

Final Evaluation Report

Your Details	
Full Name	A. Robério G. Freire Filho
Project Title	Climate change impact and priority areas for the conservation of the Endangered Caatinga howler monkey, <i>Alouatta ululata</i> .
Application ID	26990-2
Grant Amount	£4,995
Email Address	freirefilho@outlook.com
Date of this Report	25 th 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
Habituation of two Caatinga howler monkey groups to perform the proposed data collection efficiently.				Over 2 months, we carried out habituation campaigns for two caatinga howler monkey groups to obtain ecological and behavioural data about the species.
Installation of thermo-hygrometers				At the start of the research, we installed this equipment in different forest strata in order to understand the temperature and humidity differences in each stratum.
Installation of traps for plant material and phenological evaluation.				During the research, we installed traps for plant material and performed the phenological evaluation of the vegetation.
Collection of ecological and behavioral data				During the study period, we performed monthly collections (at least 7 field days) of ecological and behavioral data from two groups of <i>Alouatta ululata</i> . This was the first research involving ecological and behavioural aspects for this primate species. The information obtained is very important for the conservation of the species.
Assess how climate change can affect ecological and behavioral aspects of caatinga howler monkeys.				Through Structural Equation Modeling (SEM) we analysed how climate change will potentially affect ecological and behavioural aspects of caatinga howler monkeys. The increase in temperature in the regions inhabited by the species will directly affect its behavioural budget.
Influence of climate change in priority areas for the conservation of the species.				We were also able to understand how climate change will affect the priority areas in relation to the conservation of this species. More northern areas with drier vegetation will be more impacted first, in terms of climate.
Propose measures for the conservation of the species based on the				We managed to develop a set of measurements that can help the conservation of caatinga howler

potential influences of climate change on the ecology and habitat of the caatinga howler monkey.				monkeys, considering the potential impacts of climate change. For example, we identified areas that are most sensitive to climate change within the priority areas for the conservation of the species.
Installation and use of arboreal camera traps.				This was not an initial objective of the project, but we were able to install arboreal camera traps to monitor primates in a reserve in Private Natural Heritage Reserve (RPPN Serra das Almas), Cratéus, Ceará, Brazil (near our study area).
Monitoring of primates using arboreal camera traps.				We monitored primates in the Private Natural Heritage Reserve (RPPN Serra das Almas). During this period and through arboreal camera traps, the first photographic records of the species were obtained in this reserve.
We will assist in the production of an educational children's book.				We assisted in the production of an educational children's book. This was also not an initial objective, but we were able to participate in the production of an educational children's book. In this material, a story about fires and the trafficking of wild animals was told, illustrated using a group of primates of different species (including the caatinga howler monkey). This material was addressed in our educational activities and will be made available in pdf format for teachers or early childhood educators.
Carry out the exhibition of informative banners in at least eight public schools or community centers in North-central Piauí				Due to the pandemic and social isolation, we had difficulty running the exhibition of informative banners. However, we managed to do so in five schools.
Perform talks in eight public schools, reaching at least 200 local students.				Due to the pandemic and social isolation, we had difficulty performing in-person talks. However, we managed to do so in five schools, and we reached around 200 local students. Most of these activities were carried out virtually.
Submit two papers to journals within one year of				We are working on producing these manuscripts.

project completion.				
Present part of our results in the XVIII Brazilian Congress of Primatology (Teresópolis-RJ, Brazil, 2019) and XXXII Brazilian Congress of Zoology (2020) or similar events.				We presented part of our results at the XVIII Brazilian Congress of Primatology (Teresópolis-RJ, Brazil, 2019). Due to the pandemic, no other congresses with the same profile were held, but we participated in virtual presentations.
Dissemination of the project and research on social networks				Throughout the research period, we publicised our activities on social media platforms (mainly Instagram) in order to inform as many people as possible about our work.
Execution of 1st Northeastern Primatology Meeting.				This was not an initial objective of the project, but we held the 1st Northeastern primatology meeting. It was a virtual event in mid-May 2021 and was attended by the main primatologists working in the northeastern region of Brazil.

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

The COVID-19 pandemic and social isolation have made educational activities in schools and community centres very difficult. But we tried to get around this by organising virtual presentations.

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

- Habituated groups, collection of behavioural and ecological data:
 After collecting ecological and behavioural data on the species, we have information about its behavioural budget throughout the day and year. We were able to understand how variations in temperature and rainfall affect these animals. Additionally, we obtained data on diet, home range size, interactions with other primate species and microhabitat use. This was the first study on the ecology and behaviour of caatinga howler monkeys. We have established a research base that will allow for the long-term study of caatinga howler monkeys and other mammal species in the north-central region of Piauí.

We were also able to reach out to and educate the local community living in our study area. Thus, we were able to mitigate the possible conflicting relationships with our study species. We consider these people as true collaborators of the project.

The first photographic record of caatinga howler monkeys in the in the Private Natural Heritage Reserve (RPPN Serra das Almas), Crateús-CE, Brazil was achieved through our study.

- Understand how the species can adapt in ecological and behavioural terms to climate change:

Based on ecological and behavioural data, we were able to assess, through Structural Equation Modelling (SEM), potential influences of climate change on the behavioural budget of caatinga howler monkeys. Thus, we found that an increase in temperature tends to increase the frequency of resting records and that the structure of the forest is crucial for the conservation of the species. The forest, for example, can offer microhabitats that facilitate the thermoregulation of animals throughout the day.

During the dry period in the caatinga biome, few trees remain with leaves. These few trees function as islands that the animals use to rest and protect themselves from the sun's rays. More conserved forests tend to maintain denser areas, increasing the number of these microhabitats during drought.

- Identification of regions most exposed to climate change within priority areas:
The climate models built for the future allow for the identification and characterisation of these regions within the priority areas for the conservation of species that will be more sensitive to potential climate changes. Thus, we were able to better establish strategies for the conservation of this species in the long term, by evaluating what can be done to mitigate the effects of climate change in regions that are more sensitive.

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.

During the period of ecological and behavioural collections, we were able to involve the local community with the project idea. We always tried to explain what we were doing in the region and the importance of our research. In addition, we directly involved some people from the community in the project activities. These people helped us with our data collection. Throughout the pandemic, we had difficulty carrying out environmental education activities. We tried to mitigate this with virtual activities, and we therefore sought to inform students and teachers through online presentations. However, we were also able to carry out face-to-face activities in north central Piauí, Brazil. We expected to involve more people and carry out more in-person activities, but the pandemic and social isolation (a totally necessary measure) made the realisation of these activities difficult.

6. Are there any plans to continue this work?

This research is part of my doctoral work, but the ideal scenario would be to continue working with this endangered primate species. Long-term monitoring allows us to obtain more accurate information. Thus, it would be important to continue working at the population level, seeking to answer broader questions (e.g., birth and death rates, generational time, biological data, population estimates and population viability).

In the Private Natural Heritage Reserve (RPPN Serra das Almas), we have a perfect scenario for understanding how four or five *Alouatta ululata* individuals managed to repopulate a protected area and with environmental suitability. How does population growth take place? What is the birth or death rate? What is the generational time of this population? This is an experiment that will take several years, but it will provide fantastic results for the conservation of the species and can direct conservation strategies for other species of the genus *Alouatta*.

Additionally, we intend to identify owners who want to create conservation units (Private Natural Heritage Reserve - RPPN) on their properties. This is a very important tool for conserving the region's biodiversity. We think that a project with the caatinga howler monkey can aid the conservation of several other mammalian species. Currently, we have already addressed this in lectures and in communication with local communities, where we sought to discuss topics such as hunting, deforestation (and burning) and animal trafficking. As such, our goal is to continue this work with the caatinga howler monkey, with the aim of expanding the study to other species of mammals.

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

Initially, we intend to submit at least two scientific articles to international journals. We will likely submit one or two more specific articles on ecological and behavioural aspects for journals that are more focused on primatology. Another manuscript will be submitted to a journal more focused on conservation, addressing the potential influences of climate change in priority areas for the conservation of the species. This year we also intend to participate in national events, for example, the National Congress of Primatology and the National Congress of Mastozoology. Our results will also be provided to the National Action Plan for the Conservation of Primates of the Northeast (PANPriNE). In addition, we will continue with our scientific dissemination on social media platforms, especially Instagram.

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

Funding for the project was used between June 2019 and February 2022. Due to the pandemic and the need for social isolation, some project activities were affected. This resulted in an increase of the stipulated period for the project by about 16 months.

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
Subsidy to field collaborators and guides (local people and biologists)	350	500	+150	We spent more on field collaborators and guides
Accommodation in fieldwork (during environmental education campaigns)	460	460		N/A
Food in fieldwork	540	400	-140	We spent more on food in the field.
Laptop	380	400	+20	N/A
Cell phone to register behavioral and ecological data in the field	230	300	+70	We spend a little more on our cell phone.
Two thermo-hygrometers with coupled datalogger	305		-305	We used the thermo-hygrometers with coupled datalogger of the laboratory that supports us.
Material to install fruit traps and mark feeding trees	80	80		N/A
Car maintenance	500	500		N/A
Fuel (based on 12 km/L, about 18,500 km in the fieldwork and fuel value 0.95 pounds)	1500	1500		N/A
Material for lectures and exhibitions (banners, posters, t-shirts and any office supplies)	650	400	-250	We carried out many educational activities virtually. This lowered material costs for lectures and exhibitions.
Subtotal	4995	4540	-455	
Camera traps and batteries		840	+840	Due to the pandemic and the need to monitor the caatinga howler monkeys that repopulated the Serra das Almas RPPN, we decided to acquire camera

				traps to carry out the first study with arboreal camera trap in the Caatinga biome.
TOTAL	4995	5380	+385	

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

In September 2022, I intend to finish my PhD. However, contact with the local community will not stop and we will continue this field work. Thus, we will seek to carry out long-term research with the habituated groups and with this population.

I hope to continue the work with arboreal camera traps in the RPPN Serra das Almas and to monitor the group of caatinga howler monkeys that repopulate the reserve. In this area we have a perfect scenario for understanding how the population growth of this species can occur over time in a preserved area. This is an experiment that will take a few years, but it will provide fantastic results in terms of population growth, birth and death rates, population management.

During the current project, a graduate student used the arboreal camera trap data to perform research on arboreal mammals. In the future, we will help train more researchers in the northeast of Brazil.

We intend to encourage and support the creation of a Private Natural Heritage Reserve – RPPN in the state of Piauí and Ceará, Brazil.

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?

We have used the RF logo in all the communication materials produced during the project. The RF logo was used during our lectures at schools and community centres. We will use the RF logo in conferences at the Brazilian Congress of Primatology and Brazilian Congress of Mastozoology. Furthermore, we will always mention and thank the RF in papers and any kind of public material.

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

Bruna Martins Bezerra and I, together with collaborators from the local community, worked more directly on the design, logistics and execution of the project. Bruna was responsible for evaluating the results related to ecological and behavioural data. She was also extremely necessary for the discussion of our results.

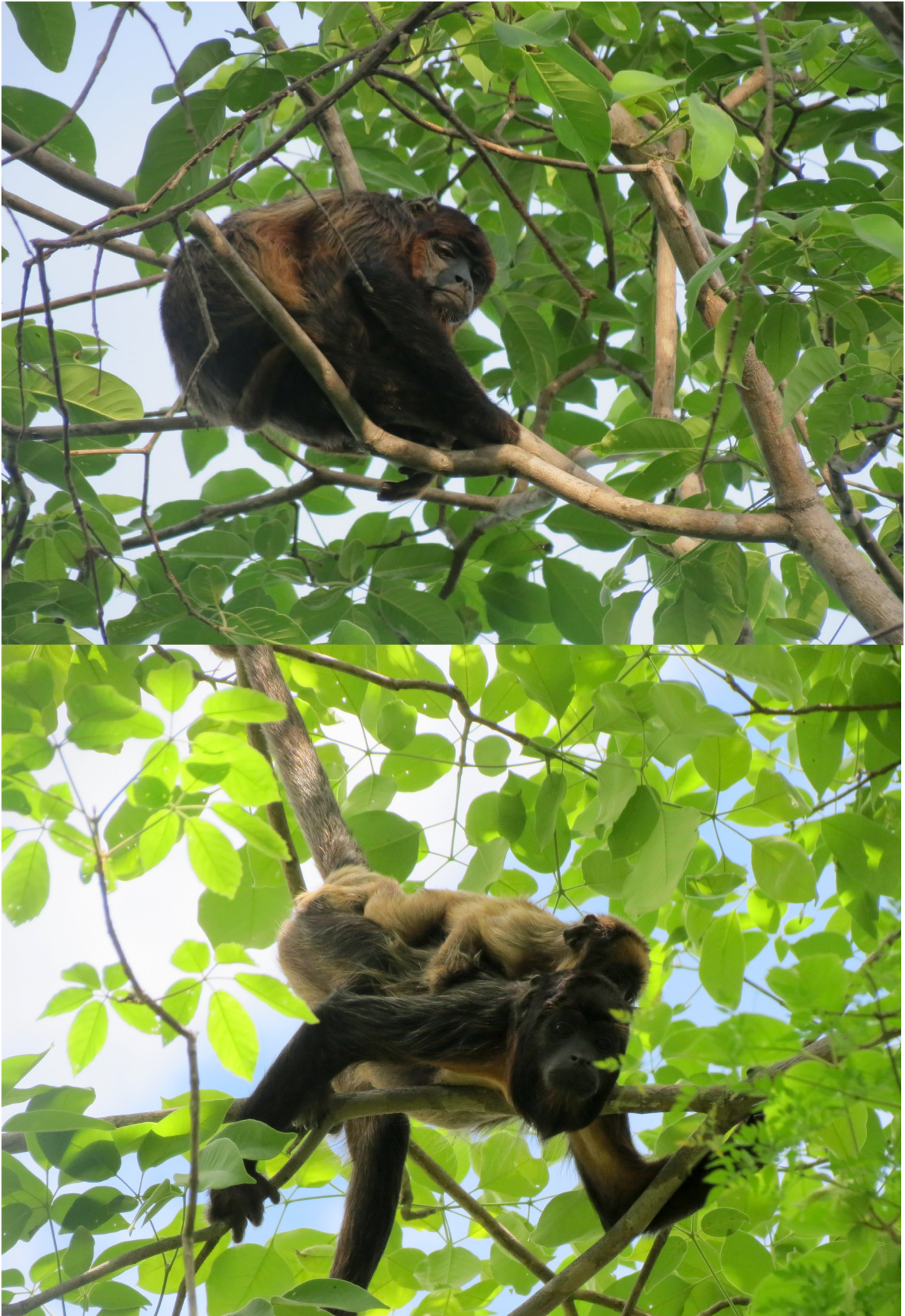
Jorge Palmeirim was very important in the construction of spatial models. We discussed the methods and how to evaluate the results obtained.

Diego Rodrigues was a very important component of this project. He helped us design educational activities for schools and community centres. he also helped us to establish a better approach with the local community.

13. Any other comments?

We had a lot of difficulties executing the project due to the conditions and challenges imposed by the pandemic. Despite these limitations and difficulties, we managed to contribute significantly to the conservation of the caatinga howler monkey. When we started the first Rufford Small Grant, the species was practically unknown and poorly studied. Today, the project entitled "Projeto Guariaba" is a reference for the study of primates in north-eastern Brazil. The "Projeto Guariaba" in addition to promoting the conservation of *Alouatta ululata* also helps studies on other endangered species. All of this is only happening thanks to the support of The Rufford Foundation. This financial support makes a big difference to the conservation of several species on the planet. Congratulations and thanks for your trust.









Julia Carquejo e Sabrina Cairo
Ilustrações de **Rodrigo Eli**

