

Final Evaluation Report

Your Details	
Full Name	Sathya Chandra Sagar Halehalli Sathyanarayana
Project Title	Understanding the biodiversity conservation benefits under carbon finance projects
Application ID	34923-1
Date of this Report	26 March 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
Explicit understanding of the status of the faunal community, particularly those species threatened by hunting and wildlife trade				Despite the large tracts of forests that have not been logged or degraded, based on our field observations, we found sightings of ungulate and primate species to be very rare. If they were seen, then they were very skittish and afraid of people, showing a possible sign of hunting pressure. We are currently analysing the data we collected from the field.
Strong ecological evidence useful to inform management actions				Based on our observations from the field, despite the presence of a memorandum of understanding between the villages to not to poach animals within the protected areas, we found explicit evidence of poaching (using snares and shotguns) within the PAs. This was widespread within the PA that has no REDD+ strategy in place and was more prominent closer to villages. We are currently analysing the data we collected from the field and preparing our report to the management team.
Identify the efficiency of using bioacoustics under a quasi-experimental study design, as a default method to evaluate carbon financing initiatives (REDD+)				Based on the preliminary results, we were able to capture the difference in response of biodiversity to hunting pressure within and between protected areas, with and without REDD+ strategies. We still have to finalise the analysis.

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

The project yielded several significant outcomes, which are as follows:

a). Successful collection of crucial field data on biodiversity to fulfil our primary objectives:

(i) Obtaining a comprehensive understanding of the faunal community status, especially species vulnerable to hunting and wildlife trade. We collected over 14,000 hours of recordings of soundscape data, which are currently being analysed.

(ii) Generating systematic biodiversity data that will inform management actions and potentially contribute to long-term adaptive management. We sampled our study sites at a gradient of accessibility from the nearby villages, to determine the hotspots of hunting pressure within the between our two study sites.

(iii) Evaluating the effectiveness of using bioacoustics, employing a quasi-experimental design, as the default method for assessing biodiversity conservation benefits within areas managed under carbon-finance projects. We conducted bioacoustics surveys at 100 locations between two very similar, contiguous protected areas, except for the difference in their management strategies.

b). Establishment of robust local relationships, collaborations, and capacity building:

This project was designed in collaboration with local conservation and management organisations, incorporating their insights into identifying crucial research and evidence requirements. This approach fostered a sense of equal ownership between our team from UW-Madison and our local partners, strengthening our relationship. Additionally, we were delighted to engage in mutual capacity building, where our team shared our experiences in bioacoustics and tropical forest conservation from other countries, while our local partners shared their expertise in forest management, protection, and traditional ecological knowledge. Furthermore, we forged connections with organisations like the Wild Chimpanzee Foundation (WCF) and the Elephant Research and Conservation (ELRECO), both of which are dedicated to safeguarding tropical forest biodiversity in Liberia and expressed interest in future collaborations.

c). Identification of site-specific needs for applied conservation research and strategies:

Through extensive fieldwork involving traversing second-growth, old-growth, and community forests within the greater Gola landscape, we observed the immediate threats posed by land-use changes and over-exploitation. Collaborating with on-ground NGOs, we engaged in discussions to explore potential win-win solutions for both people and wildlife. Based on the insights gained from this work, we are currently in the process of developing promising future avenues for conservation research and strategies tailored to the specific needs of the area.

One of the most notable achievements of our project was the successful collection of 14,400 hours of soundscape data from 100 sites within the Gola Rainforest National Park (GRNP) and Gola Forest National Park (GFNP). These two protected areas jointly form a cross-boundary peace park between Sierra Leone and Liberia (Fig. 1). The biodiversity data we have gathered through extensive fieldwork is currently undergoing analysis, and it holds immense potential in comprehending the effectiveness of carbon finance as a win-win-win solution for people, wildlife, and climate. Throughout this process, we maintained collaboration with an international

NGO and two national NGOs from both countries, while ensuring ongoing communication with local indigenous communities.

Preliminary analysis of the data has revealed that the negative correlation between remoteness (serving as a proxy for hunting pressure) and biodiversity, as measured by soundscape saturation (Fig. 2). This means that, the probability of finding animals within the national park is much higher in remote locations, far away from human settlement, showing a clear sign of hunting pressure gradient. This effect is particularly prominent during the dawn and dusk periods (Fig. 2b & c), when acoustically communicating species such as birds and mammals are most active. These initial findings provide valuable insights into the impact of human presence and hunting activities on biodiversity within the studied areas.

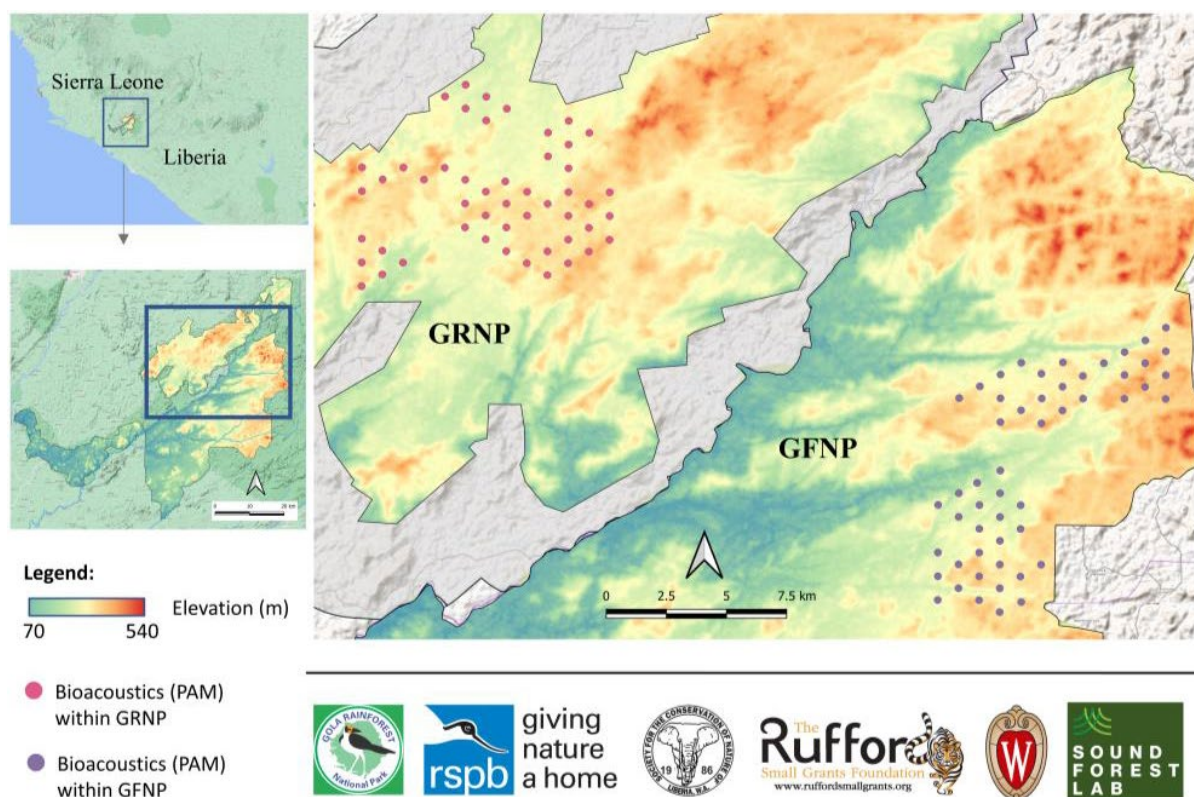


Fig 1: Map of my Study site. Pink and purple points show the sampling locations for passive acoustic monitoring, conducted at Gola Rainforest National Park (GRNP) within Sierra Leone, and Gola Forest National Park (GFNP) within Liberia, respectively. The colour of the map from green to red represent the elevational gradient within the study sites, which was one of the bio-geographic variables considered to identify sampling locations.

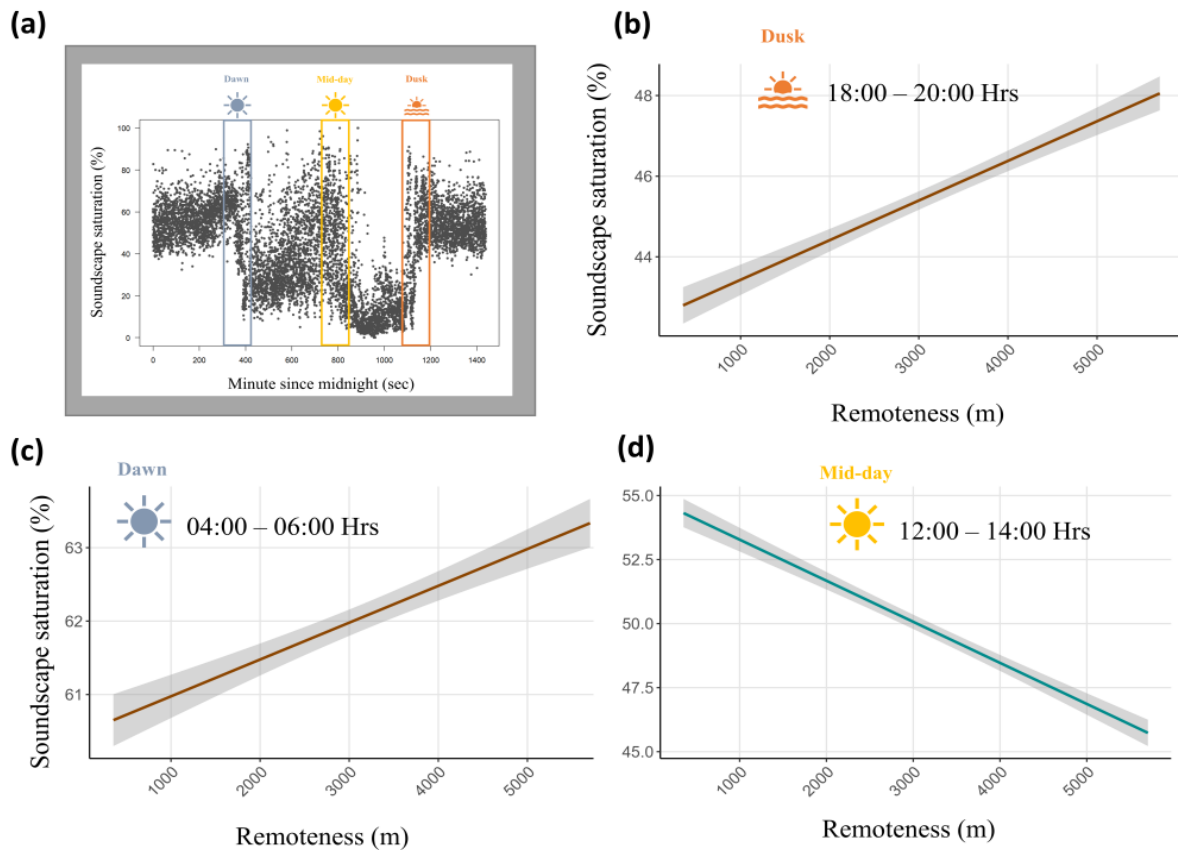


Fig 2: Response of biodiversity measured using soundscape saturation (a) towards remoteness - a proxy measure for hunting pressure, during, (b) dusk (c) mid-day and (d) dawn chorus.

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

One major issue we encountered was the increased cost of field expenses. This was primarily due to the remote locations we were working in and the need for additional research assistants and local guides, resulting in higher costs. To address this problem, we reallocated funds that were initially designated for buying acoustic recorders and used them to cover these expenses. We were able to obtain the acoustic recorders through a separate grant.

Another challenge arose during my research in Liberia, specifically when I stayed in a diamond mining village on the outskirts of a protected area. Some villagers expressed concerns about my presence in the forest, fearing that I would observe illegal poaching and mining activities within the protected area. They requested the village chief to forbid me from entering the forest, hoping to leverage my compliance as a means to advocate for the denotification of protected areas to enable diamond mining. Given the remote location, which was devoid of phone signal and 2 days of travel away from the capital, I faced difficulty reaching out for assistance.

Nonetheless, I managed to continue my research with minimal disruption by establishing and maintaining respectful relationships with the local community and adhering to their customs and traditions from the outset. While in the village, I dedicated time to engage with the community elders and explain the purpose of my presence. Additionally, I had two separate meetings with the village chief, community members, and our local partners, reiterating the goals of my research. I emphasised that my work aimed to understand the success of a REDD+ project implemented in Sierra Leone, which the villagers were already aware of. Furthermore, I ensured that members of our local collaborators accompanied us at all times.

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

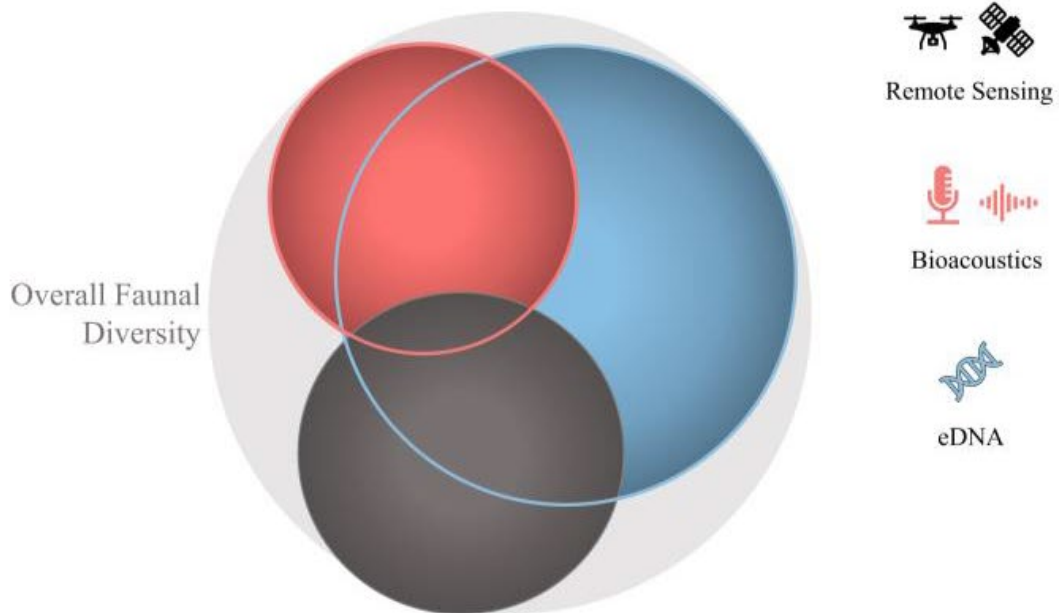
During my project, I employed local research assistants who had been previously trained by our local partner organisations. These assistants received further training in the collection of bioacoustics and habitat data to support my research. In addition to the employment, I provided to the people from the local community as field assistance, I identified the enthusiastic younger individuals who have not undergone training previously by our partner organisations. I then provided them with training in field data collection techniques, including the use of GPS, compasses, bioacoustics recorders, and habitat surveys.

Furthermore, I provided informal internships to two interested undergraduate students from the local university, with prior consent from our local organisations. This allowed me to train them in essential field ecology skills, similar to those provided to the field assistants. By building the capacity of these individuals through such training, they not only acquired valuable knowledge and skills but also gained a deeper understanding of the importance of forest conservation and the potential career opportunities within the fields of ecology, conservation, and eco-tourism.

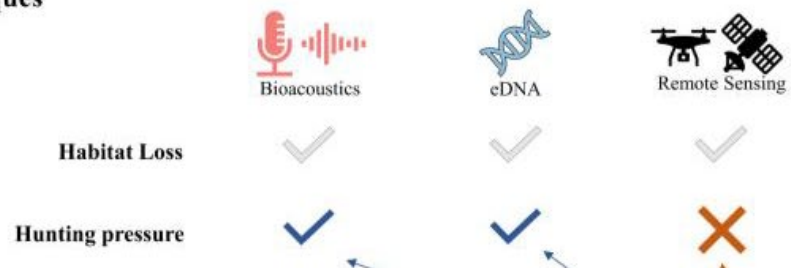
5. Are there any plans to continue this work?

Yes, we have plans to continue our work. We are currently working on finishing up the analysis and publishing it in peer-reviewed articles and as reports to our collaborators. We have plans to scale up the current work using more recorders to conduct long-term monitoring through soundscapes, as an integral part of monitoring biodiversity across other protected areas in Liberia. We also have plans to integrate results from bioacoustics with field detection based metrics such as transect surveys, camera traps and mist netting to model overall distribution and abundance of species. With our newly formed collaboration, we have plans to combine our data with remote sensing and environmental DNA (eDNA) data on biodiversity, to understand their complementarity and redundancy to efficiently monitor biodiversity and evaluate the impact of carbon finance initiative.

Effectiveness, Complementarity & Redundancy



Effectiveness of Techniques



Causal Relationships

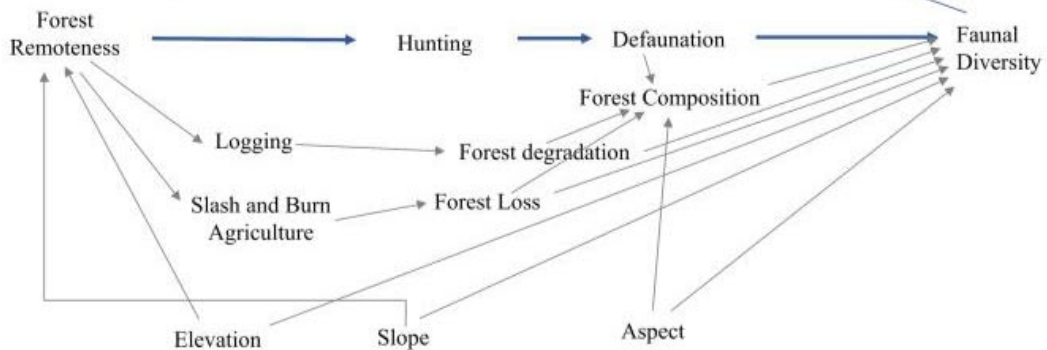


Fig 3: Conceptual framework to look study the complementarity and redundancy between bioacoustics, eDNA and remote sensing.

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

1. Peer-reviewed publication of my research findings in an open-access scientific journal, such as Conservation Biology and Conservation Letters. Preliminary title: Effectiveness of carbon finance project in conserving faunal community within tropical forests.
2. A report to communicate my findings to my target audiences: Gola Rainforest Conservation Limited by Guarantee, managing the Gola-REDD+ in Sierra Leone and Society for Conservation of Nature in Liberia (please refer to Links).
3. Popular articles in leading newspapers such as Sierra Leone Telegraph and Liberian Observer to inform the non-scientific community of Sierra Leone and Liberia at local and national level.

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

The key upcoming tasks are as follows:

- Finalise the statistical analysis of the data collected during our fieldwork in Sierra Leone and Liberia. This analysis will provide essential insights into the findings of our project.
- Collaborate with members of our local organisations to publish multiple peer-reviewed publications based on the project's results. These publications will contribute to the scientific community's understanding of biodiversity conservation and carbon finance initiatives.
- Prepare comprehensive reports detailing the results and recommendations for on-ground management organisations. These reports will serve as valuable resources to inform decision making processes and guide conservation efforts.
- Write engaging articles targeted at the general public to share our research findings. These popular articles will help raise awareness among a wider audience about the significance of biodiversity conservation and the potential benefits of carbon finance projects.

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?

The Rufford Foundation logo was prominently displayed and mentioned during various presentations we conducted, including:

- Presentation delivered at the British Ecological Society Annual Meeting in 2022, at Edinburgh, Scotland. This was attended by members of the academic and conservation communities. Title: Efficient monitoring of

biodiversity to inform carbon finance initiatives in tropical forests. Date: 19-21 December 2022

- Presentations made to the academic committee at the University of Wisconsin-Madison.
- Presentations delivered to members of our local partner organisations and the local community in Liberia and Sierra Leone.
- Discussions and presentations given to our newly established collaborators, WCF and ELRECO.

In addition, we intend to acknowledge The Rufford Foundation as one of our primary funding organisations in all future peer-reviewed publications and reports we publish. By doing so, we will ensure that the foundation's contribution to our research and conservation efforts is duly recognised and acknowledged.

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

Dr Alessandro Albani

Technical advisor for GRNP, RSPB

Project planning; technical support and assistance during data collection at GRNP in Sierra Leone.

Dr Sorrel Jones

Conservation scientist, RSPB

Project planning; technical support and assistance during data collection at GRNP in Sierra Leone.

Nyallay

Research assistant, GRNP

Assisted during field data collection at GRNP, Sierra Leone

Michael E Taire

Program Manager, SCNL

Project planning; technical support and assistance during data collection at GFNP in Liberia.

Tarik Bodasing

Technical Advisor, RSPB

Project planning; technical support and assistance during data collection at GFNP in Liberia.

Zwanna,

Research Assistant, SCNL

Assisted during field data collection at GFNP, Liberia

Maia E Persche

Department of Forest & Wildlife Ecology

Assisted during field data collection at GFNP, Liberia

Dr Zuzana Burivalova Assistant Professor,

Principal Investigator (PI) of the Sound Forest Lab, University of Wisconsin - Madison
Project advisor, project development and planning, fundraising.

Dr Anna Pidgeon

Professor, Co-PI of Silvis Lab, University of Wisconsin - Madison
Project advisor and fundraising.

10. Any other comments?

I am grateful for the invaluable financial support extended to us by The Rufford Foundation. This generous funding has played an instrumental role in facilitating the successful execution of our fieldwork endeavours within the tropical forests of Sierra Leone and Liberia. We firmly believe that the outcomes derived from our extensive research will undoubtedly contribute significant insights to the realm of conservation science, particularly in relation to the preservation of tropical forest biodiversity. The knowledge gained through this study holds immense promise in advancing our understanding of these delicate ecosystems and informing effective conservation strategies.

Furthermore, this funding has not only enabled us to forge new connections and collaborations, but also promises to serve as a pivotal catalyst in the fulfilment of my doctoral aspirations. I firmly assert that the funding will not only aid in the successful completion of my PhD programme but will also serve as a vital stepping stone towards my professional growth as conservationists. In light of these considerations, we shall forever remain indebted to The Rufford Foundation for their unwavering support and belief in our research endeavours.