

Jana Robeyst Trust Fund Grant Report

Grantee: Lara Boudinot

Project Title: Exploring the impact of anthropogenic seismic noise on large mammal avoidance behavior

Grant Period: April 2025 – September 2025

Grant Amount: €1,500

Project Location: applied for Murchison Falls National Park, Uganda, but safety concerns brought me to fieldwork in Mpala Reserve, Kenya

1. Summary of Project Activities

During the grant period, fieldwork was originally planned in Murchison Falls National Park, Uganda, to conduct experimental seismic playback studies simulating seismic noise and observe elephant and large mammal responses. However, due to unforeseen safety concerns, it was not possible to return to Uganda.

Instead, the grant facilitated a field season in Kenya focused on passive monitoring of large mammals in areas with anthropogenic noise, including gunfire, vehicle traffic, and planes. Key activities included:

- Deployment of 45 seismic sensors, 15 camera traps, and 15 acoustic sensors across selected sites.
- Identification and cataloging of known anthropogenic seismic sources such as vehicles, aircraft, and other human activity.
- Planned thumper playback experiments were attempted but were not feasible due to high elephant skittishness; animals either avoided the experimental area or displayed aggressive/defensive behavior, preventing direct experimental manipulation.
- Passive monitoring captured baseline data on elephant behavior and habitat use relative to human-generated seismic and acoustic noise.

These activities allowed for collection of an extensive dataset on large mammal behavior in response to real-world seismic disturbances in Kenya and provide complementary insights to prior Uganda observations.

2. Outcomes and Preliminary Findings

Although analysis is ongoing, preliminary observations and existing data from prior Uganda fieldwork indicate:

- Elephants (*Loxodonta africana*): Highly sensitive to both persistent and transient seismic noise. Occupancy declines sharply in areas with higher vibration levels (RMS) across frequencies, with a tendency to shift toward nocturnal activity in response to daytime noise.
- African buffalo (*Syncerus caffer*): Similarly disturbance-avoidant, concentrating activity at night and avoiding high-noise areas, sometimes more strongly than elephants.
- Other large mammals:
 - Uganda kob and hartebeest appear more tolerant or even positively associated with human-modified noisy areas, remaining largely diurnal.
 - Giraffe show limited sensitivity, avoiding high-frequency disturbance but remaining active during daytime in noisier areas.
 - Warthog responses were weak and inconsistent.

These patterns support the hypothesis that seismic noise affects large mammal spatial use, diel activity, and potentially communication, consistent with prior research showing elephants rely on low-frequency vibrations for social signaling. A publication for this has been submitted to Nature Communications Earth & the Environment, pending review.

The Kenya data collected during this grant period will provide further insights into behavioral responses to ongoing human activity and sporadic disturbances (vehicles, gunfire, planes), complementing Uganda findings and building a broader regional, East-African understanding.

3. Challenges and Adaptations

- Safety constraints in Uganda prevented the originally planned experimental work with the thumper machine.
- Thumper playback experiments in Kenya were limited by elephant behavior; animals avoided experimental areas, preventing controlled manipulation.
- Adaptation: Focus shifted entirely to passive monitoring with seismic, acoustic, and camera data, enabling valuable observational insights without direct disturbance.

Despite these challenges, the grant successfully supported data collection, sensor deployment, and groundwork for long-term analysis. We are now partnering with Save the Elephants to continue seismic monitoring for elephant conservation.

4. Outputs and Deliverables

- Deployment of a multi-modal monitoring array: 45 seismic sensors, 15 camera traps, 15 acoustic sensors.
- Cataloging of anthropogenic seismic sources (cars, planes, gunfire) for correlation with animal behavior.
- Analysis of elephant and buffalo responses in Uganda demonstrates sensitivity to anthropogenic seismic noise for a publication.
- Dataset from Kenya field season now collected and ready for analysis, providing a regional comparison of seismic disturbance effects on large mammals.

Planned outputs:

- Peer-reviewed publication in Nature Communications Earth & the Environment on large mammal responses to seismic noise for the Uganda data, and another planned for the Kenya data.
- Integration of Kenya and Uganda findings into PhD thesis.
- Recommendations for mitigation strategies to minimize seismic disturbance in protected areas partnered with Save the Elephants.

5. Impact and Relevance to Conservation

This project provides critical new insights into how anthropogenic seismic noise affects large mammals in East Africa, particularly elephants and buffalo. Key conservation implications:

- Demonstrates avoidance of noisy areas by sensitive species, highlighting potential conflicts with human activities such as oil drilling, road construction, and tourism.
- Provides baseline data for developing management strategies that reduce human-induced seismic disturbance in protected areas.
- Enhances understanding of species-specific responses to noise, informing targeted mitigation efforts (e.g., traffic management, operational timing, buffer zones).

The study directly aligns with the Jana Robeyst Trust Fund's mission to support innovative, high-impact conservation research in Africa.

6. Financial Report

Item	JRTF Contribution (€)	Other Sources (€)	Total Cost (€)
Mini Quaker Tactile Transducer (2)	299.65 * 2 = 599.30	0	599.30
FlexSeal Rubber Sealant Coating	101.16	0	101.16
Acrylic Plate (2)	68.00*2 = 136.00		136.00
MP3 player, Receiver, Misc. field equipment	663.54	1,184.95 (NSGG)	1,848.59

Total spent: €1,500 (JRTF contribution fully utilized).

In-kind support: Borrowed seismic nodes, camera traps, and acoustic sensors from previous grants (ERC & Royal Society) were instrumental in enabling the Kenya field season.

7. Lessons Learned and Next Steps

- Elephants and buffalo demonstrate the highest sensitivity to seismic disturbance, confirming prior observations from Uganda.
- Passive monitoring is an effective method for assessing behavior when experimental manipulation is unsafe and can provide good correlations with vibrational noise.
- The next phase will analyze Kenya data fully, with planned publication and development of conservation recommendations.

8. Acknowledgements

I am extremely grateful to the Jana Robeyst Trust Fund for supporting this project and enabling the deployment of extensive monitoring arrays. Additional thanks to the Uganda Wildlife Authority, Kenya Wildlife Authority, Mpala Research Center, Save the Elephants, the Near Surface Geophysics Group (NSGG), and colleagues from the University of Oxford for in-kind support and guidance.