



## Proposal to the African Elephant Fund

1.1 Country: **KENYA**

1.2 Project Title: **Developing drought mitigation measures for elephants in Tsavo by understanding long-term elephant distribution and mortality patterns in relation to NDVI, rainfall and waterholes**

1.3 Project Location: **TSAVO ECOSYSTEM, KENYA**

1.4 Overall Project Cost: **USD 28,840**

AMOUNT Requested from African Elephant Fund: **USD 23,440**

1.5 Project Duration: **1 year**

1.6 Project Proponent:

**KORIR David Kimutai, LALA Fredrick, CHIYO Patrick**

1.7 Name of Project Supervisor: **KASIKI Samuel**

1.8 Address of Project Supervisor:

**Deputy Director,  
Biodiversity Research and Monitoring Division,  
Kenya Wildlife Service,  
P.o. Box 40241-00100,  
Nairobi, Kenya**

1.9 Telephone Number: **+254 (0) 721446729**

1.10 Email: **skasiki@kws.go.ke**

1.11 Fax:

1.12 Date proposal submitted: **27 December, 2017**

## 2.0 Project Summary: (not more than 250 words)

The proposed project aims to develop drought mitigation measures for elephants in Tsavo East by understanding long-term elephant distribution and mortality patterns in relation to Normalized Difference Vegetation Index (NDVI), rainfall and the distribution of waterholes. Specifically, the project will: 1) examine effects of previous elephant drought mortality on elephant age and sex structure, 2) examine temporal and spatial pattern of elephant mortality in relation to rainfall, NDVI and waterholes, 3) examine current and past elephant distribution in Tsavo in relation to NDVI, vegetation, rainfall and waterholes, and 4) Strengthen the capacity of KWS rangers in monitoring elephant drought related mortality.

Because the distribution of water, NDVI and vegetation are usually positively correlated, and their spatial distribution dictates elephant spatial distribution and grouping patterns, this project will employ geospatial discordances in the distribution of water holes, NDVI, Vegetation and elephants to make inferences on factors that amplify elephant drought mortality in the Tsavo East.

Discordance in the distribution of forage (NDVI and Vegetation), waterholes and elephants may be driven by risk avoidance and disproportionate influence of water on elephant distribution causing localized forage reduction. Such patterns will suggest the need to improve security by strategically positioning ranger outposts and waterhole in areas with adequate forage and vegetation cover. The proposed project will use KWS elephant aerial census and mortality data, remote sensed vegetation indices from the last 20 years to unravel factor amplifying elephant drought mortality and to identify locations for new waterholes, ranger outposts and habitat restoration.

## 3.0 Which Priority Objectives and Activities (there may be more than one) in the African Elephant Action Plan does this project fall under? (For ease of reference, Priority Objectives are attached under Appendix 1)

**PRIORITY OBJECTIVE 5: STRENGTHEN RANGE STATES KNOWLEDGE ON AFRICAN ELEPHANT MANAGEMENT.** An understanding of elephant populations and their distribution is essential in order to maximise the impact and effectiveness of elephant conservation and management policies and activities

Specific to this project, the objectives are:

1. To examine effects of previous elephant drought mortality on elephant age and sex structure
2. To examine temporal and spatial pattern of elephant mortality in relation to rainfall, NDVI and waterholes
3. To examine current and past elephant distribution in Tsavo in relation to NDVI, vegetation, rainfall and waterholes
4. Use information gathered from objective 1 to 3 to draw recommendation on mitigation measures to minimize the effects of drought on elephant mortality
5. Strengthen the capacity of KWS rangers on monitoring elephant drought poaching related mortality

4.0 Project Rationale – why is this project necessary and urgent? What threats face this elephant population (give, for example, what information you have regarding population details, trends in population (downward or upward), ivory seizure information, details about levels of poaching, human/elephant conflict, etc.).

The Tsavo ecosystem is a stronghold of elephant conservation in Kenya and drought has been a persistent cause of elephant mortality in the Tsavo Ecosystem with severe drought impacts recorded in the Tsavo East National Park. Drought causes elephant mortality directly through starvation, and indirectly by increasing elephant susceptibility to disease, human elephant conflict and even poaching. With rising global temperature, rainfall variability is expected to become extreme leading to severe droughts and flood years are expected to increase in East Africa and yet we understand so little about factors that exacerbate elephant drought related mortalities.

The discordance in the distribution of forage and water resources needed for elephant survival during severe droughts has been linked to increased vulnerability of elephants to drought related mortality in south Africa. This project will identify causes of this discordance and draw recommendations for strategic security deployment and waterhole development as well as areas for habitat restoration through fencing.

Additionally, understanding the relationship between past elephant mortality patterns and climatic and vegetation variable and long term climatic trends will lead to development of early warning systems for drought mitigation.

The impact of drought related elephant mortality on different elephant age groups and sexes can have important outcomes for elephant population growth and recovery from droughts. When drought mortality targets young females with a high reproductive potential, drought can dramatically reduce population resilience to droughts. Yet previous studies on drought have shown variable and inconsistent mortality effects on different elephant age groups and sexes. The driver for this variation is less understood.

Building capacity of frontline staff likely to encounter elephant carcasses will enable collection of quality long-term data for monitoring elephant mortality and collecting relevant data on causes of mortality age and sexing of dead or sick as well as injured elephants. This will generate quality data for elephant management in the Tsavo Ecosystem.

5.0 Detailed Proposal – including activities to be carried out, milestones (at least quarterly milestones), timelines, equipment to be purchased, reporting procedures, etc. (not more than 1000 words). It will be helpful in evaluating this Project Proposal if you to divide it into Phases such as planning; Procurement; Implementation; Evaluation and Reporting

Should include anticipated benefits (including benefits to the conservation and management of elephant populations and communities) and outputs from the project, and how the project will be monitored and evaluated.

## **5.1 Activities, expected outputs and monitoring indicators**

### ***Impact of previous elephant drought mortality on elephant age and sex structure***

#### *5.1.1*

##### *Activities*

The main activity for this objective will be field based. It will involve locating elephant jaws and skulls in the field and estimating the ages of elephants at time of death using georeferenced historical data (past 10 years) as well as data currently being collected. We will employ the molar progression method of Laws et al 1966. Sex will be determined from jaw morphology and tusk measurement when available using the method of Western 1989

#### *5.1.2 Monitoring indicators and expected outputs*

Monitoring indicator will be a comprehensive list of georeferenced elephant carcasses in the last 10 years compiled by the first and second quarter. From the second quarters onwards the number of georeferenced jaws located, aged and sexed per quarter will serve as indicators for the progress in this objective. The expected output will be a report on the potential impact of Tsavo droughts relative to other causes of mortality on elephant population age-sex structure and implications for population growth and sustenance. This will impress upon conservation managers to consider drought in elephant conservation.

### ***5.2 Temporal and spatial pattern of live elephant as well as dead elephants in relation to NDVI, vegetation, rainfall NDVI and waterholes***

#### *5.2.1 Compile reports*

We will compile Tsavo East elephant mortality data for the last 10 years. In addition we will also compile and where raw data is not available, digitize georeferenced aerial census data from 1990s to the last aerial census. Sourcing and compiling current and historical rainfall data for Tsavo East Weather stations from the 1960s to the present. Data will be obtained from archived data collected from a network of 10 weather stations in Tsavo East NP as well as Voi. As a field component we will map and georeference all elephant water points in the dry season in Tsavo East. Finally we will source and process remote sensed images to produce NDVI data for live elephant locations, elephant mortality locations and spatio-temporal data for the Tsavo Ecosystem.

Datasets on rainfall will be analysed using time series analyses to determine periodicity in drought and to predict future patterns of drought occurrence in the Tsavo. Spatio-temporal patterns in the distribution of live and dead will be analysed using spatio-temporal GIS and Remote Sensing tools.

#### *5.2.2 Monitoring indicators and expected outputs*

Objective indicators include, number of years of compiled rainfall data obtained from KWS archives and Kenya Meteorological Department. The target is to obtain rainfall and temperature data since 1960s for Tsavo East weather stations

and Voi met station. Remote sensed monthly data from 1995 to present will be sourced and quality images obtained for Tsavo East. The number of aerial census data will be compiled or digitized. Aerial census data for the Tsavo Ecosystem is available from 1960 to present. More recently this aerial census data is available for intervals of 4-5 years.

The expected output is a report on the spatio-temporal relationships in dead and live elephant distribution and their relations to rainfall, NDVI, vegetation and waterholes. A geospatial analysis of discordance in elephant distribution resource availability and mortality patterns will inform new locations for waterholes and ranger outposts. Implemented, this will minimize negative effects of drought on elephant populations.

### **5.3 Strengthening the capacity of KWS rangers on monitoring elephant drought mortality**

#### *5.3.1 Develop Training Materials*

The activities for this objective are to develop training manual on elephant mortality monitoring including techniques for ageing and sexing live and dead elephants. The training will also involve protocols for determining the cause of mortality, geo-referencing and note taking and reporting procedures. The training will target 40 rangers from Tsavo East, Tsavo West and surrounding community conservancies. This will be a 4 day training workshop including hands on practical training inside Tsavo East NP.

#### *5.3.2 Monitoring indicators and expected outputs*

Manual for elephant monitoring developed and printed. Another indicator is that the ranger training is conducted and ranger are competent at, sexing and ageing dead and live elephant, assessing cause of elephant mortality whenever possible and follow reporting protocols for MIKE. The expected outcome is consistent and high quality data collection of elephant mortality and distribution data that will be used for elephant conservation management and planning.

6.0 Project Timeline – outline the timeline for proposed activities within this project. You may find it helpful to relate the timeline to the Phases identified in Section 5.0 above.

This project is planned to be implemented within 1 year. For monitoring and evaluation, we have divided the year into 4 quarters each quarter is approximately 3 months. Below is an outline of quarterly project outputs and indicators.

Objective activity	Output	Phase 1	Phase 2	Phase 3	Phase 4
5.1.1 & 5.1.2	Locating elephant jaws in the field	50% of the jaws located	100% jaws located	Age structure completed	Final report
5.2.1	Compiling mortality reports for the last 10 years	Compilation completed	Analysis	Analysis	Final Report
5.3.1	Staff are trained	Field work and	Field work	Production of	Final

	on monitoring elephant mortalities related to drought	training	and training	training materials	report
Activity (see proposal above)	Phase I	Phase 2	Phase 3	Phase 4	
5.1.1					
15.2.1					
15.3.1					

## BUDGET

7.0 Has this project received or been pledged any other sources of funding (external)? Give all relevant details (for example, amount, source of funds, timetable, Any restrictions):

7.1 Please provide a detailed proposed budget for this project (in US\$). You may find it helpful to relate expenditure to the Phases you have set out in Section 5.0

Details included in Table annexed to the document:

*Any other budget lines:*

7.2 Please specify the proponent's contribution towards the project

FULL PROPOSAL BUDGET					
BUDGET LINE	Quantity/Days/Participants	Cost/Unit (USD)	Expected source of funds and amounts (USD)		
			AEF	PROPONENT (GOVT.)	Other (please specify)
<b>EQUIPMENTS/ GEAR/ SUPPLIES</b>					
(If applicable list all purchases)					
Laser Range finder (Bushnell Pro 1M Slope)	2	600	<b>1,200</b>		
GPS (Garmin GPSMAP 64S)	10	220	<b>2,200</b>		
Camera (Nikon D7200 DX-Format-DSLR)	2	800	<b>1,600</b>		
Laptop	2	900	<b>1,800</b>		
Fuel for field Vehicle	48 Days/Year	80	<b>3,840</b>		
<b>TRAINING/CAPACITY BUILDING</b>					

(If applicable: note number of participants, locations/venues, fees involved, activities involved, etc.)					
Train 40 KWS Rangers	4	30	4,800	2,400	
<b>PRODUCTION OF AWARENESS &amp; EDUCATIONAL MATERIALS</b>					
(If applicable note all materials and prices for each item)					
Teaching material	100	10	2,000	1,000	
<b>CONSULTANCY/PROFESSIONAL BACKSTOPPING SERVICES</b>					
(If applicable note all services, number of consultants)					
Remote Sensing , NDVI Extraction and GIS Analysis		4,000	4,000	1,000	
<b>MEETINGS AND WORKSHOPS</b>					
(If applicable note all activities, number of participants involved, venues, etc.)					
Final Wrap up workshop	50	40	2,000	1,000	
<b>TOTAL</b>			<b>23,440</b>	<b>5,400</b>	

Please submit the completed proposal by:

Email: [africanelephantfund@unep.org](mailto:africanelephantfund@unep.org)

You should receive acknowledgement of receipt of your proposal within 14 days. If you do not receive such an acknowledgement, please telephone: (254) 20 7625069 / (254) 20 762 5046

Further details on any of the above details may be requested by the Steering Committee of the African Elephant Fund.