Population Estimates of Mt Cameroon Elephant Using Capture-Recapture

Presented by
Anya Dabite Abeh

University of Buea, Cameroon

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Background

Mount Cameroon, the highest peak in West and Central Africa, is home to one of the continent's most biologically diverse ecosystems. Among its most iconic inhabitants are the forest elephants (*Loxodonta africana*), whose presence remains vital yet poorly understood. Despite their ecological importance, these elephants often exist as elusive figures, with little known about their population size, distribution, or movement patterns. This lack of data is particularly concerning given the growing frequency of human-elephant conflict in surrounding communities conflict driven by habitat loss, agricultural encroachment, and increased competition for space and resources. Understanding the dynamics of elephant populations is therefore not only a matter of ecological urgency but also essential for fostering coexistence and shaping effective conservation strategies.

Objectives

1. Estimate the population sizes of forest elephants

2. Determine their movement, ranging, and distribution patterns across the park; and

3. Assess the influence of abiotic, biotic, and anthropogenic factors on their population dynamics and spatial behavior.

Methods

Employs a capture-recapture framework across three park clusters North, South, and Centre defined by PSMNR-SWR (2020). Each cluster includes 8 survey cells (2×2 km), with one camera per cell, totaling 24 camera sites, surveyed between **2020–2022,** and in dry seasons of 2023 and 2025. Incorporates **TEAM Network imagery (2015–2019, 2024)** with 30 traps deployed during dry seasons.

 A total number of 66 camera traps were used

Identification criteria and scoring system

Identification Criteria Used

1. Tail characteristics
2. Tusk Shape and Size
3. Ear Notches and Tears
4. Body Marks and Scars
5. Overall, Body Size and Shape
6. Earhole and ear tear
7. Unique marks (trap marks, scars/tumours, broken tusks)

Scoring system

Signs	Score
Presence of Tusk	0.5
Tusk arrangement	1
Tusk angle	1
Tusk Thickness	0.5
Ear tear	1
Ear hole	0.5
Tail Length	0.5
Distinct patterns/unique signs	5
Total score	10

Physical signs
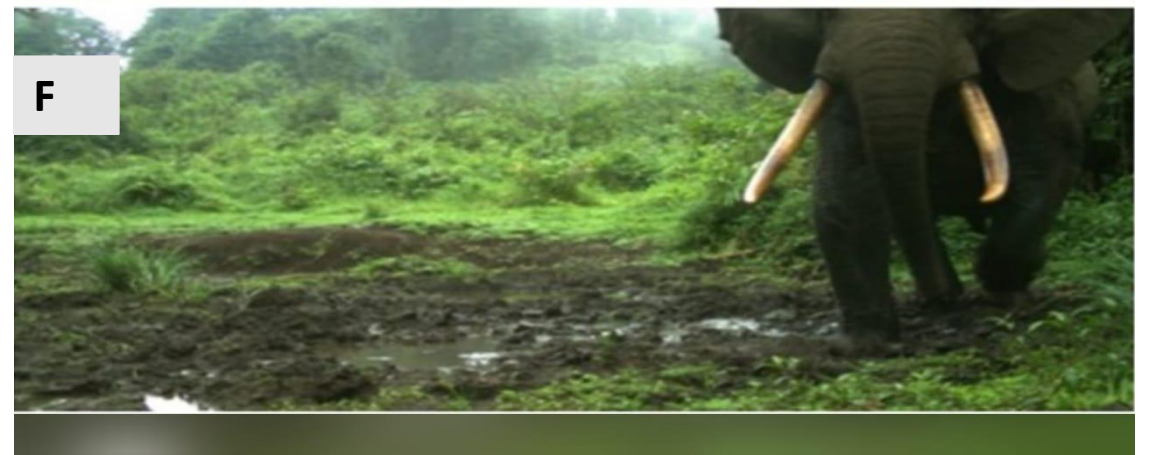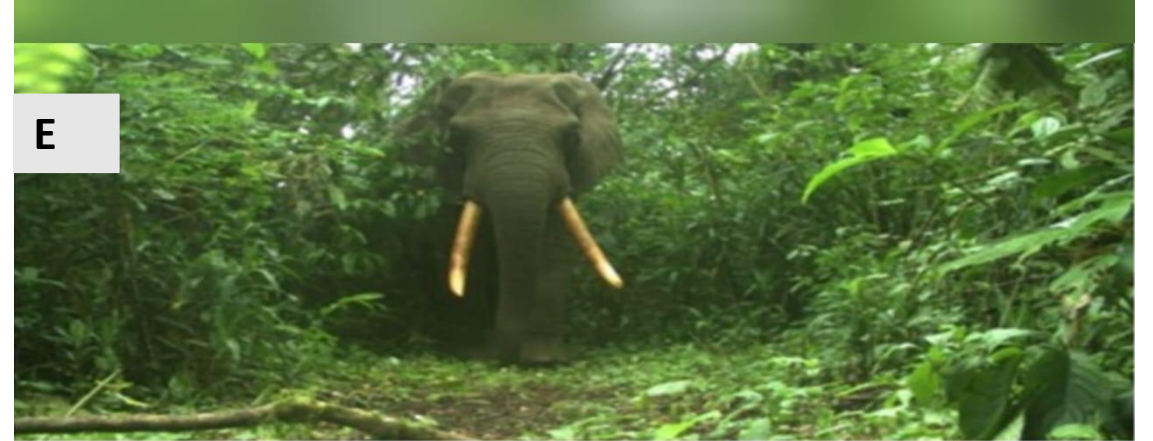
Results

Population Estimate

Parameter	Link Function	Estimate	Standard Error (SE)	95% CI Lower (lcl)	95% CI Upper (ucl)
D	log	**2.11**	**0.65**	**0.65**	**0.65**
g0	logit	0.00286	0.00076	0.00170	0.00483
σ	log	49,997.88	0.0355	49,997.81	49,997.95

Detection Probability
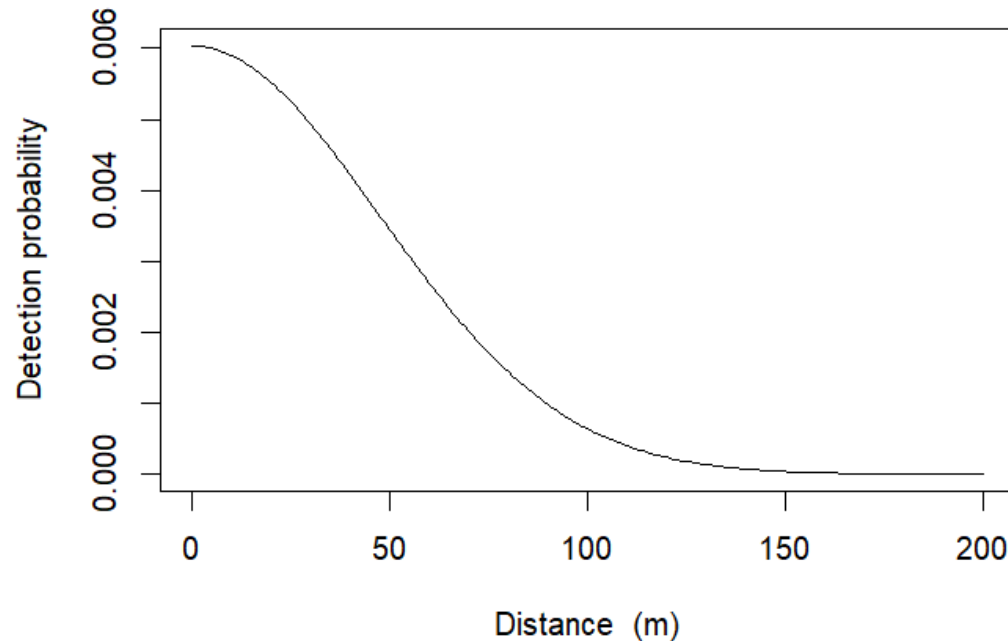
- If an animal is **very close** to the trap (0–20 meters), it has the **highest chance** of being detected (~0.006, or 0.6%).

- As the animal gets **further away**, say 50–100 meters, the chance of detection **drops steeply**, down to near zero.

- Beyond 150 meters, the chance of detection is practically **zero**. The curve almost kisses the x-axis

Elephant Movement
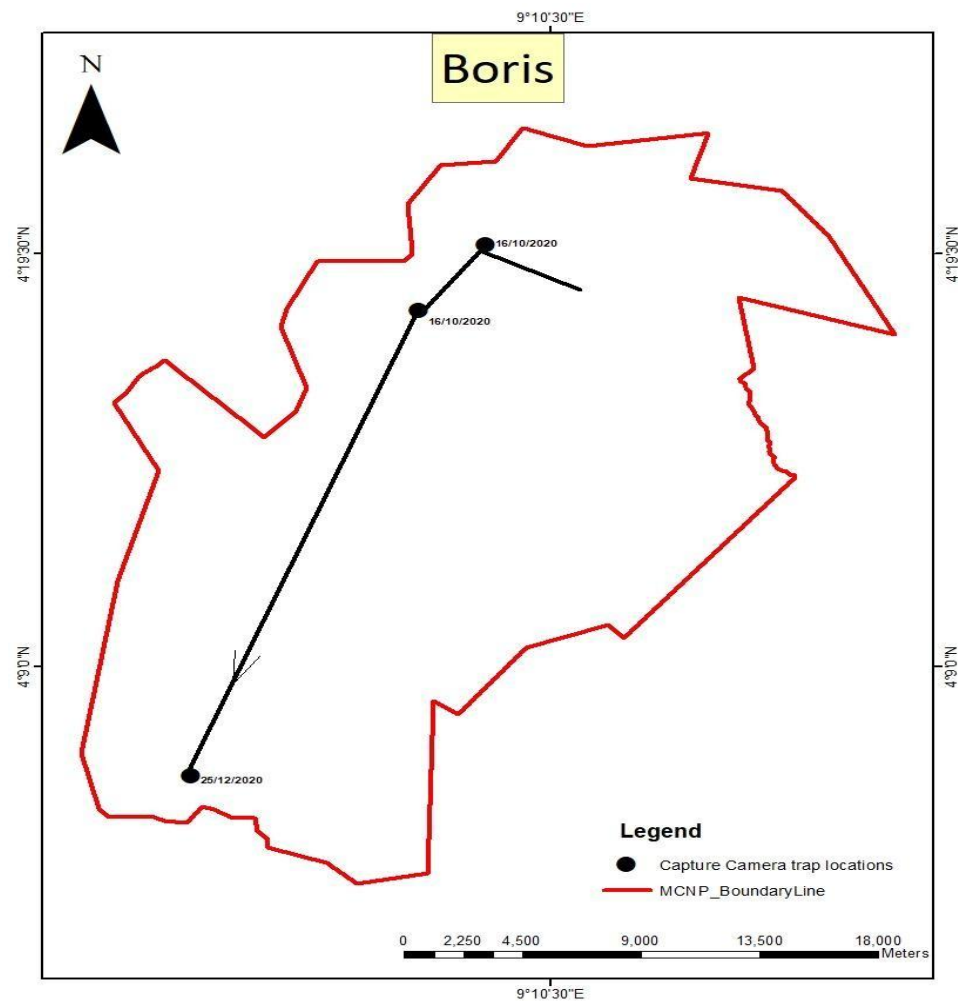
Influence of Environmental Factors on Population & Spatial Patterns

Factor Type	Covariate	Estimate (β)	Interpretation
Abiotic	Elevation (on Density)	+0.00515	Higher elevations support more individuals/km²
	Elevation (on g0)	−0.94629	Dense/steep terrain hinders detectability
Biotic	Habitat: MPF	+7.68387	MPF likely has clearer visibility or more activity
	Habitat: SMF	−1.37507	Secondary forest decreases detectability
	Max Tree Density (g0)	+51.62488	Big trees attract more activity around traps
	Max Tree Density (σ)	−0.19900	Animals stay close to large trees
Anthropogenic	Habitat Degradation	Implied via GL, SMF	Animals avoid or reduce activity in disturbed zones