* (N = 0,29 tree/ha), *Tamarindus indica* (N = 1.15 trees/ha), *Parkia biglobosa* (N = 1,25 trees/ha), *Vitellaria paradoxa* (N = 6.71 trees/ha) and *Pterocarpus lucens* (N=5,11 trees/ha). Regarding species regeneration, we also found that juveniles of overharvested species are less represented in habitats with density considered as very low from 0 to 153.33 individuals per ha.
Assess the effects of uncontrolled branch pruning on potential of fruit/seed production of three species over-pruned				Data were collected on 96 trees of two over-pruned species, especially *Lannea microcarpa* and *Pterocarpus erinaceus* with 48 trees per species. Sampled trees were ranged into four pruning degrees from no-pruning (0% of crown pruned) to heavily pruned (>50% of crown pruned). Results showed that 40.30 % of branches are pruned per tree for fruit harvesting in *Lannea microcarpa* and 45.08% of branches are pruned per tree for leaves harvesting in *Pterocarpus erinaceus*. Regarding fruit production, data were only collected for *Lannea microcarpa* and results indicated that fruit biomass loss due to branch pruning is estimated at 24,31% of the potential production (production of tree not pruned). Indeed, potential production was estimated at

				82.18 kg of fruits per tree while production in tree pruned was 62.19 kg per tree, indicating a loss of 19.99 kg of fruits per tree pruned. Surveys were conducted on local and urban markets to assess economic loss related to production loss due to branch pruning. Based on the price of 1 kg of fruits in markets, economic loss was estimated at 4.19 $ and 8.59 $ per tree in local and urban zones respectively. Leaves of *Pterocarpus erinaceus* are high forage value and therefore, branches of the species are pruned by herders to feed livestock in dry season. On field we noticed that the evaluation of the loss in forage (leaves) would be more significant in terms of awareness than the loss in seeds of the species. Therefore, we assessed foliage production loss related to branch pruning. Potential foliage biomass was estimated at 15.54 kg per tree while foliage biomass for tree pruned was 9.78 kg per tree, resulting in a loss of 5.76 kg per tree (which is 37.07% of potential biomass). *Saba senegalensis* is listed among species over-pruned but unfortunately, we did not find appropriate methods to assess the effect of branch pruning on its fruit/seed production as it is liana species. Reflection is still undergoing to find specific method for next studies.
People awareness				People awareness was operated at three levels: assisted regeneration, workshop and media (radio). Assisted natural regeneration was conducted with the involvement of local people to protect 150 juveniles from species with lowest regeneration (*Khaya senegalensis*, *Tamarindus indica*, *Pterocarpus erinaceus* and *Saba senegalensis*). A workshop was organised with local community on April1st 2022 in the municipality of Douroula to discuss about the implications of our findings in species conservation and sustainable use of forest resources, propose best methods for NTFP harvesting and/or alternative

				solutions in participative approach. 43 participants including ecologists, children, women, herders and local leaders attended to the workshop. Results of the project activities were shared with participants in oral and poster presentations. At the end of the workshop the following common methods were proposed by participants. 1. Promoting of the use of pole for fruit harvesting instead of branch pruning. 2. Avoid integral harvesting of fruits by focusing on accessible fruits. The remaining fruits on the trees can serve as seed bank in the habitats for the regeneration of the species. 3. Cutting of leafy and fruiting twigs for harvesting instead of large branch pruning to enable the fast renewal of branches. Alternative solutions and recommendations were also formulated as follows. 1. Promote planting of native species by raising awareness and training local communities in the silviculture of these species. 2. Promote planting of forage species with fast growth to reduce human pressure on tree forage species in natural savannas. 3. Establish local committees in the management and sustainable use of NTFP species to discuss, train and sensitise people, but also to sanction infractions according to their own criteria. 4. Widely disseminate the results of this project to raise people's consciousness about the negative effects of the use of destructive methods for NTFP harvesting on species conservation and ecosystem services providing.

2. Describe the three most important outcomes of your project.

a). The local community became aware of the negative effects of branch pruning for NTFP harvesting during the presentation of the project results at the workshop. By seeing the losses in fruit and foliage production as well as the economic losses associated with the use of destructive methods, people became aware of the

impact of these methods on long term conservation of the species and suppling of NTFPs. Indeed, they ignored or deliberately neglected these impacts because they never took care to assess economic losses and ecological consequences related to branch pruning. They realised that they are the most affected and the future of their children is compromised if attitudes do not change. Therefore, they decided to be ambassadors for plant conservation awareness in their community. Participants at the workshop are also expressed their willingness to plant local species in their agro-ecosystems. For many, local species are slow growing and abundant in natural habitats, so they do not need to plant them. But after the workshop they understood that it is imperative to plant these species not only for strengthening their long-term conservation but also for the well-being of future generations.

b). 150 juveniles from species with lowest regeneration (*Khaya senegalensis*, *Tamarindus indica*, *Pterocarpus erinaceus* and *Saba senegalensis*) were naturally assisted to create suitable conditions for their survival and growth. This will increase tree density of these species in natural habitats, contributing to their long-term conservation.

c). The implementation of the project has helped to develop and strengthen scientific skills on the issue of biodiversity and ecosystem conservation. A PhD student was involved in the implementation of the project activities and will use the project data to write and defend his PhD. Therefore, the project will contribute to professional career building to further develop research and projects in biodiversity and ecosystem conservation. The results of the project have also strengthened the scientific knowledge of the researchers of our institution.

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

The main difficulties we met were related to Covid-19 context. Restrictions due to Covid-19 protecting measures delayed the implementation of the project activities for almost 6 months. Indeed, the study site is in a region that has been under containment several times due to increasing cases of Covid-19 and, therefore, we were forced to postpone our field work to later periods. In the original plan, focus group discussions should be conducted immediately after the individual interviews to identify common conservation methods. However, to avoid multiple groupings of people, we conducted the focus group discussions during the final workshop. Methods were thus identified, and recommendations were also made as mentioned in Activity 4 (people awareness). In addition, the individual interviews were limited to 104 people instead of the 249 people initially planned. Indeed, the interviews were conducted in 2020 when the rural people were afraid to meet people, especially those coming from large cities such as Ouagadougou where there were significant cases of Covid-19. The data collected on a sample of 104 people was statistically reliable and was published in the journal "Ethnobotany Research & Applications"

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

Local communities actively participated in ethnobotanical investigations by providing honest and useful information about methods use for NTFP harvesting. They were also involved in the implementation of assisted natural regeneration (ANR) to improve the recruitment of juveniles of species with lowest regeneration. During this activity, they benefitted from practical training on how to carry out ANR, especially to protect species from fire and livestock. The involvement of local communities in the final project workshop was very significant. They strongly contributed to the discussions for the identification of NTFP harvesting methods that do not compromise the conservation of species and their habitats as well as to the formulation of alternative solutions. Participants will certainly put into practice the methods and solutions proposed at the workshop and communicate them to their respective communities, which will strengthen the sustainable use of the species and their conservation. Moreover, this project supported two assistants for fieldwork and one interpreter for ethnobotanical surveys. They were recruited and paid during the whole data collection and workshop activities. 24 people participated to ANR implementation on field and benefitted subsistence allowance, which was a great relief for some households in food shortage.

5. Are there any plans to continue this work?

Yes, we planned to continue this work by focusing on the following points:

- Particular attention will be paid to *Ptercarpus erinaceus* which has been identified as the most overexploited species in the study area but also classified as endangered species by IUCN. We plan to improve its conservation status by addressing issues related to its regeneration, growth and habitat protection.

- Monitoring of juveniles naturally assisted through dendrometrical characteristics measurement and survival assessment.

- Provide environmental education for children (including primary and middle school students) and women on the sustainable use of NTFP species. Indeed, these groups that are strongly involved in NTFP harvesting still considering NTFP species to be abundant whereas populations of these species are really in decline.

- Promote planting of native species by raising awareness and training local communities in the silviculture of these species.

- Establish local committees in the management and sustainable use of NTFP species to discuss, train and sensitise people, but also to sanction infractions according to their own criteria

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

We planned to share our results using four communication means:

I. Media: awareness messages based on fieldwork data and workshop results are being developed and will be shared to general public using radio announcements every week for 6 months.

II. Scientific journal publications: We already published a paper entitled "Assessing human pressure on wild food and forage tree species for designing effective conservation actions in West Africa Sahel region" in Ethnobotany Research & Applications. A second paper is under preparation and will be soon submitted in peer review journal.

III. Posters and oral communications at scientific events: We already presented two oral communications at scientific workshops at Ziniaré in 2020 and Dédougou in 2022. A poster was also presented at a scientific event at Sao Paulo in Brazil in 2019. We are still seeking possible scientific events to share our results.

IV. Teaching: Being a teacher-researcher at the University Joseph KI-ZERBO, we will use our results to support our teaching on ecosystem degradation.

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

For the next steps, it is important to:

- Improve conservation status of *Pterocarpus erinaceus*, an endangered species, by addressing issues related to its regeneration, growth and habitat protection

- Promote planting of native species by raising awareness and training local communities in the silviculture of these species.

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?

Yes, the logo of The Rufford Foundation was used in posters and oral communications in scientific events where the foundation was publicly acknowledged as the funder of our project:

- São Paulo School of Advanced Science on Scenarios and Modelling on Biodiversity and Ecosystem Services to Support Human Well-Being from 1st to 14th July 2019, in São Pedro, São Paulo, Brazil. During the school, I also presented a poster addressing the question «Why the sustainable management of food tree species is a great challenge for human well-being? »

- Give back workshop of the research results of the project "Senna Obtusifolia Management (SOM)", Ziniaré, 24th November 2020, Burkina Faso. During the workshop, the PhD student involved in the project present oral communication entitled "Human pressure on forage tree species in the region of Boucle du Mouhoun, Burkina Faso"

- 1st edition of the Scientific Days of the University of Dédougou, 12th to 15th January 2022, Burkina Faso. During this scientific event, the PhD student involved in the project present oral communication entitled" Food trees face to anthropic pressure: which solutions for a sustainable exploitation?"

Our scientific papers and the project supported by The Rufford Foundation are also presented in ResearchGate (https://www.researchgate.net/profile/Loyapin-Bonde) and ORCID ID (https://orcid.org/0000-0002-9399-8644) for publicity.

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

Dr. Loyapin Bondé, Teacher-Researcher at Université Joseph KI-ZERBO/ Laboratory of Plant Biology and Ecology. Project grantee, I coordinated the project activities and contributed to fieldwork, workshop organization and preparation of scientific papers and final report of the project.

Mr. Bossila Séraphin Hien, PhD Student at Université Joseph KI-ZERBO in Plant Biology and Ecology. He contributed to fieldwork (data collection) and dissemination of project results (posters, communication and articles).

Mr. Bakari Deme, fieldwork assistant and contact person in the municipality of Douroula for local community organisation during the workshop.

Prof. Oumarou Ouédraogo, Teacher-Researcher at Université Joseph KI-ZERBO/ Plant Biology and Ecology. He is the supervisor of the thesis work of the PhD student (Bossila Séraphin Hien). I contributed to fieldwork supervising and manuscript revision.

Dr. Sié Sylvestre Da, Scientist at West African Science Service Center on Climate Change and Adapted Land Use. He was the contact person at the host institution and helped in the coordinating of the project activities and reviewing of the manuscript.

Prof. Issaka Joseph Boussim, Teacher-Researcher at Université Joseph KI-ZERBO. He is the Director of the laboratory of Plant Biology and Ecology and member of our research team. He contributed to manuscript revision and shared his experience during the project implementation.

10. Any other comments?

We thank The Rufford Foundation for supporting this project which has significantly contributed to the development of my scientific career and training of new skills in plant and ecosystem conservation studies.