Final Evaluation Report

Your Details	
Full Name	Sandy Oduor
Project Title	Understanding nutritional and physiological stress response of African elephants exposed to varying land use types in Kenya to aid conservation management.
Application ID	33160-2
Date of this Report	December 2022

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 assess how human disturbance index differ between Mpala Ranch (private ranch) and Naibung'a Wildlife Conservancy (communal conservancy).				Population density for the census period 2019 within the two study sites, livestock density and road density for the two study areas were rasterised and used in creating human footprint index (human disturbance index) for the two study sites. R programming software was then used to create a visualisation map for areas with high and low human disturbance index across the two study areas.
To assess the spatio-temporal distribution of elephants in Naibung'a Wildlife Conservancy through community participatory approach.				Security rangers on patrol from both Naibung'a Wildlife Conservancy and Mpala Ranch were given a smart phone that had a CyberTracker (i.e., a conservation software for mobile data capture) where they would record the GPS location of the elephants across the two study sites. R programming software was used to plot the distribution of elephants across the two study sites.
To assess how the physiological and nutritional stress response differ between African elephants found in Mpala Ranch and Naibung'a Wildlife Conservancy.				A total of 53 samples from Naibung'a Wildlife Conservancy and 61 samples from Mpala Ranch were collected during the study period. Of the 53 samples collected from Naibung'a Wildlife Conservancy, eight were from juveniles, 20 were from sub-adult and 25 were from adult. Of the 61 samples collected from Mpala Ranch, 12 were from juveniles, 22 were from sub-adults, and 27 were from adults.
To assess the influence of vegetation quality (measured by satellite remotely sensed measure of vegetation greenness) on thyroid hormones of African				Satellite based remote measure of vegetation quality i.e., Normalized Difference in Vegetation Index (NDVI) for the two study sites were processed in Java Script (see figure 2) and will be correlated with the results of the thyroid hormone samples.

elephants at Mpala Ranch and Naibung'a Wildlife Conservancy.				

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

a). Contrary to what we thought, more elephants were found within communal land (Naibung'a Wildlife Conservancy) compared to private ranch (Mpala ranch) While elephants were mostly concentrated in the north at Mpala private Ranch, within communal conservancy (Naibung'a Wildlife Conservancy), elephants were mostly concentrated towards the western part. This is shown in Figure 1 below.

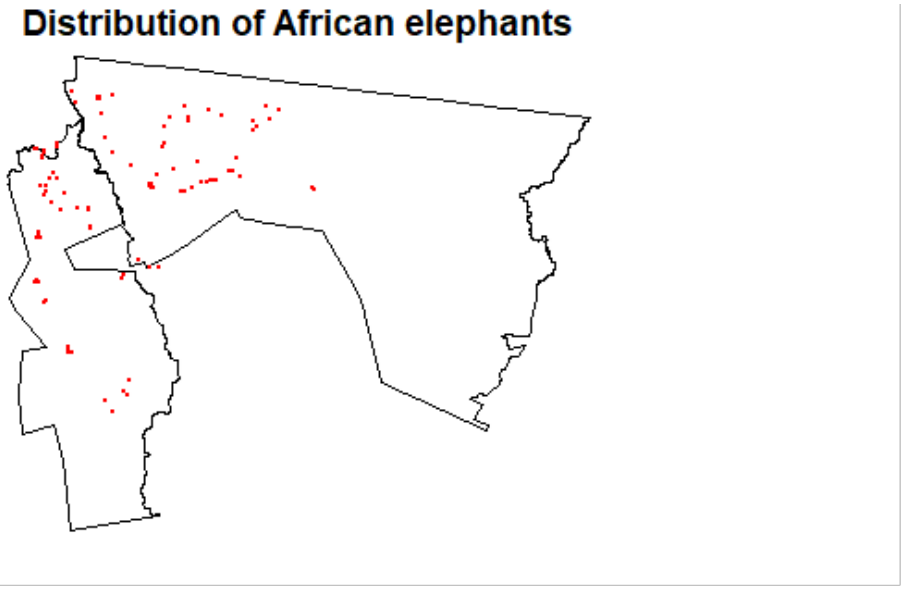

Figure 1: A map showing the distribution of African elephants (red points) within Mpala private ranch (on the left side) and Naibung'a Wildlife Conservancy (On the right side) during the study period.

The distribution of elephants within Mpala private ranch and Naibung'a Wildlife Conservancy (communal land) was mainly influenced by vegetation quality. While communal lands (including Naibung'a Wildlife Conservancy) are known to have lower grass density due to overstocking of livestock compared to other land use types, elephants are known to switch their diets by being browsers during the dry season and being grazers during the wet season. The high distribution of elephants within the western part in Naibung'a Wildlife Conservancy was mainly attributed to higher tree cover. A mean NDVI (Normalized Difference Vegetation Index) map of the study area (Mpala Ranch and Naibung'a Wildlife Conservancy) for the period January 2022 and December 2022 together with the distribution of the elephants is shown in figure 2 below.

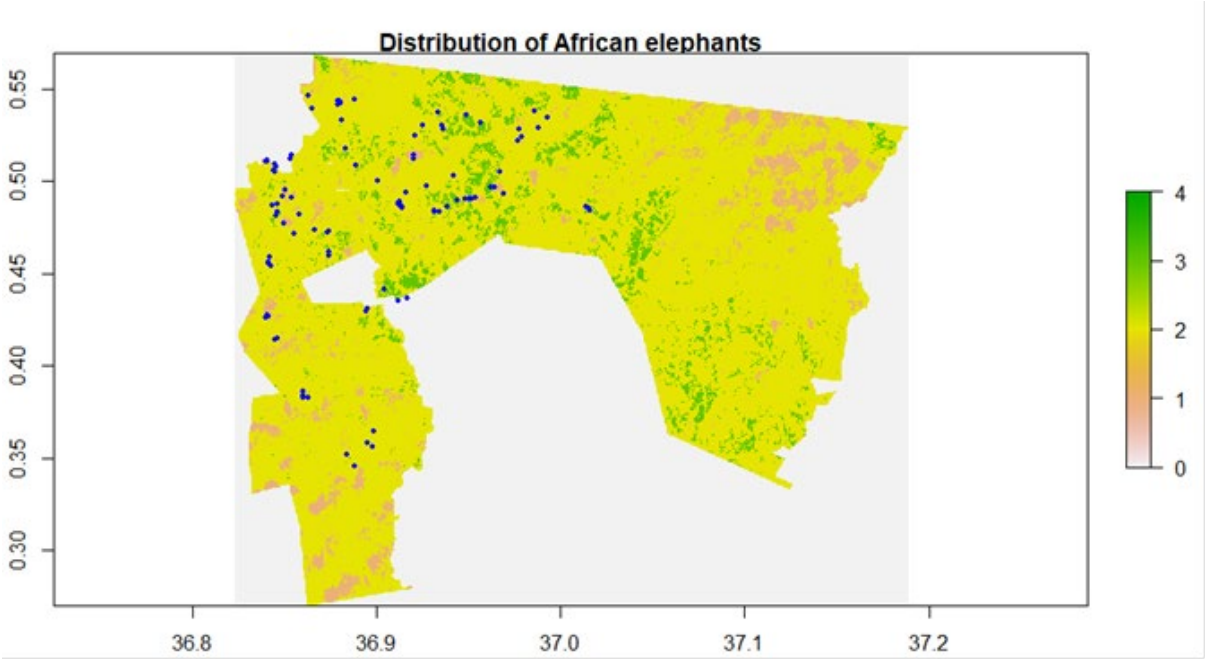

Figure 2: An NDVI (Normalised Difference Vegetation Index) map of Naibung'a Wildlife Conservancy and Mpala Ranch showing the distribution elephants in respect to different vegetation types. Within the legend of the map, 0 = bare ground, 1 = open grassland, 2 = 0pen shrubland, 3 = Acacia woodland, and 4 = Mixed acacia thicket. The distribution of the elephants within Mpala Ranch and Naibung'a Wildlife Conservancy is represented by the blue points.

b). High human footprint index was observed within Naibung'a Wildlife Conservancy (communal conservancy) compared to Mpala Ranch (Private Ranch). Coincidentally, areas with high human footprint index also had high elephant densities in both Naibung'a Wildlife Conservancy and Mpala Ranch (See figure 3). The community living in the area are mainly pastoral nomads and as a result, they move to areas with high resource abundance (particularly pasture for their livestock) which is also tracked by elephants resulting in conflict between humans and elephants. Findings of the lab results (hormonal studies) will be correlated with our findings from vegetation quality and human footprint index across different land use systems.

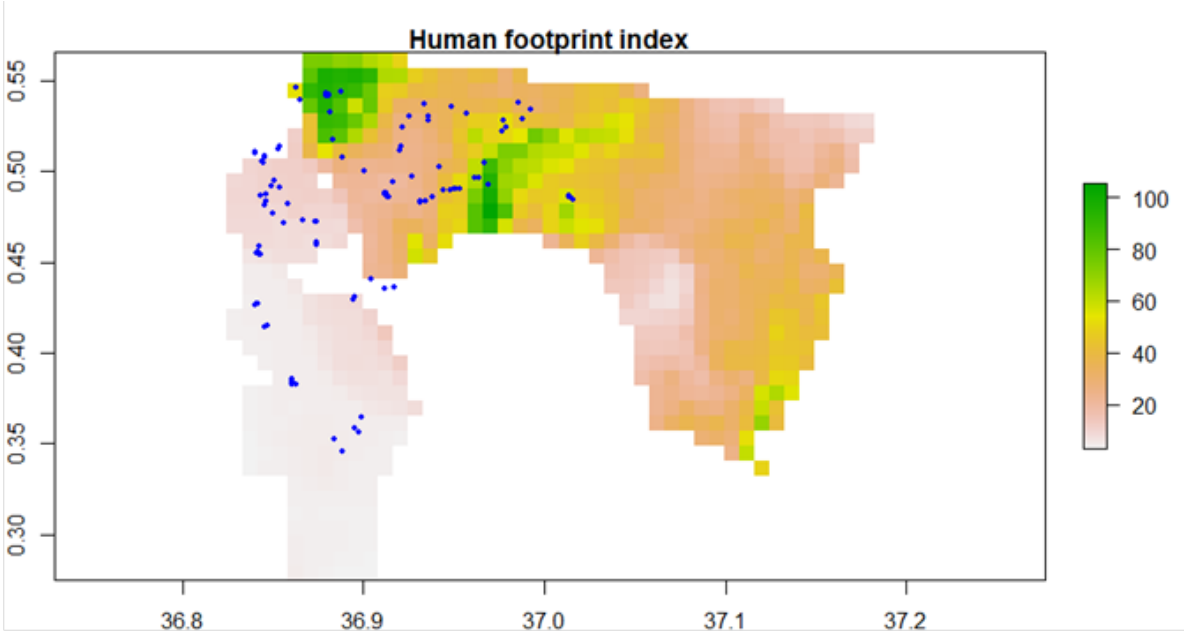

Figure 3: A raster image of Mpala Ranch and Naibung'a Wildlife Conservancy indicating areas with high human footprint index. The grey colour represents areas with low human footprint index while green represent areas with high human footprint index.

c). A total of 53 faecal samples were collected from Naibung'a Wildlife Conservancy and 61 faecal samples were collected from Mpala private ranch. The sexes of 23 of the faecal samples collected from Naibung'a Wildlife Conservancy could not be determine due to the dense habitats that the elephants were in while the sex of only one individual could not be determined. A summary of the samples collected across the two land use types is shown in table 1 below.

Table 1: Summary of faecal samples collected across different land use types.

		Age group			Sex		
Sample site	Land use type	Juvenile	Sub-Adult	Adult	Female	Male	Unknown sex
Naibung'a Wildlife Conservancy	Communal conservancy	8	20	25	21	9	23
Mpala Ranch	Private ranch	12	22	27	37	23	1
Total		20	42	52	58	32	24

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

During the study period, a few challenges were encountered including:

- The study encountered a few delays in acquiring a research permit which resulted in the study commencing a little late. The Rufford team was, however, kind enough to extend the time line of the study.

- This study was carried out when northern Kenya where the study is located was experiencing once of the worst drought in over 40 years. This resulted in the death of some of the elephants. Additionally, only a few resident families were encountered within Mpala Ranch and Naibung'a Wildlife Conservancy. To mitigate on this, an additional funding was secured from Save the Elephants which extended the study site to Samburu National Reserve (representing protected area/reserve), Namunyak Wildlife Conservancy (representing communal conservancy), and Ol Maisor Ranch (representing agro-pastoral landscape where crop raiding is rampant).

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

Local community through the local rangers and scouts were involved in data collection on the spatial distribution of elephants across the two land use systems (i.e., Naibung'a Wildlife Conservancy and Mpala Ranch). Through their indigenous knowledge, the local community were involved in locating elephants for sample collection for this study. Additionally, the local community were trained on the use of CyberTracker i.e., a software that was developed by a South African NGO with a view to capture data on animal presence and communicate their environmental observation (https://cybertracker.org/).

Figure 4: A photo showing two-armed security guards and two local scouts who were trained on the use of CyberTracker for collecting data on the distribution of elephants within Naibung'a Wildlife Conservancy.

5. Are there any plans to continue this work?

There are plans to continue with this work. The second phase of this project involved collection of faecal samples across different land use types (i.e., private ranch and communal conservancy). Due to the prolonged drought period that was witnessed during the study period, many elephant calves were orphaned either because of the calves falling into open wells dug by humans as they look for water, lack of food or due to human elephant conflict resulting in retaliatory attacks. We therefore plan to map out the magnitude and distribution of elephant orphaning for management intervention.

Figure 5: Rescuing of a calve that fell on the water well left by humans that was also being used by elephants to look for water.

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

Findings from this study will be published in one of the high impact factor journals including Journal of Comparative Endocrinology, Conservation Physiology or PeerJ. Findings from this study will also be shared with the land use types to elucidate on how different land use systems with different management systems affect both the physiological and nutritional stress of African elephants.

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

The next step will involve mapping out the magnitude and distribution of elephant orphaning that has been occasioned by the on-going drought and transformation of human landscape and identify possible factors causing elephant orphaning for management intervention. We also plan to continue undertake the physiological and nutritional stress of orphaned elephants and how they adjust to the natural environment post-rehabilitation.

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 logo of the Rufford Foundation was not used in any of the material produced. However, The Rufford Foundation did receive publicity within the two land use types on the organization sponsoring the study.

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

The following individuals were involved in the project:

Sandy Oduor: Sandy was the principal investigator of the study and he coordinated the implementation of the study.

Gabriel Metiaki: Gabriel was involved in data collection during the study period. He was critical in identifying elephants within Mpala and Naibung'a Wildlife Conservancy during the study period.

Charles Kinyua: Charles was involved in data collection during the study period.

Robert Angila: Robert was involved in data collection during the study period.

Ian Keshine: Ian was involved in field work and is currently also involved in processing faecal samples for analysis. He is a member of the local community from Naibung'a Wildlife Conservancy.

10. Any other comments?

I would like to take this opportunity to immensely thank Rufford Foundation for awarding me the 2nd Rufford Small Grant. The study has greatly contributed to my

growth as a wildlife endocrinologist (focusing on African elephant) which will be evident by the publication due next year.