Final Evaluation Report

Your Details	
Full Name	Jakelyne Suélen Bezerra de Sousa
Project Title	Slash-and-burn agriculture and the resilience of the Caatinga dry forest: implications for socioecological sustainability
Application ID	33318-1
Date of this Report	22/08/2023

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
To compare seed bank damage and viability, as well as structure, especially with regard to seed density and diversity, and taxonomic and functional composition of seed bank assemblages in response to slash-and-burn agriculture.				This objective was satisfactorily achieved, combined with a continuous process of expanding scientific issues. 1) We carried out a slash-and-burn agriculture experiment to quantitatively evaluate the effects of fire used in this agricultural method on the seed bank. 2) We performed seed viability analyses through the tetrazolium test. In parallel, we analysed how slash-and-burn agriculture impacts seed community attributes. 3) We published a scientific article with the results of this specific objective in early 2022;
Quantify the impact of slash-and-burn agriculture on the seed rain, as well as structure, (seed density and diversity), and taxonomic and functional composition of seed rain assemblages.				This objective was satisfactorily achieved, combined with the training of human resources through an undergraduate student, who completed his course conclusion work on topics addressed in this project.
To understanding the impact of slash-and-burn agriculture on the plant resprouting				This objective was satisfactorily achieved through a quantitative analysis of the ability to regrowth of woody plant species in our study area.

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

a). Objective 1: I found a significant reduction in the frequency and proportion of intact (undamaged) seeds after fire, and a 3.6-fold decrease in the proportion of viable seeds of the soil seed bank. While seed density remained constant, species diversity declined dramatically after the fire, especially the number of rare species. The compositional dissimilarity (β-diversity) between plots also decreased after the fire, particularly its turnover component, causing the homogenisation of seed assemblages across space. The functional composition of seed assemblages was also altered, with the relative frequency of shrub species increasing after fire,

especially species with fleshy fruits and biotic dispersion, (For further details see Bezerra, J.S., Arroyo-Rodríguez, V., Tavares, J.M., Leal, A., Leal, R.I., Tabarelli, M., 2022. Drastic impoverishment of the soil seed bank in a tropical dry forest exposed to slash-and-burn agriculture. For. Ecol. Manage. 513, 120185 https://doi.org/10.1016/j.foreco.2022.120185).

b). Objective 2: The density of propagules was reduced by 15 times in burned plots when compared to forest plots. Species diversity, particularly the number of rare species, decreased in burned plots. No difference was observed regarding the composition and functional of the seed rain assemblages, (For further details see Bezerra, J.S., Arroyo-Rodríguez, V., Dupuy-Rada, J.M., Leal, I.R., Tabarelli, M., 2023. 244 Negative impact of slash-and-burn agriculture on the seed rain in a tropical dry forest. 245 For. Ecol. Manage. 531, 120821). Also, we evaluated the proportion of viable seeds in the seed rain of native and regenerating forests using the tetrazolium test. However, we observed that viable seeds represent only 12% of the total number of seeds that arrive in native and regenerating forests. The proportion of viable seeds was approximately 8.3 times higher in native forests than in regenerating forests, evidencing the contribution of local adult trees increasing the proportion of viable seeds in native forests. Finally, seed size does not seem to interfere with seed viability, suggesting little influence of species traits on seed viability, (Bezerra, J.S., Arroyo-Rodríguez, V., Tavares, J.M., Santos, M.G, Meave, J.A., Leal, R.I., Tabarelli, M. *Habemus* seeds but they are inviable: the importance of assessing seed viability in the seed rain, Journal of Arid Environments, Under review).

c). Objective 3: In general, it seems that fire has little effect on the available regrowth bank, since a small decrease in the number of regrowth plants after fire was observed. Furthermore, most surviving plant individuals are associated with a subset of the original flora. These results demonstrate that slash-and-burn agriculture can act by altering the assemblage of species, reducing its structure and functional and taxonomic composition, as well as causing the biotic homogenisation of communities across space, (For further details see Bezerra, J.S., Arroyo-Rodríguez, V., Tavares, J.M., Santos, M.G, Meave, J.A., Leal, R.I., Tabarelli, M. Slash-and-burn agriculture and its impacts on forest regeneration: The importance of the resprouting for forest resilience. Under preparation).

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

Carrying out this project generated important challenges, such as:

1) Access to the areas of the experiment through private properties made by initial agreements was made difficult over time or by external conflicts (e.g.: conflicts between residents and the park management).

2) Maintenance of vehicles, essential for access to the most distant plots and areas of the park. In this sense, to maintain the quality and excellence of the research developed, it was necessary to have reliable long-term partnerships, trying to avoid conflicts and explaining the importance of research to residents and seeking other means to reach the study plots. In general, I believe that I managed, to a certain

extent, to find solutions to difficulties that do not depend entirely on financial resources.

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

Local farmers were involved in all stages of the project (i.e., finding areas for the study, running the slash-and-burn agriculture experiment, and collecting seed samples and measuring resproutings). As a result of the project, farmers used the cut woody biomass to build fences and produce coal, as well as divide agricultural products among them. In addition, the families involved in the project (five families) were able to count on a small source of income, even for a short period of time, and thus avoiding the loss of forest services in the study landscape.

5. Are there any plans to continue this work?

Yes. To achieve the long-term objective of this research, other secondary studies are being/will be developed in the experimental plots. Most of these activities are part of monographs, dissertations, theses and research developed to understand the effects of anthropic disturbances (e.g., slash-and-burn agriculture, hunting and logging) on the structure and composition of species, as well as the patterns of taxonomic, functional and phylogenetic diversity of communities of different organisms in the caatinga.

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

Information about the project was posted on the LTEP-Catimbau homepage (www.peldcatimbau.org.br) which also includes a blog (peldcatimbau.org/blog) with scientific publications, project news, event information, among others. Additionally, I intend to create a practical guide and video on biodiversity-friendly agriculture that will also be shared with local communities and stored at www.peldcatimbau.org.br.

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

As future steps, I believe it is necessary to investigate the role of slash-and-burn agriculture on the shrubing process of the Caatinga dry forest through two questions:

1) Quantify the plant biomass exposed to slash-and-burn agriculture to observe the relative contribution of tree and shrub individuals to the local biomass.

2) Examine the structure of the forest by quantifying the number of single-trunk and multi-branched individuals from the base.

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?

In all papers derived from this project, as well as the thesis, presentations and lectures given, explicit thanks are given to The Rufford Foundation.

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

The research team was composed of myself, **Marcelo Tabarelli, Inara Roberta Leal** and six local field assistants, who alternated with each field expedition. I contributed to the experiment logistics, collected the data, performed the seed viability tests, analysed the data and wrote the scientific papers. Marcelo Tabarelli has contributed to the design of the project, and theoretical and statistical analyses. Inara R. Leal has contributed with crucial field experience and methodological and theoretical discussion. **Ricardo S. Gomes da Silva**, **Marcelo Lima Beserra**, and **José Inácio Bezerra Ferreira** were essential in establishing the agricultural experiment and helping to collect field data. **Lucivanea Bezerra de Santana, Ana Beatriz Silva** and **Ana Cristiana Santos da Silva** participated in resprouting data collection and field soil samples.

10. Any other comments?

No comments.