Final Evaluation Report

Your Details	
Full Name	Consolata Gathoni Gitau
Project Title	Soundscape as a land degradation and ecosystem restoration monitoring tool in savannah ecosystems
Application ID	43873-1
Date of this Report	01/07/2025

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
To conduct meeting and focused group discussions with the local community leaders, stakeholders, and residents to train on land degradation and ecosystem restoration, and discuss how the community can be involved.			✓	We conducted a community meeting with wide participation (21 community members) and feedback. Community leaders, including elders (part of the 21) and representatives from Enarau Conservancy management (the manager, 2 board members, 4 conservancy rangers, 1 conservancy employee in charge of community engagement and 1 employee in charge of the research department) took part, ensuring that local perspectives and priorities were well represented. Their involvement helped strengthen ownership of the restoration and monitoring activities.
To train selected community members on acoustic monitoring techniques, vegetation survey protocols, and soil sampling procedure and run field demonstrations to familiarise community members with the equipment and			✓	The project successfully delivered hands-on training in acoustic monitoring, vegetation surveys, and soil sampling to selected participants (11 community youth members). We also conducted conservation awareness sessions at a local school, engaging 187 students (aged 9 to 15) and teachers in environmental education. These activities effectively built technical skills while fostering community support for

techniques used in monitoring activities and data collection protocols.				conservation efforts. We worked closely with Enarau Conservancy management, who in turn engaged community elders to help identify youth with a strong interest in conservation and active involvement in local initiatives. The selection process aimed to achieve gender balance and ensure representation from different parts of the community, thereby increasing the likelihood that the skills gained would be shared more widely. However, securing female participants proved challenging, as fewer young women were willing to take part in the training; hence only 1 lady was involved.
Acoustic monitoring		✓		We successfully deployed recorders in selected clusters. In total, we had 16 deployment sites (clusters) within the large-scale area (100 km²) and 6 within the small-scale area (121 ha). This required a minimum of 22 recorders to cover all sites simultaneously. However, only 14 recorders were available. To address this, the deployment sites were divided into two sets: in week one, 8 recorders were deployed in the large-scale area and 3 in the small-scale area, with the remaining sites covered in week two. Three recorders were deliberately kept in reserve to serve as backups in case of vandalism or equipment failure. So far, we have collected 840 hours of acoustic and ultrasonic recordings across five seasons, totalling 1.5 TB of raw data. We use Kaleidoscope

				Proprietary (Kaleidoscope Pro by Wildlife Acoustics), a software designed explicitly for bioacoustic analysis, offering tools tailored to process and analyse acoustic data to calculate acoustic indices efficiently We later use R to correlate the sound scape indices, with vegetation, soil and bird count metrics. However, this objective is not yet complete, as we will continue the deployment in subsequent seasons to monitor trends.
Vegetation sampling		✓		We visited all the target sites and collected vegetation metrics. Similar to acoustic data, we will continue to collect vegetation data until 2026. We recorded species identity and distance from the transect of grasses, forbs, shrubs, and trees to assess diversity and distribution. We also recorded the number and species identity at the subplot level (100m2), structural attributes such as plant height, Diameter at breast height (for trees), canopy width (for shrubs) and canopy length to calculate woody plant parameters including tree and shrub density, diversity, size class distribution, and basal area.
Soil sampling			✓	We collected soil samples and conducted infiltration tests in all intended plots across the landscape.

				We collected 355 soil samples, sent them to the ICRAF lab, and received lab analysis results in October 2024. Eighteen soil properties were analysed
To monitor bird community diversity and composition across the study area using point count surveys conducted along 1-km walking transects within each 1-km² study cluster		✓		We conducted point count surveys in 32 1-km transects in each season. We have recorded 238 species so far. We will continue with the point counts concurrently with acoustic data collection.
To assess bat community composition and diversity across habitat types by mist net trapping along probable flyways in six sites (two degraded, two restored, and two reference clusters).			✓	Our bat surveys spanned two full seasons across all target habitat types. We conducted mist netting in all 6 targeted sites. In addition, we scanned around the caves in the study area, but none were active bat habitats (no signs of scats). While mist netting protocols were implemented without incident (zero animal injuries), capture success was low due to the high-flying behaviour characteristic of savannah bat species. During the first season, we captured no bats, while in the second season, we only trapped two species. To complement these efforts, we employed handheld echo-meter technology, which confirmed the presence of at least seven bat species per survey site.

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

- Demonstrated the use of passive acoustic monitoring as a viable, cost-effective and efficient method to assess ecosystem degradation gradient and restoration success in savannah ecosystems.
- Engaged and trained local youth in ecological monitoring techniques, fostering environmental stewardship and capacity building in conservation science.
- Collected a multi-indicator dataset combining acoustic, vegetation, soil, and birds and bats data, which provides a valuable baseline for future long-term monitoring. The multi-indicator nature adds robustness and depth, as correlating diverse ecological data with acoustic signatures strengthens the validity of acoustic data as indicators. This comprehensive dataset establishes a robust framework for assessing ecosystem health in African savannahs, underscoring its importance for future research, conservation planning, and tracking environmental changes over extended periods.

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

Several unforeseen challenges emerged during project implementation, requiring innovative problem-solving:

1. Field Logistics
    - *Challenge*: Remote site accessibility due to the rough terrain and heavy rains during the data collection seasons, which could increase the cost of transportation and increase the number of field work days.
    - *Solution*: Partnered with local motorbike operators familiar with the terrain, ensuring that we collected data within the targeted number of days and our transport budget. This also created community income.
2. Equipment Security
    - *Challenge*: Vandalism of acoustic monitoring equipment (batteries and SD cards stolen from 1 cluster).
    - *Solution*: Worked with conservancy rangers and the local community engagement assistants to raise awareness about the purpose of the recorder. We plan to relocate vulnerable acoustic deployment stations to more secure areas, but within the 1km^2 cluster.
3. Community Engagement
    - *Challenge*: Low women's participation due to cultural norms.
    - *Solution*: We encouraged and gave opportunities to the women and girls present to air their views and opinions during our school and community engagements.
4. Data Complexity
    - *Challenge*: Over 1.5 TB of acoustic data overwhelmed initial analysis capacity in R.
    - *Solution*: We resorted to using Kaleidoscope Pro by Wildlife Acoustics, a software designed explicitly for bioacoustic analysis, offering tools tailored to process and analyse acoustic data to calculate acoustic indices efficiently

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

Our project has fostered deep engagement with the Maasai community in Enarau and Mbokishi Conservancies and surrounding villages, creating meaningful two-way knowledge exchange. Through structured workshops and training, we involved community members and youth in our research. In one of the meetings, an elderly man shared invaluable traditional ecological knowledge, particularly about disappearing native species like the shade-providing Shepherd's Tree (*Boscia albitrunca)* and medicinal plants, which enabled us to see and understand ecosystem degradation from a local community perspective.

The capacity-building component has been particularly transformative. We trained 11 local youth in acoustic monitoring, vegetation surveys, and soil sampling techniques. The trained youth continue to engage in vegetation data collection for our project. The skills they gained in ecological monitoring have already created tangible opportunities - several trainees are now being engaged by other researchers conducting ecological surveys in the region. This demonstrates the project's success in developing marketable conservation skills that extend beyond our immediate work.

We visited the Emarti Primary school, which has pupils from Enarau and Mbokishi areas. Our target through the interactive sessions with 180+ students, especially girls, was to showcase conservation science as a viable profession alongside traditional lucrative paths like medicine and engineering. We also trained them about what degradation is and why we need to restore the ecosystem, introduced the acoustic tools to them and played some acoustic recordings for them to have a better understanding of the method.

We inspired next-generation conservationists through youth engagement and school visits. The shared ownership of the project ensures its conservation impacts will endure beyond the research timeline.

5. Are there any plans to continue this work?

We plan to continue and expand this work through October 2026 to track long-term ecological changes and enhance conservation impact. Our extended monitoring will focus on documenting biodiversity trends across seasons, through vegetation sampling and acoustic monitoring. Through strategic partnerships with universities, NGO, conservancies and government agencies, we aim to integrate our methods into broader ecosystem assessments while informing restoration policies by drafting a policy brief. We plan to introduce AI-assisted species identification pipelines, which will assist other researchers outside of our project area. This continuation phase will transform our project from localised research into a replicable model for evidence-based ecosystem management, while maintaining all existing community engagement components.

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

To maximise the impact of our findings, we will employ a multi-tiered outreach strategy targeting academic, conservation, and community stakeholders:

1. Academic Engagement
    - Submit a peer-reviewed journal article synthesising key results to advance methodological approaches in ecoacoustic monitoring

- Present findings at international conferences (e.g., Society for Ecological Restoration Conference) and university seminars

2. Community Outreach
    - Develop accessible materials (posters, infographics) translated into local languages to share the final results of the project in a simple way for locals to understand.
    - Host workshops at local schools and conservancy meetings to demonstrate monitoring techniques
3. Stakeholder Collaboration
    - Share protocols with conservation NGOs and other practitioners in restoration programs
    - Leverage my role as a member of communities, including the African Bioacoustics Conference committee and the Conservation Leadership Programme:
        - Circulate results through digital bulletins and newsletters
        - Foster dialogue on scaling acoustic monitoring regionally
4. Production of a policy brief- we plan to produce a policy brief targeting government officials and policymakers. This will be developed towards the end of the three-year project, once we have consolidated findings from acoustic monitoring, vegetation, and soil assessments. The brief will provide clear, evidence-based recommendations to support restoration and conservation policies at local and national levels.

This integrated approach ensures results inform both global conservation science and local decision-making while building technical capacity.

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

To build upon the project's successes, we have outlined several key priorities for the coming year:

1. Long-Term Ecological Monitoring- We will expand our acoustic and vegetation data collection to track ecosystem changes over time, by collecting more data until the end of 2026, creating a comprehensive dataset of biodiversity patterns. This will include both acoustic and ultrasonic recordings to capture a full spectrum of vocalising species.
2. Advanced Data Integration- By combining acoustic indices with AI and machine learning techniques, we aim to enhance species-level identification of birds and bats. A critical step will be developing an ultrasonic call library for bat species in the Maasai Mara ecosystem—a resource currently lacking but essential for accurate monitoring.
3. Community-Centred Conservation- We will deepen engagement with local community members in data collection efforts, ensuring the monitoring programme remains collaborative and sustainable. This approach fosters long-term stewardship and aligns conservation goals with community interests.
4. Science Communication and Outreach- Findings will be disseminated through peer-reviewed publications, highlighting the effectiveness of ecoacoustics in assessing land degradation and restoration. We will also share results with stakeholders through workshops and policy briefs to support evidence-based decision-making.

These steps will strengthen the project's scientific rigour, technological innovation, and community impact while contributing to global understanding of acoustic monitoring in conservation.

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 in all materials produced for this project. During the project period, we acknowledged the Foundation's support at multiple international conferences, including presentations at the African Bioacoustic Community Conference in Cape Town held in 2024, the Nottingham Trent University Eastern Africa Centre Conference held in 2025, and the International Conference for Conservation Biology (ICCB) in Australia held in 2025.
The Rufford Foundation was acknowledged in a LinkedIn post highlighting a presentation given at ICCB. The foundation's support was publicly recognised in the post, providing visibility among a professional conservation audience.
The logo was also incorporated into presentations shared with our key collaborators, including the Centre for Ecosystem Restoration Kenya (CERK) and Enarau Conservancy, when discussing preliminary project findings. Through these activities, we ensured visibility of The Rufford Foundation's valuable support throughout our project's dissemination efforts.

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

Name	Role
Consolata Gathoni Gitau	Principal Investigator, Project lead, data analysis, reporting
Lucy Waruingi	Bird surveys
Albert Cheruiyot	Bird surveys, community engagement facilitation
Victor Saitoti	Field technician (soil and vegetation sampling)
Julius Gichira	Vegetation sampling and data entry
Samwel Karia	Local community engagement, acoustic recorder deployment and retrieval
Erick Keter	Bat trapping and identification
Benard Koromicha	Vegetation sampling
Koros, Munka, Muli, Koisikir	Community assistants helped in data collection and translation during our engagements with community members during data collection
Dr Antonio Uzal, Dr Carlos Abrahams, and Dr Esther Kettel from Nottingham Trent University (UK), and Dr Paul Webala from Maasai Mara University	Supervisors: guidance on project execution, review of data collection methods and analysis, and final reporting and thesis writing.

Name	Role
Dr. Felipe Melo	Guidance on the experimental design and landscape scale analysis of the data to assess land degradation gradient.

10. Any other comments?

We are deeply grateful to The Rufford Foundation for supporting this work. This grant has helped us bridge the gap between scientific knowledge and community understanding, laying the groundwork for more inclusive, data-driven conservation in the Maasai Mara ecosystem.

ANNEX – Financial Report

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