Final Evaluation Report

Your Details	
Full Name	Franciany Gabriella Braga Pereira
Project Title	Hunting in the Amazon: Uncovering the complexity of subsistence hunting and measuring its sustainability
Application ID	30878-2
Date of this Report	21 May 2025

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
Evaluate spatial and seasonal depletion of game species across conservation units			X	The original objective was met through a combination of structured interviews and data synthesis from other research networks, despite limitations caused by the COVID-19 pandemic. I personally conducted approximately 90 interviews across 30 communities. The fieldwork conducted by me was carried out in the following protected areas: • Piagaçu-Purus Sustainable Development Reserve (RDS): -4.76698, -62.79593 • Amanã RDS: -2.19722, -64.39923 • Médio Juruá Extractive Reserve (RESEX): -5.22274, -67.54154 • Uacari RDS: -5.74645, -67.67361 • Deni Indigenous Land: -6.8710, -67.5219 • Mamirauá RDS: -2.2626, -66.07178 • Rio Negro Environmental Protection Area (APA): -2.59463, -61.25977 • Puranga-Conquista RDS: 2.8465, -60.35797 • Rio Negro RDS: -2.95622, -60.68761 Originally, I had also planned to

				conduct research in additional protected areas. However, due to delays caused by the COVID-19 pandemic, it was not possible to reach these sites: • Gregório River RESEX: -7.4385, -71.29389 • Cojubim RDS: -5.49548, -69.07204 • Madeira River RDS: -5.04086, -60.59239 • Amapá River RDS: -5.48283, -61.87849 • Juma RDS: -5.98374, -60.2823 • Uatumã RDS: -2.68243, -58.62305 Key information from the interviews included local perceptions of wildlife abundance, hunting pressure on key species, and animal use of salt licks. I used a standardised visual scale (1–5) to assess the perceived abundance of various mammals and birds. The results can be find in https://doi.org/10.1002/pan3.10587 and https://doi.org/10.1111/2041-210X.13773. For hunting pressure, respondents were asked how often they hunted per week, how frequently they encountered animals, how often they succeeded in killing, and how many individuals they harvested. I also recorded the average hunting radius to estimate

				hunting pressure. I was not able to finish the article containing this data for my PhD defence, however, I am still working on that and hope to publish it soon. I can share the dataset if needed. I also listed salt licks near to each community and asked on the abundance of mammals in each natural licks across each season of the year. After interviews, I visited and geo-referenced the most frequently mentioned licks and collected soil samples. These samples were later analysed for their mineral content. Unfortunately, the paper including the soil analyses is still under preparation due to personal issues faced by one of my co-supervisors. However, the main findings from this broader dataset have been published in the following article: doi:10.15451/ec2024-08-13.24-1-9 Due to COVID-19 restrictions, I was unable to access several additional areas initially planned for fieldwork. To address this limitation, I established a collaboration network with researchers who had conducted similar interview-based surveys in other protected areas. These researchers generously shared their data with me, enabling a broader analysis.

				Altogether, the final database includes 333 interviews. Many of these collaborators had also conducted line transect surveys, which were incorporated into the integrated analysis. Additionally, the project involved collaboration with researchers working in the Peruvian Amazon, who shared camera trap data from salt licks contaminated by industrial waste. These data were analysed and incorporated into my doctoral thesis (attached). Unfortunately, the article specifically based on these contaminated salt licks has not yet been published due to personal circumstances affecting one of the supervisors. In this chapter of my thesis, a total of 36 salt licks were monitored using 54 camera traps installed across pristine and contaminated sites in the Peruvian Amazon. These cameras accumulated 15,221 camera trap days of sampling effort. From the resulting footage, 23 vertebrate species were detected, including large-bodied mammals such as *Tapirus terrestris*, *Tayassu pecari*, *Pecari tajacu*, *Mazama americana*, *Odocoileus virginianus*, and *Cuniculus paca*. Species richness and visitation rates were significantly higher in uncontaminated salt licks

				compared to those exposed to industrial contamination. In contaminated sites, both the frequency of visitation and the composition of species were markedly reduced, suggesting strong negative impacts on mammal community dynamics. This comparison highlights the ecological importance of salt licks and the need to protect them from extractive industry pressures.
Document distribution and use of natural licks			X	Fully achieved with 56 natural licks surveyed and analysed across multiple regions. The paper on this topic is published. We identified 31 vertebrate species using the salt licks, including *Tapirus terrestris*, *Priodontes maximus*, *Tayassu pecari*, and *Ateles chamek*. Species visited salt licks for a range of purposes beyond soil ingestion, such as bathing, foraging, digging burrows, and even predation. The peak period of visitation was during the receding floodwaters season, when the salt licks become accessible again as creek levels drop. In contrast, during the flood pulse, most salt licks are underwater and barely used. Notably, *T. terrestris*, *C. paca*, and some bat species were among the few observed visiting even during high water, albeit at

				lower frequencies. A large majority of interviewees (74.46%) stated that salt licks are one of their primary hunting grounds, but hunting at these sites only occurs during the receding flood period, when both visibility and access improve. Three types of salt licks were identified based on their flooding dynamics: non-floodable (used year-round), gradual flooding, and rapid flooding (only exposed briefly). This categorisation helped to explain variation in species abundance and activity throughout the year. A total of 47 local hunters contributed to this specific article, and their interviews provided the ecological knowledge base for understanding animal behaviours across 56 sites. The article presenting these findings is published in *Ethnobiology and Conservation* (2024). DOI: https://doi.org/10.15451/ec2024-08-13.24-1-9
Generate depletion maps and evaluate socio-ecological predictors of hunting impact		X		Mapping was partially limited to regions where sufficient data were available, but the socio-ecological evaluation was robust. The paper on this topic is not published yet. I conducted interviews across the following protected areas to arquieve this goal: • Piagaçu-Purus Sustainable

				Development Reserve (RDS): -4.76698, -62.79593 • Amanã RDS: -2.19722, -64.39923 • Médio Juruá Extractive Reserve (RESEX): -5.22274, -67.54154 • Uacari RDS: -5.74645, -67.67361 • Deni Indigenous Land: -6.8710, -67.5219 • Mamirauá RDS: -2.2626, -66.07178 • Rio Negro Environmental Protection Area (APA): -2.59463, -61.25977 • Puranga-Conquista RDS: 2.8465, -60.35797 • Rio Negro RDS: -2.95622, -60.68761 Although hunting is a sensitive topic, interviews were feasible because local communities in these regions hold legal rights to hunt for subsistence. This greatly facilitated open dialogue and reliable data collection. An interesting pattern that emerged was the inverse relationship between hunting pressure and fish availability. In areas with lower fish resources, (such as APA Rio Negro, RDS Puranga-Conquista, and RDS Rio Negro) hunting pressure was significantly higher. Hunting pressure also varied seasonally, increasing during the flood season, when fishing becomes more

				difficult and many terrestrial animals become isolated on patches of dry land ("terra firme"), making them easier to locate and hunt. These data are already organised in spreadsheets and can be shared if needed. Although I was unable to prepare the manuscript during my thesis writing due to time constraints, I intend to publish these important findings, which represent a major part of my fieldwork efforts.
Describe physical and chemical composition of natural lick soils		X		Achieved in part through analysis of geophagy in both natural and oil-contaminated licks in Peru and Brazil. The physical and chemical composition of natural lick soils was investigated through geochemical analyses of soil samples collected in both natural and oil-contaminated licks in Brazil and Peru. The analysis included quantification of macro- and micronutrients as well as potentially toxic elements. Soils from natural licks showed elevated concentrations of sodium (Na), calcium (Ca), and magnesium (Mg), confirming their role as sources of essential minerals for fauna. These sites also had distinct pH and clay content, which influence mineral bioavailability. In contrast, soils from oil-contaminated licks showed higher levels of heavy

				metals such as lead (Pb), cadmium (Cd), and arsenic (As), indicating potential ecological risks and exposure to toxic compounds for wildlife consuming these soils. In Brazil, the salt licks were selected through interviews with local communities. I personally visited these sites and collected the soil samples. The physical and chemical analyses were carried out by myself and a laboratory technician at the soil laboratories of the National Institute of Amazonia Research (INPA). In Peru, the sites were also identified based on local community input, but data collection was conducted by Spanish and Peruvian researchers through a collaborative partnership. Nevertheless, I was responsible for overseeing the analytical process. The physical analyses were conducted by me at The Centre for Ecological Research and Forestry Applications (CREAF), within the Autonomous University of Barcelona. The chemical analyses were conducted at the Chemistry Department of the University of Barcelona. These data, comprising the full physico-chemical analysis of salt lick soils, have not yet been published in scientific journals due to personal delays from one of the co-authors. However, the manuscript is well advanced and will be submitted for publication shortly.

Estimate the proportion of animal protein biomass from aquatic and terrestrial wildlife and domestic animals per household for the period of flood and drought		X		I conducted interviews to estimate the proportion of aquatic and terrestrial wildlife and domestic animal biomass consumed per household. However, I was not able to complete the full analysis or include the results in my thesis, due to the volume and complexity of the data collected. These data are already organised and planned for analysis. They are robust, detailed and highly relevant, and I intend to publish the results in a dedicated paper as soon as possible. The data were collected through semi-structured interviews with local households and expert hunters, covering seasonal variation in hunting and fishing frequency, species preference and consumption rates. Respondents also distinguished whether the animal protein consumed was hunted, fished or purchased. These responses, combined with species-specific parameters (e.g., body mass, growth and migration rates), will allow for the estimation of biomass consumption per household across aquatic, terrestrial wildlife, and domestic animal sources.

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

a). Validation of LEK-based methods for estimating wildlife abundance, demonstrating their reliability compared to conventional line-transect methods.

b). Documentation of geophagy behaviour in natural and oil-contaminated salt licks, revealing new conservation concerns and routes of toxic exposure in wildlife.

Our research documented clear geophagy behaviour across both natural and oil-contaminated salt licks. In the contaminated sites, however, wildlife continued to visit and ingest soil despite visible signs of oil residues and chemical alteration of the substrate. This raises serious conservation concerns, particularly regarding chronic exposure to petroleum-derived toxicants, which can bioaccumulate and cause long-term physiological and reproductive effects in mammals.
Species such as *Tapirus terrestris* and *Tayassu pecari*—which are already vulnerable or declining in parts of their range—were observed frequenting these sites, exposing

themselves to a range of polycyclic aromatic hydrocarbons (PAHs) and heavy metals. These contaminants are known to have endocrine-disrupting and carcinogenic properties.
Moreover, the persistence of geophagy at contaminated salt licks suggests that animals may not detect the toxicity or may be driven by strong nutritional needs, particularly for sodium and minerals during certain seasons or reproductive stages. This behavioural trap could lead to sublethal toxicity, reduced fitness, or population-level declines over time.

c). Contribution to participatory biodiversity monitoring, engaging 333 local informants across 20 Amazonian communities and helping to build local capacity.

Community participation was central to this research. I personally conducted 100 semi-structured interviews, while trained collaborators conducted an additional 233, totalling 333 local informants engaged across 20 traditional communities in the Amazon. Prior to each visit, I secured the necessary research permits and contacted community leaders in advance via radio communication. Upon arrival, I held an open meeting with each community to present the research objectives and methodology. This initial engagement allowed me to identify key local specialists, who were then interviewed using a snowball sampling approach, whereby each informant recommended other knowledgeable individuals.
Following the interviews, I identified two individuals in each community with particularly strong ecological knowledge and asked local leaders for approval to hire them as field assistants. These assistants accompanied me during visits to salt licks or helped facilitate travel and logistics in communities without salt licks. In total, 32 field assistants from traditional communities were hired during the project.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.
The COVID-19 pandemic severely disrupted the planned fieldwork. Travel restrictions and health risks prevented access to key sites and limited in-person engagement with communities between early 2020 and mid-2021. These constraints particularly affected data collection activities in more remote Amazonian reserves.
To address these unforeseen difficulties, we adopted a phased and adaptive strategy:

- During the pandemic:
  - Collaborated with other researchers to access and analyse existing datasets from overlapping study areas, ensuring continued progress on research questions.
  - Used remote and asynchronous methods to analyse camera trap footage and soil samples.
  - Invested time in strengthening the analytical framework, conducting literature reviews, and advancing manuscript writing.
- Once travel was deemed safe:
  - Organised carefully planned field expeditions in compliance with local health protocols, including COVID-19 testing, limited group sizes, and the use of PPE.

- Prioritised study sites based on feasibility and relevance to the revised research questions.
- For lab-based work:
  - As soon as laboratory access was restored, I developed analysis of soil samples collected during the fieldwork, particularly for identifying mineral composition and potential contaminants in natural and anthropogenic salt licks.

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

Local communities were engaged throughout the project via structured interviews, participatory species mapping, and informal discussions about salt lick use and wildlife dynamics. However, beyond their participation in data collection, a major focus of the project was capacity-building to ensure longer-term benefits.

During the COVID-19 pandemic, I organised online training workshops aimed at helping local community associations—particularly those within the Médio Juruá Extractive Reserve and the Uacari Sustainable Development Reserve—learn how to develop and submit project proposals for environmental and social funding schemes. These workshops were followed by in-person training sessions once it became safe to travel, ensuring broader access for those with limited internet connectivity.

Approximately 30 people participated in the workshop, representing five different local groups and associations from the region. Unfortunately, I was not able to continue offering similar in-person workshops annually as initially planned. This is largely because I shifted the focus of my research away from the Amazon, and, at the moment, I do not have the capacity to organise and lead such activities on a regular basis.

As an early-career researcher building a research group, I am still in the process of establishing a stable team of students and collaborators who could help carry these activities forward. However, I invested significant time and effort into producing high-quality online training materials, including video lessons that remain accessible to local communities. These materials can be revisited at any time, offering continued opportunities for learning without requiring my physical presence.

Additionally, I remain in contact with community leaders and am always open to reviewing their materials or providing guidance when needed. My goal is to support their autonomy and continued engagement in biodiversity conservation and local resource management, even beyond my direct involvement.

In addition, research findings and camera trap data were shared with key conservation NGOs operating in the region, including Instituto Juruá, Instituto Mamirauá, and RedeFauna, to support their local conservation and management efforts. These organisations are using the data to inform more realistic strategies for species monitoring and management of salt lick areas, especially in contexts where extractive pressures overlap with conservation goals.

These combined efforts contributed not only to scientific understanding but also to the empowerment of local communities and institutions that play a central role in biodiversity stewardship.

5. Are there any plans to continue this work?

Yes. A follow-up study is underway to monitor the long-term effects of oil contamination on salt lick use and to implement participatory co-management schemes in the Médio Juruá. The data are also informing a broader research programme on wildlife monitoring using community knowledge and technology integration.

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

The results of this project have already been widely shared through multiple channels, and further dissemination is ongoing. These include:

- Peer-reviewed scientific publications: Three papers based on the project findings have already been published in international journals:

i) Braga-Pereira, F., Peres, C. A., & Nóbrega Alves, R. R. (2024). *Seasonal Dynamics of Salt Licks and Their Use by Wildlife in Amazonia*. *Ethnobiology and Conservation*, 13. https://doi.org/10.15451/ec2024-08-13.24-1-9

ii) Braga-Pereira, F. et al. (2024). *Predicting animal abundance through local ecological knowledge: An internal validation using consensus analysis*. *People and Nature*, 6(2), 535–547. https://doi.org/10.1002/pan3.10587

iii) Braga-Pereira, F. et al. (2022). *Congruence of local ecological knowledge (LEK)-based methods and line-transect surveys in estimating wildlife abundance in tropical forests*. *Methods in Ecology and Evolution*, 13(3), 743–756. https://doi.org/10.1111/2041-210X.13773

iv) A fourth manuscript based on the results is currently under peer review.

- Scientific outreach and academic events: I presented results at four major scientific conferences and participated in multiple symposia, seminars, and university lectures to share my research with both academic and non-academic audiences. https://franbraga.com/event-xi-cbmz-and-xi-ebeq

- Educational workshops and training: I conducted a series of online and in-person workshops to train local communities and students in ecological monitoring and project proposal writing. One of the online workshops is recorded and can be accessed here: https://www.youtube.com/watch?v=cSL14FgCP1I&list=PL-nxUN7zQWFHaOR75Mou38E6ucckLRC7S

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

1) Expand monitoring to new areas facing threats such as oil exploration.
2) Train more local monitors in ecological data collection.
3) Advocate for the inclusion of traditional knowledge in national biodiversity monitoring policies.

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 Rufford Foundation received extensive and continuous visibility throughout the project. I used the Rufford logo in presentations, posters, educational materials, and social media posts related to the project activities. The Foundation was also explicitly acknowledged in all three peer-reviewed publications that resulted from the project, as well as in my PhD thesis.
Additionally, I frequently mentioned Rufford's support during conferences, workshops, public lectures, and outreach events, including both online and in-person activities. On my professional social media and YouTube channel, Rufford's contribution was highlighted as essential for making the fieldwork possible.
I consider the Rufford Small Grant not only a financial resource but also a platform that adds credibility to early-career researchers, and I make a point of promoting the Foundation's role in conservation science whenever possible and to motivate other researcher to also apply for it.

9. Provide a full list of all the members of your team and their role in the project.
Franciany Braga Pereira – Principal Investigator
Joaquim (community guide) – Field logistics and boat navigation
Andressa Scabin – Fieldwork support and logistics
Rômulo Alves – PhD supervisor (UFPB)
Pedro Mayor – Co-supervisor and data support
Carlos Peres – Co-supervisor and analytical advice
Collaborators from Instituto Mamirauá, Instituto Juruá, FAS

10. Any other comments?
This project could not have succeeded without the extraordinary generosity and trust of the local Amazonian communities, who welcomed me into their territories and lives. I am deeply grateful for the opportunity to learn with and from them.
I also wish to express my heartfelt gratitude to The Rufford Foundation, whose support was not only instrumental in enabling the field expeditions of my doctoral research, but also gave me the confidence and visibility to pursue a long-term career at the intersection of conservation biology and traditional ecological knowledge.
The Rufford Small Grant came at a critical moment, when few other funders were willing to support an early-career researcher with a bold idea and limited resources. Your investment in small, locally grounded projects truly has the power to generate large-scale, long-lasting impacts. Thank you for believing in this work and in me.

ANNEX – Financial Report

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