

## Final Evaluation Report

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Your Details	
<b>Full Name</b>	Thabata Cavalcante dos Santos
<b>Project Title</b>	Conservation strategies for vulnerable bushmaster snakes ( <i>Lachesis mute rhombeata</i> ) in forest remnants, Northeastern Brazil.
<b>Application ID</b>	37317-1
<b>Date of this Report</b>	31/10/2023

**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
Build the potential distribution map for the bushmaster snake.				<p>We successfully completed this stage, where we identified the five most suitable areas for the presence of the bushmaster in the state of Ceará.</p> <p>This will be of great value for future research to find new populations of this species in the state.</p>
Identify the environmental and bioclimatic variables that influence the subspecies' distribution.				<p>During the monitoring of the known population of the subspecies in the Baturité Massif, we identified that the presence of remnants of preserved rain forests, low temperatures and high rainfall were the main factors influencing its distribution.</p>
Select and define points for sampling potentially new populations of the subspecies.				<p>We have added five more sampling points to search for new populations within the state of Ceará:</p> <p>(1) the northern region of the Serra da Ibiapaba, in the cities of Granja and Viçosa do Ceará, (2) Serra da Meruoca, cities of Meruoca, Massapê and Alcântaras, (3) southern region of the Serra da Ibiapaba, in the cities of Tianguá and Ubajara, (4) Serra de Aratanha, nas cidades de Pacatuba e Maranguape and (5) Chapada do Araripe, cities of Nova Olinda, Caririaçu and Farias Brito.</p>
Search for new populations of the bushmaster snake in unknown areas.				<p>We were unable to carry out comprehensive searches in the other areas considered suitable for the bushmaster in Ceará. However, we do have reports of the species in the Serra de Aratanha region. Due to time constraints, personal medical complications, and travel difficulties (a lot of rain), we decided to focus on the known population for the state. We therefore concentrated our efforts on a more profound investigation of this known population.</p>
Collect biological, ecological and				<p>During a year of monitoring the Baturité Massif bushmaster population, we obtained</p>

<p>behavioural data from registered individuals.</p>			<p>important information on biological, ecological and behavioral aspects. We concluded that these animals are generally found in dense forest environments, but they are also found in clearings and/or plantations bordered by forests. They prefer lower temperatures, between 19 and 25°C, and high levels of humidity, with rainfall exceeding 1500 mm per year. We observed that they have calm behaviour, few animals bite, and they tend to run away when they come into contact with people. During the day the animals were frequently found resting, curled up under plants or under leaf litter. But we also found animals crossing avenues and even a cub warming up in the morning (6 AM). During the night, we noticed the most active animals, with frequent sightings of them crossing or near avenues and streets, coiled up in hunting activity and near the entrances to burrows. This information provides a more complete picture of the behaviour and ecology of the bushmaster in the region studied. Blood, scale samples and ectoparasites were collected from all the individuals captured. All these biological materials are being analysed and will be very important for future studies on genetics and animal health.</p>
<p>Conduct at least 50 interviews with local residents in the region of the sampling points.</p>			<p>Over the course of the project, we conducted interviews with more than 100 people in the Baturité Massif, a population area that is already known to bushmaster. In the other five areas considered suitable for the existence of the subspecies, our ability to interview was more limited, reaching only around 15 people in Aratanha Mountain. Unfortunately, we were unable to carry out detailed investigations into the occurrence of the bushmaster in other regions. However, we were able to delve deeply into the local communities of the Baturité Massif and understand ethnobiological aspects that are very important for the conservation of the species.</p>

<p>Make environmental educational materials to raise the awareness of local residents.</p>			<p>We produce a lot of informative material about the bushmaster and other venomous snakes in the state of Ceará. Many folders, banners, leaflets, posters and t-shirts were widely distributed throughout the Baturité Massif.</p>
<p>Distribute environmental education materials in schools and local associations.</p>			<p>We have managed to have a broad insertion within the communities in the Baturité Massif over the course of this project. All the information and educational material was used and distributed in presentations to students, members of local communities and local politicians. The aim of these talks and educational activities was to make people aware of the importance of conserving the region's snake fauna.</p>
<p>Present lectures on environmental education and the regional herpetofauna to the local community.</p>			<p>As mentioned in the previous topic, we have managed to hold many presentations to raise awareness, inform and promote the conservation of the local herpetofauna. These activities were conducted in schools, town squares, local farmers' associations and community centers. In addition, we held a snake management course for managers of protected areas in the region, environmental police and local workers. This course was taught by me and Dr Rodrigo Gonzalez, a member of the project.</p>
<p>Write the master's thesis with our sampled data.</p>			<p>From the project's data collection I was able to produce a dissertation entitled: "Extent of Occurrence, Area of Occupancy, Biology, Ecology, Population Size and Conservation of <i>Lachesis muta</i> (Linnaeus, 1766) (Snakes: Viperidae) in the state of Ceará, Brazil"(in portuguese is "Extensão de Ocorrência, Área de Ocupação, Biologia, Ecologia, Tamanho Populacional d Conservação de <i>Lachesis muta</i> (Linnaeus, 1766) (Serpentes: Viperidae) no estado do Ceará, Brasil.", to be presented in November 2023 to obtain a master's degree in Systematics, Use and Conservation of Biodiversity from the Federal University of Ceará. In addition, the data collected also formed part of Lidia Lima's graduation work in</p>

			biology, entitled: "Citizen Science as a Data Collection Tool for the Conservation of <i>Lachesis muta</i> (Snakes: Viperidae) in the Baturité Massif, Ceará, Brazil" (in Portuguese is "Ciência Cidadã como instrumento de Coleta De Dados para Conservação de <i>Lachesis muta</i> (Serpentes: Viperidae) no Maciço de Baturité, Ceará, Brasil."), presented and approved on June 29th, 2023.
Submit an article to an international journal, six months after completing our data collection.			We had an article published in the Herpetological Review about the new record of the <i>Bothrops bilineatus</i> snake in the state of Ceará, obtained from the project's efforts. We submitted a note about bushmaster conservation actions to the journal <i>Oryx</i> , we are waiting to hear back, and we are preparing a paper for submission to the journal <i>Behaviour</i> .
Disseminate the data collected in association with the project, important information, photographs and project activities on social networks.			We constantly shared all the results, events and activities of the project on social media at Instagram (@projetomalhadefogo) and on the WhatsApp groups of local residents.

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

### a). To identify new, unknown populations of bushmaster in the state of Ceará.

We have identified five new areas that are environmentally and climatically suitable for bushmaster populations in the state of Ceará. To do this, we produced a suitability map based on information from records, climatic and environmental variables using the Maxent algorithm. The five selected areas:

- (1) The northern region of the Serra da Ibiapaba, in the cities of Granja and Viçosa do Ceará.
- (2) Serra da Meruoca, cities of Meruoca, Massapê and Alcântaras.
- (3) Southern region of the Serra da Ibiapaba, in the cities of Tinguá and Ubajara.
- (4) Serra de Aratanha, nas cidades de Pacatuba e Maranguape.
- (5) Chapada do Araripe, cities of Nova Olinda, Caririçu and Farias Brito.

Unfortunately, we were unable to carry out detailed searches in the selected areas to thoroughly investigate the existence of a new bushmaster population in the state. However, we did get reports of a population in Aratanha Mountain from a local resident and his family. Due to the health problems, I suffered, the weather and logistical issues (a lot of rain in regions that are difficult to access), we decided to focus our actions on the endangered population of the Baturité Massif, where we managed to get a good insertion within the communities and thus find 28 individuals of bushmaster and a new record of *Bothrops bilineatus* (green jararaca).

**b). Carry out the lectures and training with local residents, students and teachers in each region.**

Throughout the project, we focused on disseminating information in various sectors of the community, holding various presentations in schools, town squares, communities, associations and universities for different publics. We reach kids (from the age of five), teenagers and adults, providing essential information about the bushmaster and other venomous snakes in the state of Ceará. We teach management courses to the managers of the region's protected areas, officers from the Ceará Environmental Police Battalion and local workers.

Our efforts were not limited to educational institutions; we also promoted activities in associations of farmers and rural workers in the Baturité Massif, with a focus on raising awareness, disseminating information and preventing accidents related to venomous snake species in the region.

We also promoted activities in the public squares of the towns where the bushmaster appears in the Baturité Massif, with the aim of reaching a diverse public, from local residents to tourists visiting the region. We actively participate in presential and virtual lectures at universities, university events and videos on YouTube channels, always addressing the efforts and results of the project and promoting bushmaster conservation.

**c). Submit an article to an international journal, six months after completing our data collection.**

We submitted an article entitled "Projeto Malha de Fogo: conservation of Vulnerable Bushmaster Snakes (*Lachesis muta rhombeata*) in the state of Ceará, Northeastern Brazil" in the journal *Oryx* and we are waiting to hear back from the reviewers.

In addition, we published a new record of the venomous snake Jararaca-verde (*Bothrops bilineatus*) for the state of Ceará obtained from the project, the study is entitled "An unexpected record of the Green Jararaca, *Bothrops bilineatus* (Wied-Neuwied, 1821) in Ceará State, northeastern Brazil" and was published in *Herpetological Notes*.

We also submitted a paper on the taxonomy, genetics and conservation of bushmasters in Brazil, entitled "When a name changes everything: taxonomy and conservation of the Atlantic Bushmaster *Lachesis* Daudin, 1803 (Serpentes: Viperidae: Crotalinae)." However, as the manuscript is still in the process of being reviewed, we cannot divulge any more information about this.

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

Our biggest difficulties were access to the study sites, as many of them lack basic infrastructure. High-altitude wetland regions are characterised by being very humid, with heavy rainfall and steep terrain.

During rainy periods, our campaigns became almost unviable due to the high risk of landslides and accidents. In addition, I faced health complications, suffering problems with my left eye and surgery on my ovaries, which required me to rest for a few days and consequently delayed some of the project's activities.

To get around these challenges caused by the rainy weather, we planned our campaigns and educational activities on the most favorable days, which allowed us to meet most of the established schedule.

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

To increase information and the chances of finding bushmaster individuals in the Baturité Massif, we have created an alert system for the communities. We make folders with photographs of the bushmaster, a description of the purpose of our project and our telephone numbers.

The alert system works as follows: when local residents find an individual, dead or alive, they contact us and send us the location information so that we can go to the site. With this method, we have been able to get closer to the communities, as people send us information and contact us for rescues and information about bushmasters, snakes and other animals in the region. We were surprised by the significant involvement of the entire community of Ceará in our project. From citizen science through the alert system, we obtained 90 recent and georeferenced records of the bushmaster population in the Baturité Massif.

In addition, all 28 individuals sampled in the project were found by the communities, found by the people who came to us to capture them. We also obtained a new record for a venomous snake for the region.

Our biggest service back to the community is bushmaster rescues in areas of danger, both for people and animals. Lectures and educational activities that provide information on the region's snake fauna, as well as joint actions with various public agents to strengthen the health system with anti-ophidian serum and assistance in cases of envenomation.

**5. Are there any plans to continue this work?**

The project was part of my master's research and I intend to continue working with this endangered snake species during my PhD. The long-term monitoring allows us to gain an understanding of the biological and ecological aspects of these animals, such as diet, habitat selection and use, reproduction and growth dynamics,

ontogenetic variation, movement ecology, genetic aspects and the properties of their venom.

The Baturité Massif population, which we studied throughout this project, needs special attention, because according to the data collected here, it is geographically and genetically isolated from other Atlantic Forest populations. Being in a mountainous forest fragment surrounded by a semi-arid environment, the species is unable to migrate to other fragments of humid forest and is completely separated.

Thus, we believe that the population has a high chance of being genetically and morphologically different from other Atlantic Forest bushmaster populations and we would like to continue our efforts to be able to investigate this further.

We are committed to continuing our efforts to further research with bushmasters in the region, seeking to mitigate conflicts with humans and promote the conservation of this species. We intend to search for new populations in the areas indicated by the suitability map. We therefore have high hopes of continuing our studies with bushmasters in the state of Ceará, with the aim of contributing directly to the conservation of this species.

We believe that a project that seeks to protect the bushmaster helps to conserve local biodiversity, more specifically species that inhabit forest environments. In our actions with members of the local communities, we have observed the importance of the project's presence for both the species and the people.

Brazil ranks third in the world for snakebite accidents and has several structural problems with its health system that directly impact on initiatives to protect these animals. Throughout the project, we have seen that we can act in various areas (education, health, the environment and public policies) to help improve the human-snake relationship in our region. Thus, our objective is to continue this work on the conservation of *Lachesis muta rhombeata* in the state of Ceará.

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

We have already published an article and submitted two articles with data collected from the project. We plan to submit four more studies, three from my master's dissertation and another from Lidia Lima's monograph.

In addition, the results of this research contributed to the first assessment of the threatened fauna of the state of Ceará. The subspecies was categorised as critically endangered (CR) by the Red List of Endangered Continental Amphibians and Reptiles of Ceará published in 2022 by the state's Secretary of the Environment and Climate Change. We are now collaborating with the state's Red Book of Threatened Fauna with information for the files and proposals for protection actions.

This year we took part in the X Brazilian Congress of Herpetology in Porto Seguro, Bahia, from September 10 to 15 2023. We presented four posters, two presentations and were invited to take part in two symposia, where we discussed our efforts and



results. In addition, at this national congress we were awarded the best work in the conservation category.

We also participated in a documentary about snakes made by the production company Duo2 TV, which will be broadcast on streaming platforms. In this paper we can show more about our work, discuss the importance of the bushmaster in rain forests and the need to protect the species and its natural environments.

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

In November 2023 I plan to finish my master's degree. We intend to keep in touch with the communities and continue with field activities and education. In this way, we intend to carry out further research on the bushmaster population we already know about and seek information on possible new populations.

We intend to carry out monitoring with the individuals over the long term in order to understand questions about their movements using tracking equipment. In this way, it will be possible to obtain more information on diet, reproduction, oviposition process, development of individuals, parasite load and genetics. In addition to protection actions and educational activities with communities and organisations.

During this project, an undergraduate student and resident of the Baturité Massif used data from the interviews to carry out research into the local community's relationship with the bushmaster.

We intend to continue seeking out and training new researchers on venomous snakes in northeastern Brazil. From the great impact we have achieved within the local communities of the Baturité Massif, we believe we can contribute even more to protection actions for the herpetofauna of the state of Ceará, as well as helping to mitigate human-snake conflicts.

## **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?**

All the materials we produce and disseminate include the Rufford Foundation logo and further research carried out by the institution. Throughout the project we produced booklets, posters, presentations, videos and t-shirts, all of which contained the Rufford Foundation logo.

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

**Robério Freire-Filho**, was fundamental to the entire project. He actively contributed to the field campaigns, interviews with the communities, sorting of the animals sampled, data collection and production of the environmental suitability map for the bushmaster.

**John Allyson Andrade-Oliveira**, was extremely important in all the project's processes, actively participating in the field campaigns, animal

rescue/screening/release, data collection, educational activities and discussion and publication of the data.

**Lidia de Lima Silva**, was also active in all stages of the project, participating actively in field campaigns, animal rescue/screening/release, data collection and educational activities. She also carried out a course completion research project using the data from the interviews conducted by the project.

**Rodrigo C. Gonzalez**, was a very important component of this project. He was fundamental in carrying out the management, data collection and contact for new partnerships and expanding the research. Rodrigo was also extremely important in the discussion and correction stages of the published and submitted papers and my master's dissertation.

**Hugo Fernandes-Ferreira**, was a very important component of this project. He has been involved since the project was formulated, helping throughout its execution and providing the physical and theoretical basis for all the activities. As well as being my master's supervisor and Lidia Lima's undergraduate supervisor, he has helped us through all the stages of discussing the results, submission and publication that we have carried out so far. He is also an important player in the Ceará community and helped the project achieve greater recognition in society.

#### **10. Any other comments?**

Even with all the difficulties we have faced in searching for new bushmaster populations in other areas in the state of Ceará, we have managed to contribute significant information about the bushmaster and other snakes in the region. When we started the project, we knew very little about the species' occurrence in the state and its ecological and behavioral aspects were practically unknown.

Today, the "Projeto Malha de Fogo" has become a national reference in snake research and conservation. We managed to put the isolated population of the state of Ceará at the center of academic and conservationist discussion in the state and in Brazil.

We have been able to actively contribute to filling knowledge gaps about the threats affecting the species and strengthen relations with decision-makers. In addition, we discovered a new record of a venomous snake for the region. All of these results were only possible because of the fundamental support of The Rufford Foundation, and we are deeply grateful for the opportunity, support, learning and trust it has given us!

**On behalf of Projeto Malha de Fogo, Thabata, Robério, John, Lidia, Rodrigo and Hugo, our sincere thanks.**





# ATENÇÃO!

Estamos em busca da **cascavel** e **malha de fogo**  
 na Serra de Baturité.



**Desenvolvemos pesquisas com a cascavel e a malha-de-fogo. Se você encontrar alguma dessas cobras, por favor não as perturbe e entre em contato conosco: Sua contribuição é muito importante para nossa pesquisa!**

Projeto de pesquisa focado na  
 Conservação da Cascavel no Nordeste.



**Projeto Cascavéis  
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REPORTAGEM Cidades

| MEIO AMBIENTE | Surucucu pico-de-jaca ou malha-de-fogo é capturada no Maciço de Baturité. Pesquisadora da UFC está investigando se a maior serpente peçonhenta da América Latina está em extinção no Ceará

# A serpente invisível do Ceará



SERPENTE surucucu pico-de-jaca. Hoje sobre peçonhenta da América Latina só Lactuca do Maciço de Baturité

DEBETRI TÚLIO  
Biotrop - divulgação sobre bio

Chatinhas conversam até às sete horas da noite em uma das torres do Maciço de Baturité, no Ceará. É ali que a pesquisadora Thelma Cavalcanti, do Instituto de Física da Universidade Federal do Ceará (UFC), investiga a serpente malha-de-fogo, conhecida localmente como surucucu. Ela encontrou a espécie em um sítio no Maciço de Baturité e realizou, em fevereiro último, por uma equipe de biólogos coordenada pelo professor Thelma Cavalcanti dos Santos, 47, a serpente, com alta capacidade para se camuflar, não se trata de um animal comum. Ela é encontrada em áreas de mata secundária e em áreas de agricultura. A serpente malha-de-fogo, conhecida localmente como surucucu, é encontrada em áreas de mata secundária e em áreas de agricultura. A serpente malha-de-fogo, conhecida localmente como surucucu, é encontrada em áreas de mata secundária e em áreas de agricultura.

Além da raridade por sua coloração muito acastanhada em habitat natural, a serpente possui baixa densidade populacional. Segundo a pesquisadora Thelma Cavalcanti, a raridade se deve à redução da área de distribuição natural devido ao desmatamento e ao uso da terra para agricultura. A serpente malha-de-fogo, conhecida localmente como surucucu, é encontrada em áreas de mata secundária e em áreas de agricultura. A serpente malha-de-fogo, conhecida localmente como surucucu, é encontrada em áreas de mata secundária e em áreas de agricultura.



A SURUCUCU pico-de-jaca tem registro de captura em 1979, 2017 e 2021

Parte, do mesmo tipo e Instituto Brasileiro de Meio Ambiente e Defesa do Patrimônio Histórico, Arqueológico, Artístico e Cultural (Iphan) está sendo realizada uma pesquisa para avaliar o status de conservação da espécie. A serpente malha-de-fogo, conhecida localmente como surucucu, é encontrada em áreas de mata secundária e em áreas de agricultura. A serpente malha-de-fogo, conhecida localmente como surucucu, é encontrada em áreas de mata secundária e em áreas de agricultura.

**Até o momento, não tínhamos nenhuma pesquisa voltada para entender sobre a surucucu que só ocorre no Ceará no Maciço de Baturité**

Thelma Cavalcanti, pesquisadora do Instituto de Física da Universidade Federal do Ceará (UFC), está realizando uma pesquisa sobre a serpente malha-de-fogo, conhecida localmente como surucucu. Ela encontrou a espécie em um sítio no Maciço de Baturité e realizou, em fevereiro último, por uma equipe de biólogos coordenada pelo professor Thelma Cavalcanti dos Santos, 47, a serpente, com alta capacidade para se camuflar, não se trata de um animal comum. Ela é encontrada em áreas de mata secundária e em áreas de agricultura.





Desenvolvido por StreamYard

Caudimachido 37:40 / 1:08:43

Thabata Calçote

**Projeto Malha de Fogo - LIVE**

 **Papo de Cobra**  
82,7 mil inscritos

Seja membro

Inscrito













