



**Final report prepared by the Zimbabwe Parks and Wildlife Management
Authority for the African Elephant Fund**



(Photograph by : Tim Kuiper)

Project title: Habitat Use by African Elephants in the Zambezi Valley,
Zimbabwe

30 December 2020

by Nobesuthu A. Ngwenya (Ms)

A handwritten signature in black ink, appearing to read 'Nobesuthu A. Ngwenya'.

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Project identification

Partners Name: Zimbabwe Parks and Wildlife Management Authority

Budget line: BAC \$39230

Expected Outcomes:

- Established causes of declines in elephant populations in the Zambezi Valley for policy and planning purposes
- Zimbabwe Parks and Wildlife Management Authority (ZPWMA) staff capacity developed
- Elephant home ranges, habitat preferences and migration patterns determined and enhance the role of the Trans-frontier Conservation Area in elephant conservation

Expected Outputs:

- Scientific publications
- Land use and land cover maps produced
- Considerations for elephant management planning in the landscape

Title of the approved PRC project: Habitat Use by African Elephants in the Zambezi Valley, Zimbabwe: An Inquiry into the Effectiveness of Corridors and the Suitability of the Environment to Sustain the Species

SSFA starting date: 23 September 2019

Completion date: 31 December 2020

Summary of project status

- Despite challenges faced during the project implementation period, the project milestones were achieved and impact of the project felt within the landscape and across the border in the transboundary conservation area (TFCA)
- All equipment budgeted for was purchased and these include elephant satellite collars, a computer, printer, drones, cyber trackers, immobilisation drugs
- Capacity building programmes were implemented with over 30 staff members across the country benefiting from online and live training activities
- A habitat map for Mana Pools national park was concluded with engagement of experts and training on modelling techniques having played a great role
- An elephant research meeting was held between Zimbabwe and Zambia, a first of its kind within the landscape, and opportunities for future collaboration in elephant research within the landscape promoted
- Whilst the project may require long term data to map out elephant corridors and establish home ranges, towards achieving the main objective, we intend to ensure that the final outcomes are communicated and contribute to the effective conservation of African elephants

Background

Elephant conservation in Zimbabwe has been considered a success over the years. However, elephants continue to be threatened by poaching, habitat loss, shifting land use and land cover systems, resource availability, *inter alia*, impacts of climate change. The Zambezi Valley (Zimbabwe) elephant populations declined by 40% between 2001 and 2014. The carcass ratios, however, did not relate to the percentage decline. As such mortality within the park may not have been the main contributor to the decline in the populations (ZPWMA, 2014).

The Zambezi Valley protected areas form a part the Lower Zambezi Mana Pools TFCA shared between Zimbabwe and Zambia, thus the elephant population is shared between the two countries. The movement of elephants between the two countries has not been studied and crossing routes have not been established. As such, the effectiveness of initiatives to protect wildlife corridors and crossing points is not known.

Elephants face a plethora of challenges within a shared landscape and where possible, efforts need to be made to protect them in their use of the habitat and as well as from natural factors. In a changing environment, ecological shifts resulting from climate change may have long term impacts on elephants. Habitat use by elephants has been documented to be dependent on disturbances or exposure to environmental stressors. This research intends to investigate the multiple stressors determining the geospatial distribution of elephants in the Zambezi Valley. This will enable the understanding of movements of elephants in the area to establish migratory routes and ensure their maintenance and sustainability.

Achieving sustainability is the greatest goal in conservation which this project intends to achieve, through promoting proactive decision making and ensuring proper planning.

Activities status

Activity	Description of work undertaken during reporting period	Deliverables	Delivery date	Status of Activity (completed or not completed)	If activity not completed, please describe the reason why and indicate mitigation actions that were taken.
Activity 1- Planning and Purchasing of equipment	-Planning was carried on the implementation of the project, approaching players, stakeholders and engaging professionals for capacity building. Four lecturers and experts were engaged from the University of Zimbabwe to facilitate the training of ZPWMA staff. Two trainings were held, one online and another face-to-face	-Project execution plan in place, different players engaged, and roles assigned	February 2020 & 18-25 August	Completed	

	-Purchasing of equipment -drones, laptop, printer, GPS units	-Equipment purchased	February - November 2020	Completed	
Activity 2 - Capacity Building	-Training programme for GIS, remote sensing and data analysis -Training on use of drones	Training workshops	10 August - 11 September And 30 September to 4 October 24-29 June 2020 & 17-23 December	Complete	
Activity 3 - Habitat assessment	-Habitat mapping for Mana Pools national park was carried using a drone. 80 survey points were visited and mapped using a drone. Different types of habitats were mapped out and data entered on a data collection software on cyber trackers. Vegetation mortality was noted in areas with high elephant densities and	Habitat map for Mana Pools national park	2 March 2020 - 30 September	Completed	Final consultation required to refine the maps. Expected to be completed by 30 August 2020

	deforestation recorded along boundaries between protected areas and the community area				
Activity 4 - Information dissemination	TFCA elephant meeting between Zimbabwe and Zambia and research finding communicated through a publication Scientific writing workshop	one meeting held between Zimbabwe and Zambia, publication produced writing workshop was held on scientific writing and two manuscripts were prepared	14-15 December 2020	Complete	

Evaluation of achievements and challenges for the reporting period

The project aimed at achieving two main objectives, maintenance of elephant habitats and enhancing connectivity; and strengthening knowledge on African elephant management. These broad objectives take time to yield results, yet they play a critical role in assuring impact on conserving elephants.

Whilst there were challenges faced in acquiring some of the equipment, to ensure the success of the project, many lessons were learnt. Capacity among staff was developed, knowledge acquired on the species, relationships for collaboration developed and the use of technology in science embraced. Research collaboration between Zimbabwe and Zambia was initiated and ideas shared over a workshop. All milestones achieved would not have been possible without AEF funding.

Priority objective 2: Maintenance of elephant habitats and restoring connectivity

Activity 2.1. Capacity building for monitoring of elephant habitats through the use of new technologies

A: Drone training and habitat monitoring

Two drone training workshops were held at Mana Pools national park (24 – 29 June 2020), and Mushandike College (17-23 December 2020). Rangers and the research team were trained on the use of the equipment and it is being effectively used to monitor conservation inside and outside the park area.

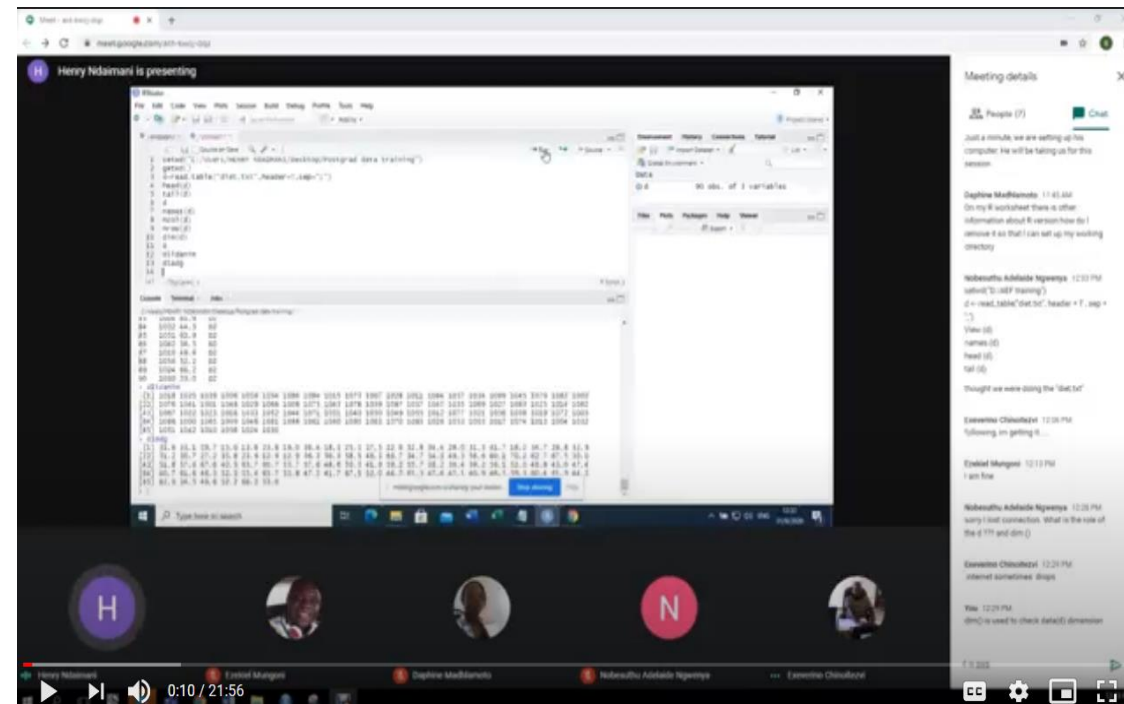
Five drones that were purchased were distributed to all protected areas in the Zambezi Valley landscape of Zimbabwe. Antipoaching teams were also trained on how to use drones for surveillance of inaccessible areas. The research team was trained on how to use drone in habitat monitoring. Permanent plots have been established in the landscape, which will be mapped using a drone each year at the same time to monitor any changes.



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BY RODNEY BELL

B: GIS, Remote Sensing and Data Analysis trainings

Two trainings were held on GIS, remote sensing and data analysis and modelling using R. The training led to the finalisation of the Mana Pools national park vegetation map, analysis of elephant mortalities in the landscape, and preliminary results being produced on habitat use by African elephants in the landscape. Rangers in the field also got an appreciation of how data collected in the field is used for decision making and also teams learnt how to develop reports from data collected in the field. The trainings covered different levels, including rangers collecting data in the field and ecologists and researchers who analyse and interpret the data. Science is evolving, new techniques are being used in research methods and capacity building is critical to ensure that conservationists in Africa are armed with necessary tools to achieve conservation objectives.

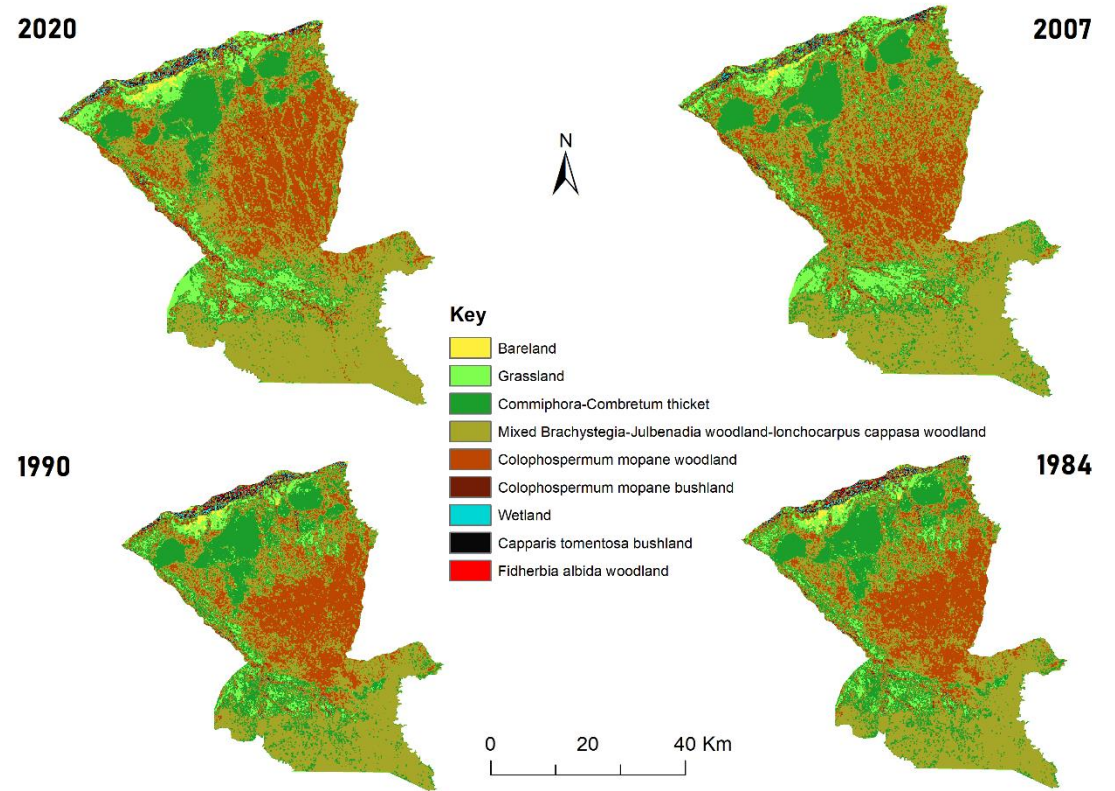


Activity 2.1.3. Investigating the impacts of climate change on elephant habitat and elephant populations through appropriate research.

Habitat assessments were carried out between March to September 2020. Drones were used to map areas which were inaccessible. This made the habitat assessment process faster and images were sorted through at the end of each flight exercise.



Images showing habitat destruction by elephants in Mana Pools national park. To the left is what used to be a mopane woodland, which has been turned into a wooded bushland, captured using a drone. To right is a baobab tree affected by elephant herbivory.



Images showing field work carried out by the research team (Ms Ngwenya and Ms Mugogororo) and land cover change in the Mana Pools national park since 1984. The habitat in the park is becoming more open and some species that were recorded in the 1960s have become very few with most even aged and dying out.

Lessons learnt and recommendations

- Prior to the funding opportunity, there was very limited knowledge of the use of drones in conservation in the country. The ZPWMA staff were motivated learning how to use a drone and how it could be used for different activities including anti-poaching
- Training on proposal development and planning is necessary for conservationists in Africa, to acquire knowledge on planning, budgeting and implementation of projects – which enables ease of access to funds and timely reporting
- AEF should encourage projects that embrace the use of new technologies in Africa

Priority objective 5: Strengthen Range States knowledge on African elephant management.

Activity 5.1.3. Coordinate research efforts, compile and disseminate research findings

Activity 5.1.4. Elephant monitoring across range States

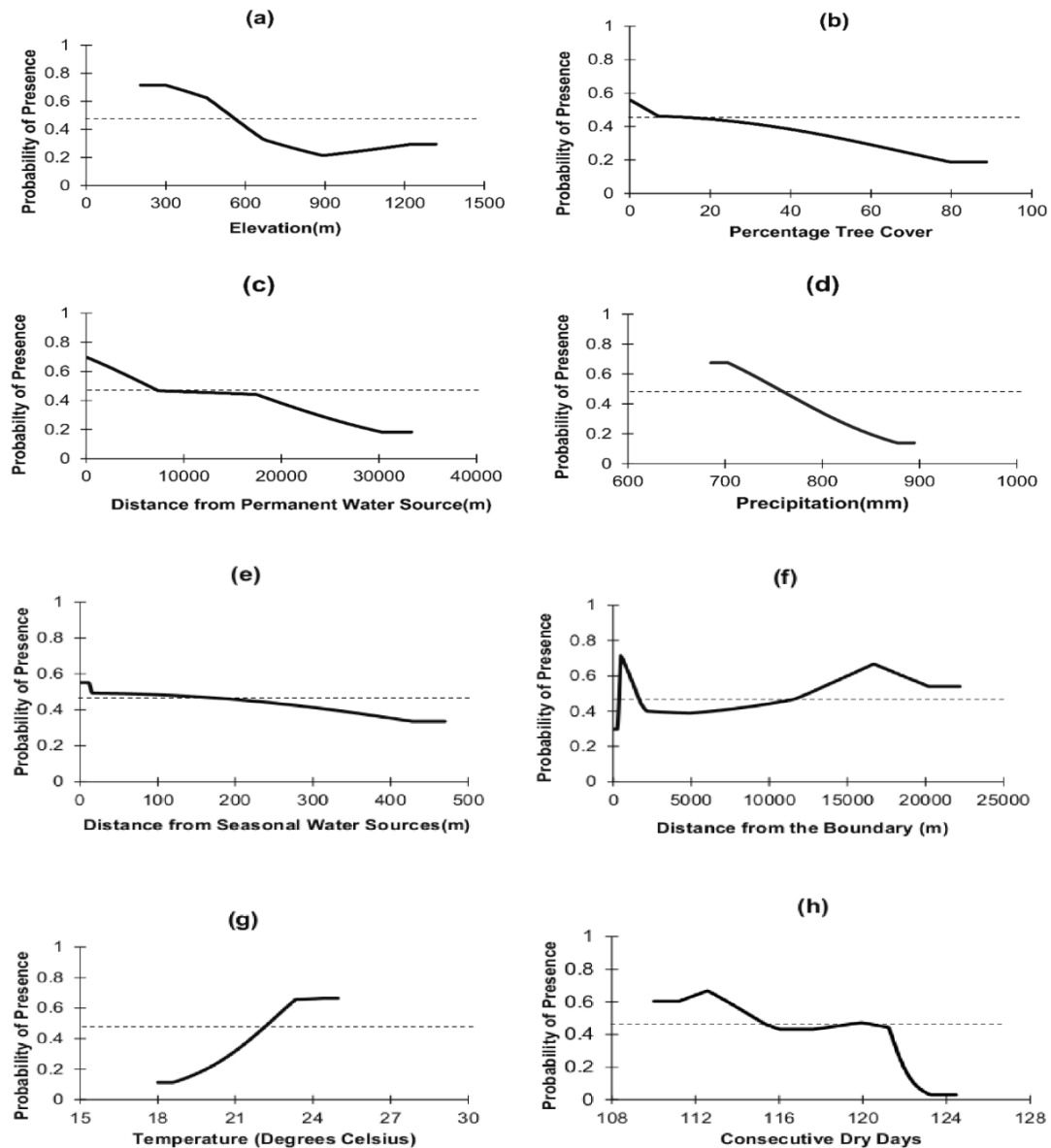
Activity 5.1.3. Coordinate research efforts, compile and disseminate research findings

Utility of machine learning or regression ensembles in identifying climatic and spatial drivers of natural mortalities in African elephant (*Loxodonta Africana*)

Abstract

While many studies focus on understanding the drivers and distribution of elephant poaching, understanding patterns in natural elephant mortality may also generate useful insights. Evaluating mortality risk from all sources can guide spatial habitat protection strategies and elephant re-introductions. In this study, we tested the effect of a variety of spatial and climatic variables on patterns of natural elephant mortality in Chewore Safari Area, Zimbabwe. Natural elephant mortality data (2000-2017) were used to separately calibrate six species distribution models: three machine learning (ML) and three regression (RG) algorithms. Three separate model ensembles were built: ML and RG algorithms combined, ML algorithms alone, and RG algorithms alone. The machine learning ensemble performed better than the other ensemble models on two separate model evaluation metrics. Results from the top performing ensemble model show that temperature, elevation and consecutive dry days contributed most to the overall model performance (importance > 0.15 %). In contrast, tree cover, precipitation and distance from seasonal water sources were not significant drivers of natural mortality distribution (importance < 0.10 %). In as much as findings from this study inform park managers on areas to prioritise when protecting elephant habitats and conditions to rectify when cases of natural mortalities escalates, it also provides insights on how environmental change might intensify elephant mortality.

Manuscript submitted on impacts of climate on elephant mortality in Chewore safari area, Zambezi Valley. Preparation of the manuscript benefited from training and consultation funded by AEF



Activity 5.1.4. Elephant monitoring across range States

A meeting was held between Zimbabwe and Zambia to share project objectives and preliminary findings, and identify opportunities for collaboration in elephant conservation research between the two countries. This was a first meeting of its kind between the two countries, and ideas and knowledge were shared on elephant conservation in the landscape. Research in the landscape had been carried out in silos and the meeting presented an opportunity to collaborate. Zambia has an elephant monitoring project similar to that of Zimbabwe, with elephants collared in Zambia. The projects aim at achieving similar objectives and it is anticipated that the research teams will collaborate on the study to establish and protect elephant corridors within the landscape



Conclusion

Covid 19 was an unforeseen challenge in project implementation and the implementation had to be constantly adaptive. Challenges and necessities continued to emerge and activities continued to adapt to ensure effective implementation of the project. Trainings were carried out online, though due to poor access to internet in protected areas, limited staff benefitted. To ensure effectiveness, face to face training were then carried out at a later stage.

In conclusion, the project has had far reaching effects in equipping, motivating, improving capacity of staff involved in elephant conservation; which may not have been possible without the funding. Whilst progress was affected by Covid-19, the project has a greatly improved capacity within the Organisation, the understanding of the species ecology and inherently its conservation in the wild.