Final Evaluation Report

Your Details	
Full Name	Nguvan Mercy Agaigbe
Project Title	Effects of burn severity and frequency on Northern Ground-hornbill in a Sudan Savannah landscape
Application ID	Nguvan Mercy Agaigbe 32842-1
Grant Amount	£6,000
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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
Map nest locations of Northern ground-hornbill in Yankari		☑		The nest search was based on observation of male behaviour and systematic inspection of large trees for cavities. We also sought information on possible nest locations from field rangers, community members and biologists with long term experience working in the reserve. Overall, we were able to identify three cavities that could serve as potential nest sites for northern ground-hornbill. Nonetheless, repeated visitations to these sites and other historic nest locations in the reserve resulted in no observed breeding. Although our surveys coincided with the documented breeding season for the northern ground-hornbill in Yankari, we surprisingly recorded several females during transect surveys suggesting a mismatch between the bird's life history strategy and our field observations. During breeding, females are sealed in a nesting cavity until several weeks after chicks are hatched. Thus, our observation of several females during this time could suggests a limitation in nesting resources, a shift in breeding periods, or both. In any case, further surveys are needed to provide more insights.
Estimate abundance of Northern ground-hornbill in Yankari			☑	Ten transects were mapped and surveyed repeatedly (at least once a week) for adult ground hornbills from February 2021 to July 2021. Along each transect, we conducted alternate morning and evening

| | | | | ground hornbill surveys using a four wheel-drive vehicle (rented from the Yankari management). Each transect was surveyed at least 20 times but not more than 26. Individual bird detections as well as their distances away from the transect line were recorded. Where possible, we collected perpendicular distances away from the transect line. Otherwise, we recorded angle of detection using a compass and the linear distance from the observer. This information was then used together to estimate perpendicular distances in the lab for detections that we could not collect perpendicular distance estimate in the field. Accounting for detection probability, we estimated a density of 0.52 + (95% confidence interval: 0.22 - 0.83) individuals per 100 ha. Given the size of our study area (2,244 km), this estimate suggests that there could be as few as four northern ground hornbills but no more than 18 in the reserve. |
| Map preferred habitat for Northern Ground-hornbill in Yankari Game Reserve | | | | Vegetation surveys to assess habitat quality for northern ground-hornbill were completed along nine transect lines. Vegetation plots measuring 20 m^2 were set up at 500 m intervals to record tree size, tree height, number of trees, and fire histories. Fire history information was gathered from the Research Unit of Yankari. Fire histories were categorised as 1 year, 2 years, and >3 years. Within the larger 20 m^2 plots, smaller plots of 2 m^2 were taken to document anthropogenic activities, grass height, and ground and litter cover. There was no active nest recorded during the survey, hence there was no vegetation data collected around active nests. Using a generalized linear modelling approach, we observed that |

northern ground -hornbill detection decreases with our measures of anthropogenic activities - presence of cow dung (B = -1.49), plastic (B = -1.34), and looping (B = -0.03) and human footprints (B = -0.025). On the other hand, the odds of detecting individuals increased in areas with higher numbers of baobab trees (72%), and large, tall trees (69%). Our analysis to evaluate the effects that fire frequency and severity may have on habitat section was thwarted by the lack of nest site detections. Nonetheless, there were indications that foraging individuals may prefer early burnt areas that provide abundance supply and easy detection of prey, though preference was not statistically significant. Given our small sample size, it is likely that inferences may become clearer with a larger sample size.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled.

The reserve is highly disturbed by poachers and armed herdsmen doubling as hunters. To tackle this, we ensured all our nest searches and monitoring was carried out only during the daylight in the company of at least one-armed park ranger and we informed the Yankari management of our daily survey plans. We were also highly disturbed by tsetse flies; we wore appropriate field clothes to reduce the risk of tsetse fly bites and carried along with us a first aid kit that included tsetse fly repellent.

3. Briefly describe the three most important outcomes of your project.

- We found species density to be relatively low with an estimate of 0.52 individuals per 100 ha. As stated above, this estimate puts the population in Yankari at between 4 - 18 individuals. Also, repeated visits to historical sites known to hold several nests of northern ground hornbill in Yankari Game Reserve (personal communication with local guides with long knowledge of the bird in Yankari) produced neither evidence of nesting nor detection of the species. However, these areas had several evidence of severe poaching activities that could have decreased habitat for the species.

- Males were repeatedly sighted in the company of females at the time the females are expected to be sealed in nesting cavities. This suggest that the

females were not nesting at the time of our surveys even though our surveys coincided with the documented nesting season for the species in Nigeria. We speculate that this could be due to loss of large sized baobab trees with large enough cavities to accommodate nests (only three such cavities were found during our survey one of which has a bees' nest), a shift in breeding periods due to climate irregulates, wrong documentation of breeding periods for the species in Nigeria (no recent documented breeding period in the literature for Nigeria). These idiosyncrasies further emphasise the need for a sustain year-round survey and monitoring programme for the species in Nigeria to ascertain its current conservation status.

- Birds were repeatedly seen in areas recently burnt, indicating their dependency on fire disturbances. They however avoided burnt areas with high poaching activities.

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

The local communities were interviewed to get information about the occurrence of northern ground hornbill outside the reserve and the prevalence of hornbill-specific hunting. While several respondents admitted to killing the species in the past, a few of them said they are still endangered in hunting the species. Respondents also provided information on areas historically known to have high abundance of the species, and this aided our research. We gathered that the species body parts (such as the head), are used as disguise during hunting. We informed them about the vulnerable state of the species and spoke to them about the need to halt their killing. We believe that a formal sensitisation programme is needed within communities around Yankari Game Reserve to persuade individuals from direct killing and habitat destruction to change the current population trajectory of the species.

5. Are there any plans to continue this work?

Our goal is to build on the achievements recorded during this first phase of our project by continuing nest search and detection surveys. An additional goal would be to embark on a community-based sensitisation programme in local communities surrounding the reserve to reduce poaching of the ground hornbill and other species in the reserve. We are confident that such sensitisation activities would in addition to improving northern ground hornbill numbers in Yankari, benefit several other species (e.g., African elephant, hooded vultures and African lion) in the reserve that are currently listed under the IUCN threat categories. Also, given the lack of nests and a probable lack of nesting activities in the reserve, we plan to provide experimental artificial nest boxes to supplement shortages in nesting cavities.

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

We are currently working on two manuscripts that would be submitted to *Oryx* and *Journal of Wildlife Management* for possible publication. We hope that these articles would complement the paucity of information on population trends of northern

ground hornbill and the relevance of fires in Sudan savanna and other fire-dependent ecosystems in West Africa.

Furthermore, we plan to produce a comprehensive report of our findings to the Bauchi State Ministry of Culture and Tourism which is the state government agency responsible for managing Yankari Game Reserve, non-governmental organisations working on biodiversity conservation in Yankari (e.g. Wildlife Conservation Society and the Nigerian Conservation Foundation), and A. P. Leventis Ornithological Research Institute (the foremost ornithological research institute in Nigeria with ongoing research programmes in Yankari) to guide management planning for the species in Yankari.

Finally, an abstract is in preparation to be submitted for oral presentations at the 2022 annual meetings of the Ecological Society of Nigeria and the British Ecological Society.

7. Timescale: Over what period was the grant used? How does this compare to the anticipated or actual length of the project?

The project duration was 12 months: January 2021 to December 2021

8. Budget: Provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Communication (phone calls to stake holders, internet bill for email)	150	150		
Transportation to and from field site for 2 team members	80	80		
Allowances for 1 field assistance - £7 x 5 days x 4 weeks x 4 months	560	560		
Accommodation team members during field work - £200 per month x 2people x 8 months	3200	3200		
food for team members - £120 per month x 2 people x 8 months	1600	1600		
1 gamin GPS unit (eTrex 20x)	125	125		
1 pair of binoculars (Vortex Optics 10x42)	230	230		
1 pair of binoculars (Vortex Optics 10x42)	30	30		

1 pair of binoculars (Vortex Optics 10x42)	25	25		
Total	**6000**	**6000**		We received 5,988. This gave us a deficiency of £12.

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

1. A year-round nest search to determine the actual breeding periods of the species in Yankari Game Reserve. This would provide some clarifications on why we were unable to recorded nests during our study even though it coincided with the documented breeding period of the birds.

2. Habitat selection study to understand the scope of habitat loss on species persistence and identify possible fire treatment strategies that could benefit population recovery.

3. Provision of artificial nest boxes at locations where individuals were repeatedly detected. We hope this will help us ascertain if the lack of nesting activities is mediated by the absence of cavities or a misrepresentation of breeding periods.

4. Conservation education activities in the adjourning communities on the implications of species decline on the environment as well as the socio-cultural impacts on livelihood.

10. 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?

We acknowledged The Rufford Foundation as the sole funder of our project at Yankari game reserve. Further acknowledgement of the support received from The Rufford Foundation will be mentioned in planned publications.

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Rosemary Abubakar: Rosemary is a final year student of Applied Ecology at the Abubakar Tafawa Belewa University, Bauchi. She assisted in conducting daily searches and monitoring for Northern Ground-hornbill nest, vegetation measurement, and road surveys.

Abdul Haruna: He was the armed park ranger who accompanied us during field surveys due to disturbance by poachers and armed herdsmen doubling as hunters in the reserve.

12. Any other comments?

I would like to thank The Rufford Foundation for their esteemed initiative in funding biodiversity conservation worldwide. This opportunity has helped me to gain more field and leadership experiences.