Mt. KENYA ELEPHANT SURVEY

CONDUCTED BY

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FINANCED BY

REVERSE THE DECLINE

WITH SUPPORT OF

INTRODUCTION

Human tolerance towards elephants varies with density

In less productive areas of Zimbabwe, elephants are excluded at human densities of 18.9 people/ km^2 (Hoare & du Toit, 1999)

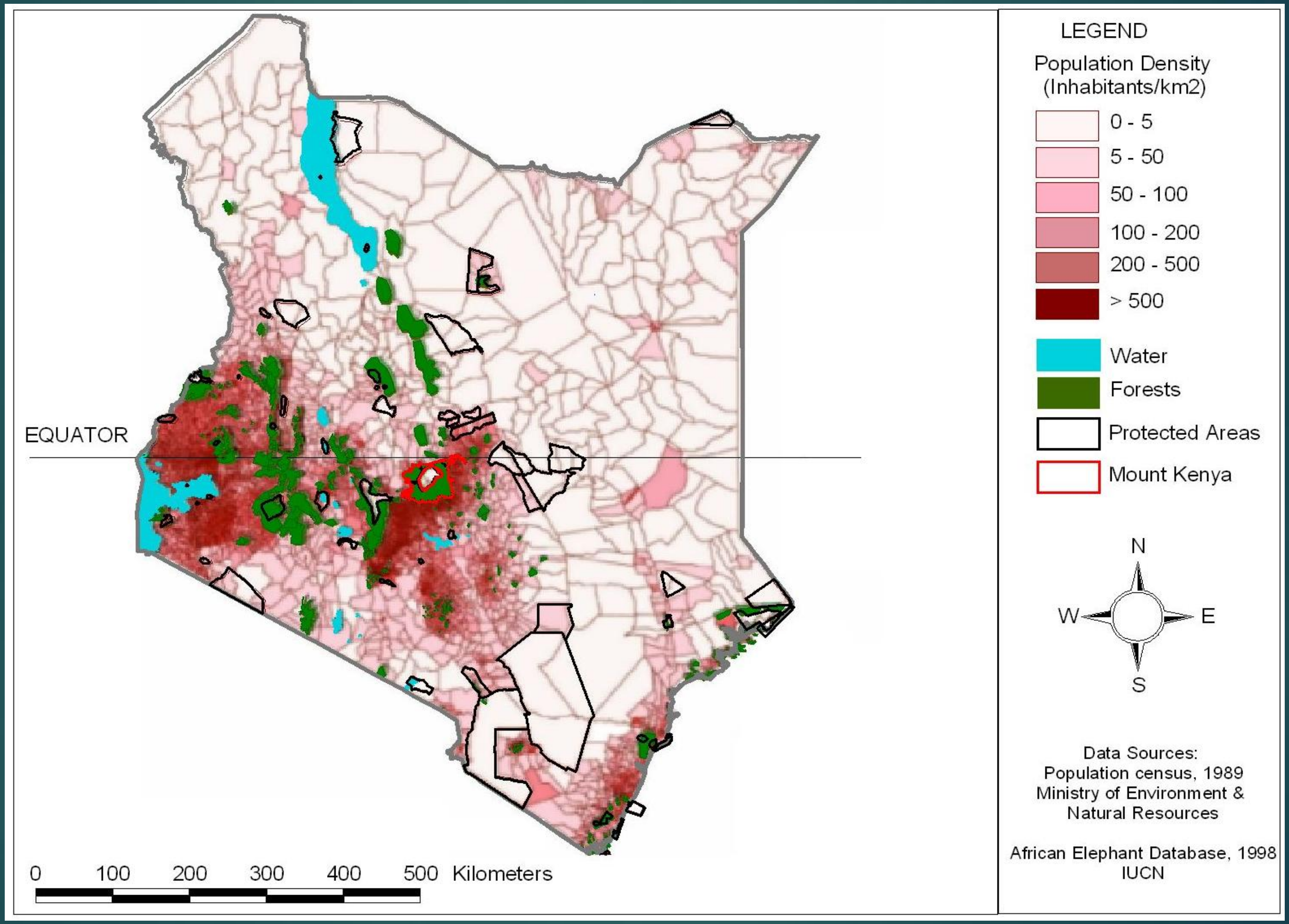
In highly fertile areas in Kenya, they are excluded at human densities of 82.5 people/ km^2 (Graham & Parker, 1989)

As elephant density increases, the likelihood of conflict at the HE interface increases.

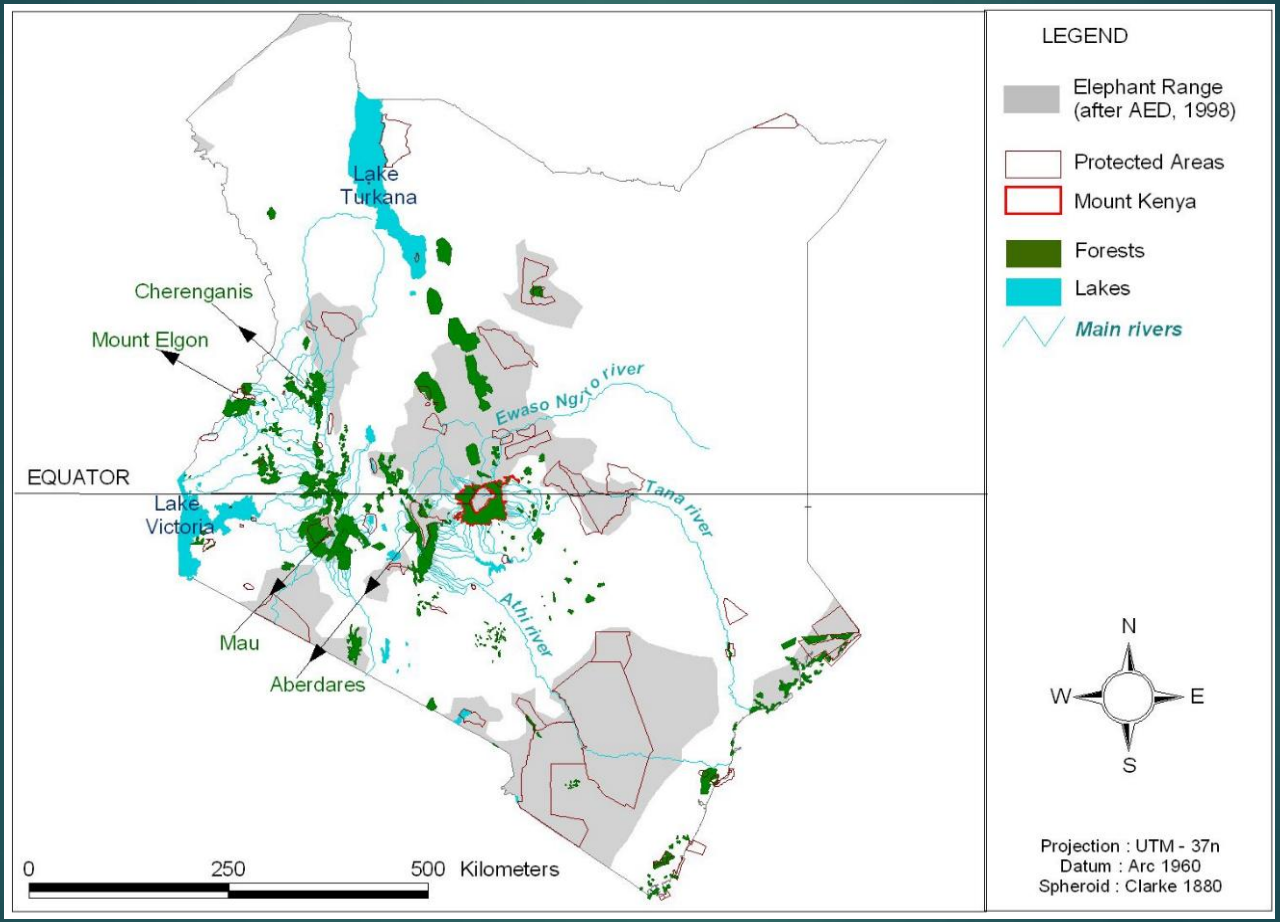
Population expansion, habitat fragmentation, competition for land, are LU problems

Sound LU management strategies cannot be made without updated information on human and elephant numbers, distribution and movements.

Kenyan forests are important for people and elephants



The elephant range typically covers areas with least anthropic pressure



Kenya's aerial counts are done regularly but most forest counts are outdated and of weak survey reliability

Site	Area in Km^2 (A)	Elephants/ km^2 (E)	A x E	95%CL	*Survey reliability	Source	AED year
Aberdare NP	767	2.40	1840	461	D	Bitok & Kones, 2005	2013
Aberdare outside	663	2.56	1700	472	D	Bitok & Kones, 2005	2013
Arabuko Sokoke	415	0.44	184	43	B	Litoroh, 2002b	2013
Loroki forest	596	0.35	210	354	E	Bitok et al., 1997	2013
Mau Forest	1267	0.79	1003		E	Njumbi et al., 1995	2013
Mount Elgon	1083	0.13	139		E	Bitok, 2002	2013
Mount Kenya	2007	1.45	2911	640	E	Vanleeuwe, 2001	2013
Shimba Hills NR	274	1.00	274		A	Ngene et al., 2012	2013
Transmara forest	300	1.71	513	49	C	Ngene et al., 2011	2013
Mathews Range	750	0.84	630		D	Reuling et al., 1992d	1998
TOTAL - Mathews R			**8144**				

AED figures suggest > 23% of Kenya's total elephant populations may live in the forests. We also know that forests are seasonally used by an important number of elephants living mostly in the savannah.

COUNTING ELEPHANTS IN FORESTS

In June 2015, a meeting was held at KWS, funded by RTD, during which 16 forest elephant populations were prioritized for renewed counts

It was proposed that the censuses would be led by WCS, who has decades of experience from Central Africa in the design and implementation of forests elephant survey techniques.

It was decided to use line-transect foot-surveys for large complexes and genetic mark-recapture techniques for smaller forest patches.

The 6 forests identified as highest priority were MK, the Aberdares, the Mau, Trans-Mara and Loita forests.

Methods to count elephants in forests

Forest elephants were estimated between 500,000 to 3,000,000 in 1982 (Anon, 1982)

In the 1920's, counting dung pellets along line transects was a technique used to count rabbits. This method was adapted in the late 70's to count elephants by measuring distance of dung-piles from line-transects.

In 1997, scientists from St. Andrews developed the program DISTANCE to assist data analysis.

Later, also genetic mark-recapture techniques were developed to count elephants in forests;

No elephant counting methods is bias-proof and perfect.

SURVEY RELIABILITY

The AED classifies counts according to their reliability.
Reliability means both precision, usually expressed as SE, CV% or CI, and accuracy (its closeness to the true number)
Most forest surveys in Kenya are considered of poor reliability
All surveys in the larger forests were sample surveys

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How does it work

In forests, we cannot count elephants from the air.

We count and measure elephant dung along line transecsts.

We measure « effort » and « perpendicular distance »

Effort = transect length. As effort increases, precision increases
Pdist = distance between a dung-pile and the transect centre-line

DISTANCE allows to plot detection curves to observed pdist data to find the best fit and calculate Y and associated precision.

To convert Dung density « Y » to elephant density « E »

We use

« r » dung decay rate &

« D » dung production rate

in the formula

$$E = Y\left(\frac{r}{D}\right)$$

Both r and D have considerable impact in Y to E conversion

Avoiding Common Bias

i) faulty conversion parameters "r" and "D";
ii) weak survey design ;
iii) observers fatigue ;

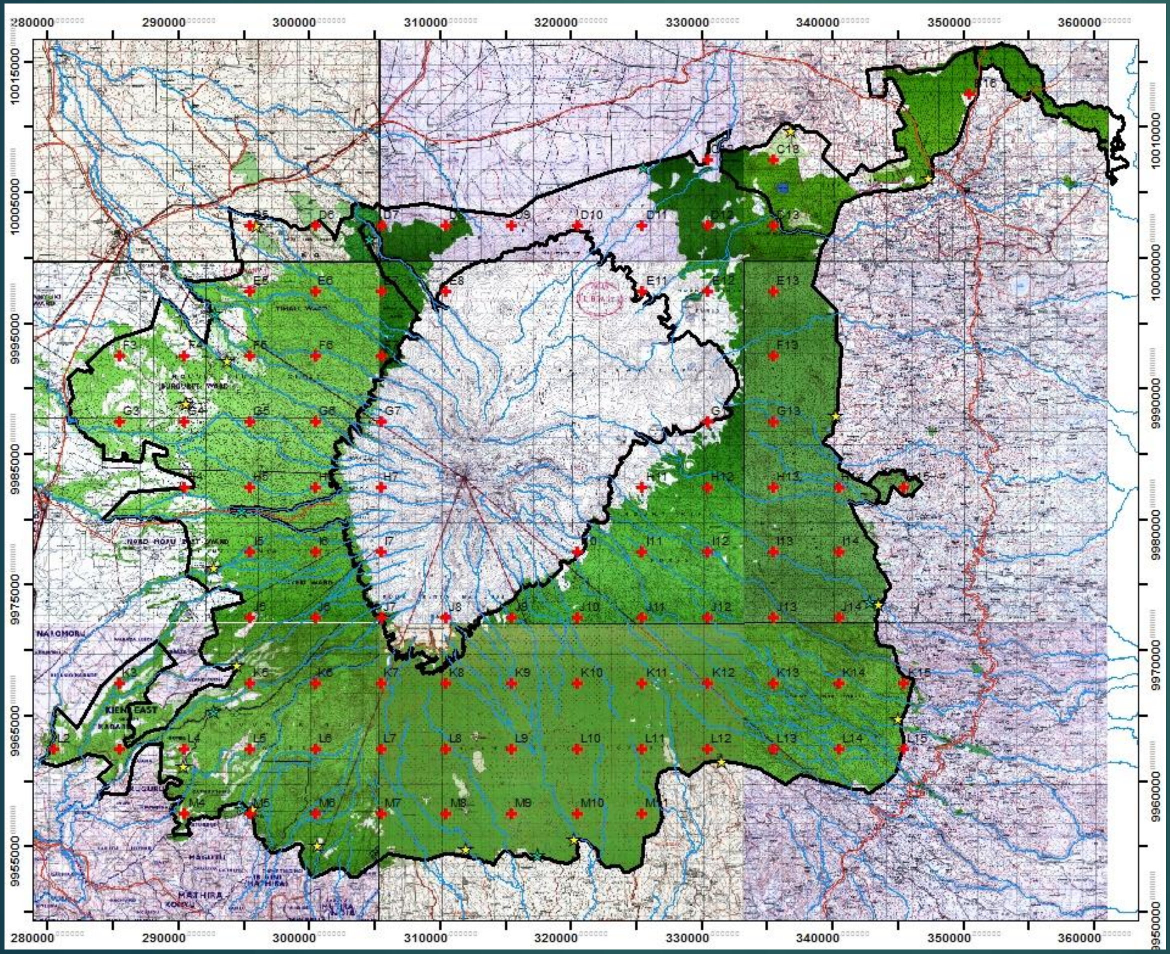
Faulty Conversion parameters "r" and "D"

A site-adapted study was done to establish r dung decay rate. The results from 56 piles at 4 different areas around MK suggested **60.59 (SE 5.21)** days to evolve from state A to the end of state D

The parameter D was taken at **18/ day**, consistent with previous surveys for MK and with study done in Ugandan forests and forests of the Parc National des Volcans in Rwanda

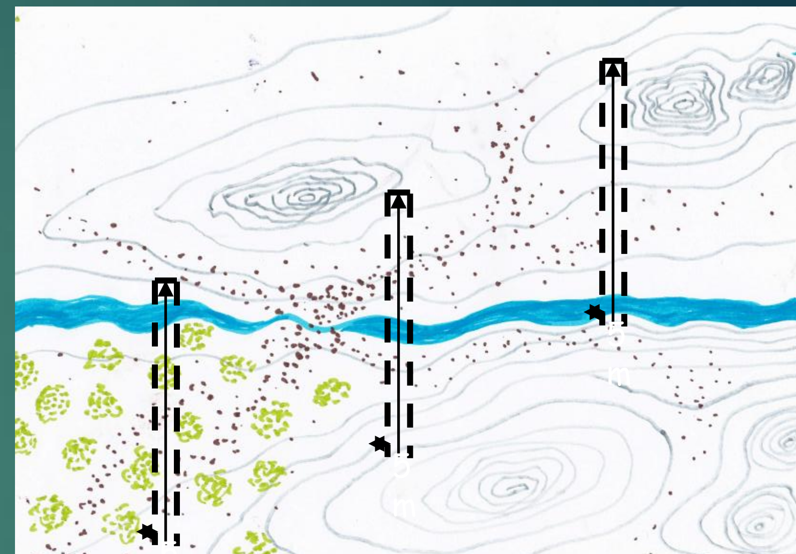
Survey Design

Elephant presence can be affected by natural factors & human factors. Survey designs need to cover each strata. One way of making sure all strata are covered is to use a total survey design

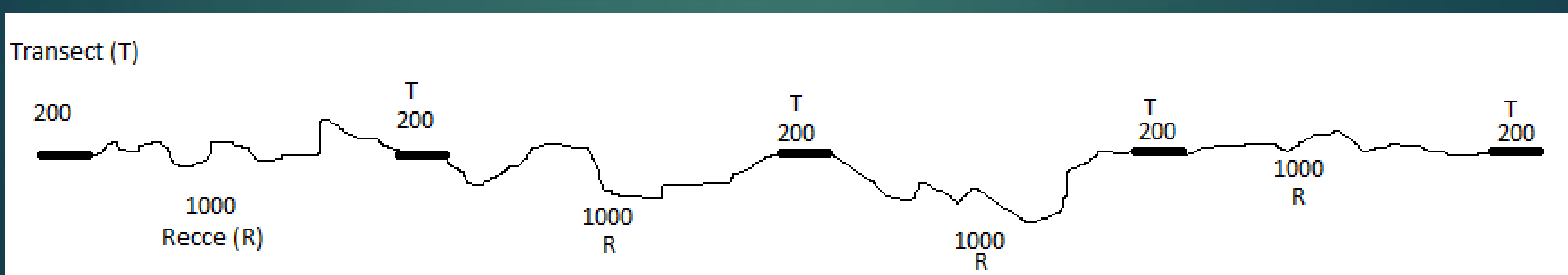


Observers Fatigue

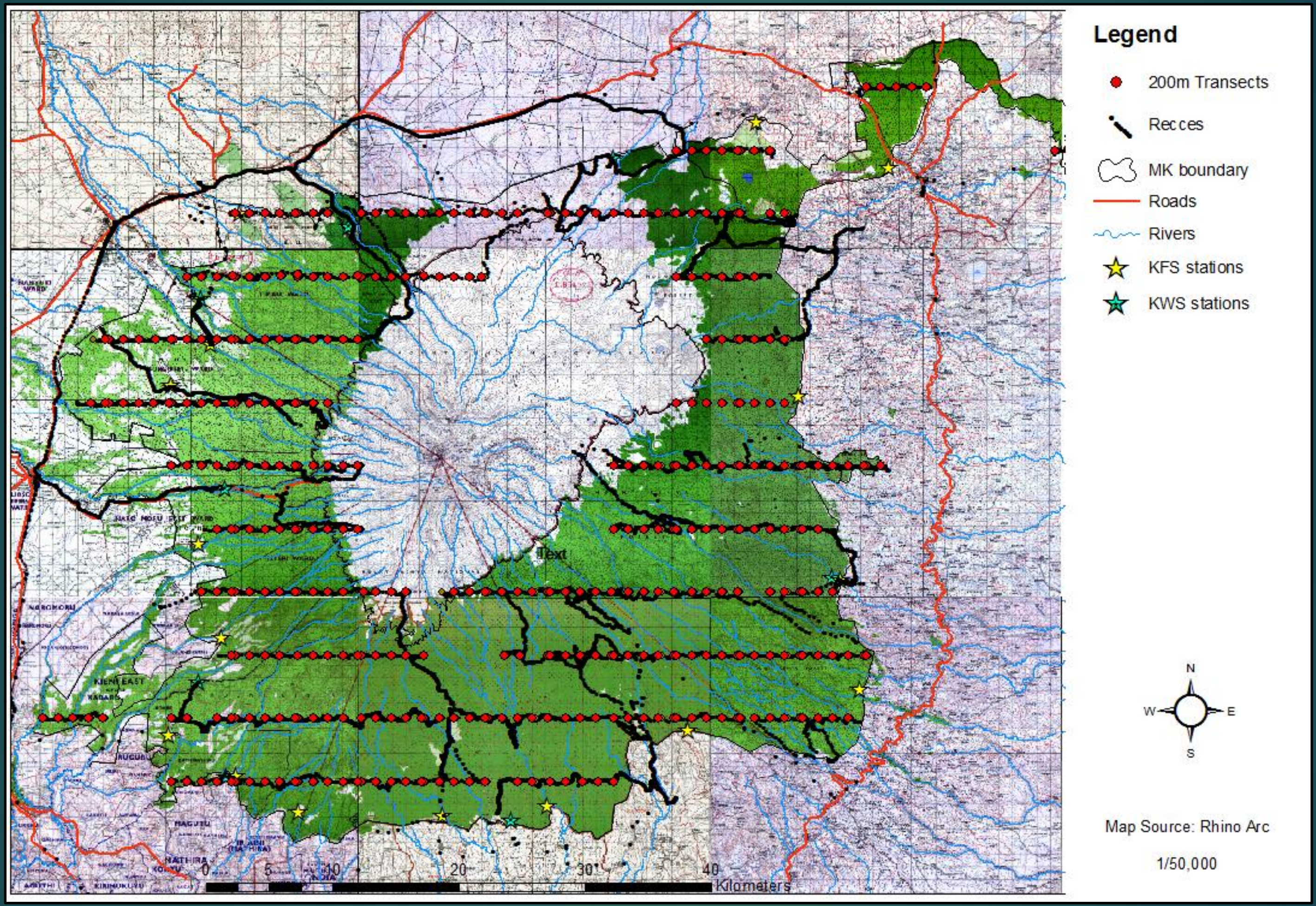
Distance sampling assumes that: Line transects are straight and avoid following elephant trails, …



One way of reduce the likelihood of observers fatigue is to shorten transects. Keeping transect straight for 200m is easier than 1000m.



Over 500kms were walked by 8 teams of 4 people. Of that, effort was 79,4Km spread as 397 transects of 200m



276 observations of elephant dung (excluding those classed age E) were used for analysis.

OBSERVATIONS









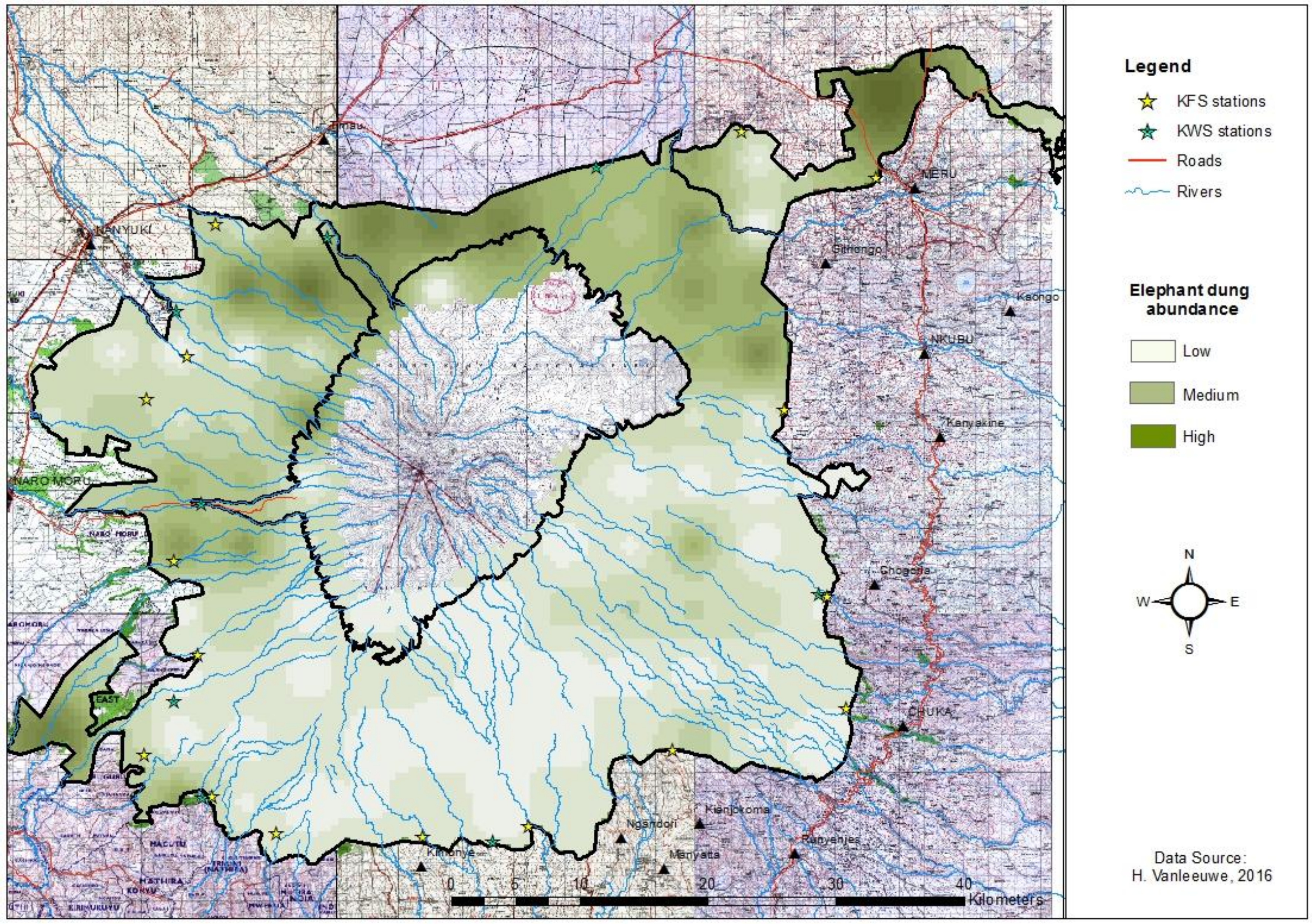
Applying 18 different detection curves to the data, the best fit proved the Hazard-rate Hermite polynomial curve with 10% data truncation.

Results showed E = **1.28** (± 0.22)/ km^2, or **2579** (± 453) elephants

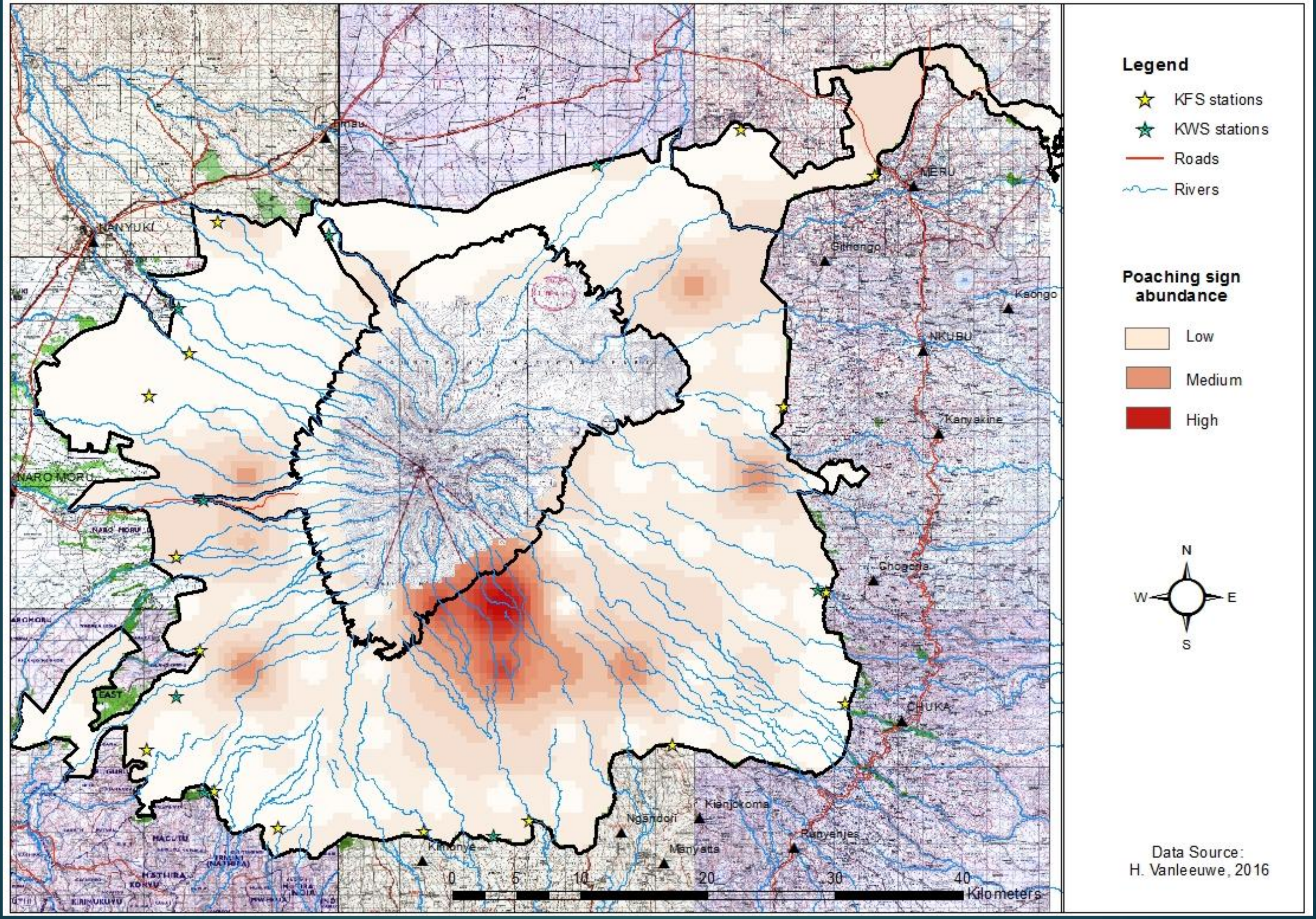
Area in km2 (A)	Elephants/ km2 (E)	A x E	CI	Source
2,007	1.45	2,911	640	Vanleeuwe, 2001
2,007	1.28	2,579	453	Vanleeuwe, 2016

The 2001-2016 difference is not statistically significant (Siegel and Castellan, $z = 0.53$, $p = 0.3$)

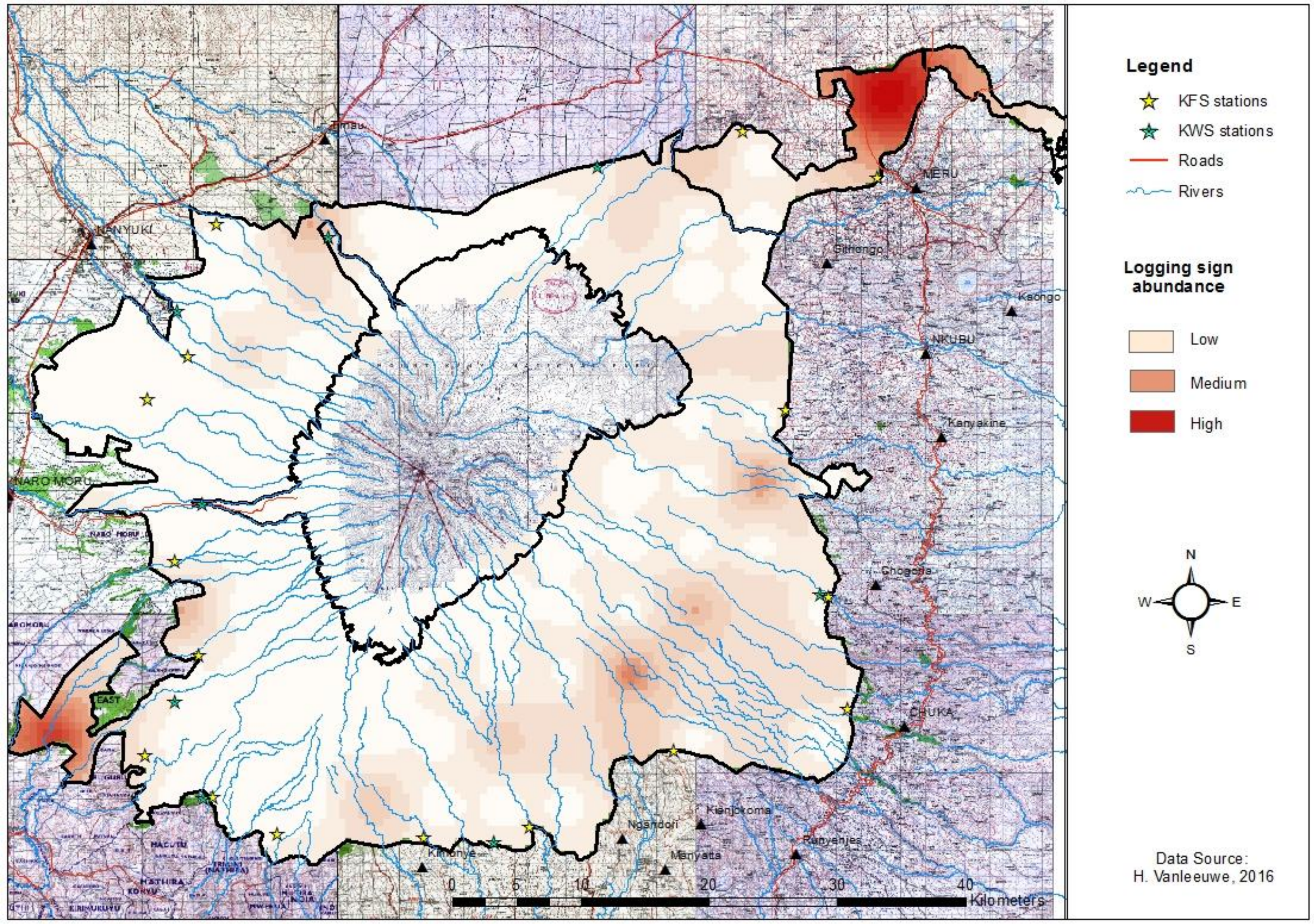
The highest densities were found in the NE/ Imenti and in Sagana SW



Poaching (meat) was most intense in the South, possibly linked to illegal cattle grazing

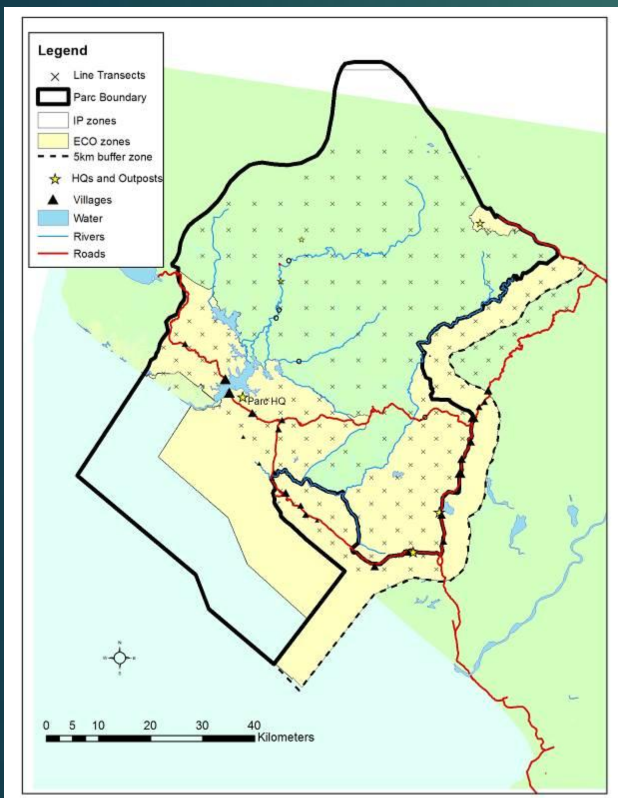


Logging was most pronounced in the Imenti forest in the NE and Sagana in the SW

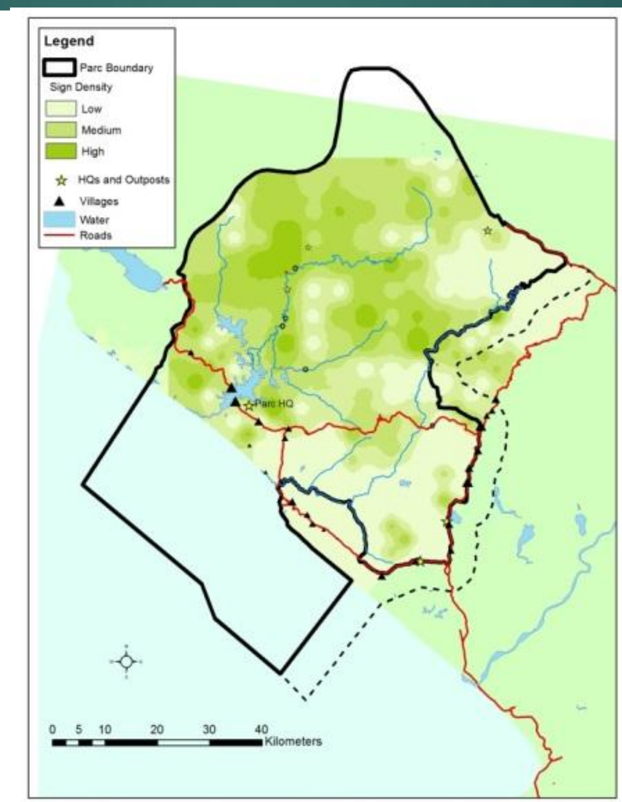


Total surveys in Central African Forests show a distinct negative correlation between elephant dung distribution and poaching sign distribution

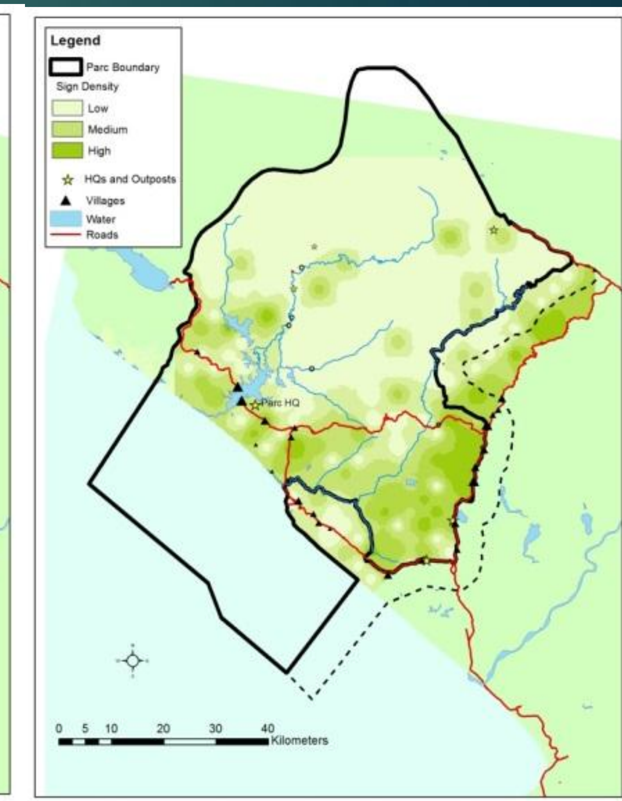
Transects, 2013



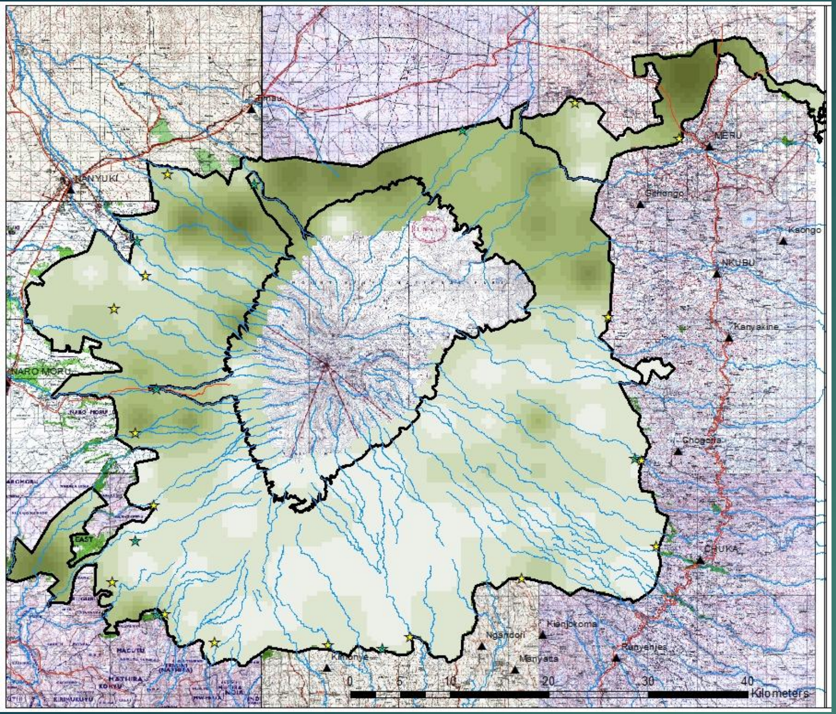
Elephant dung, 2013

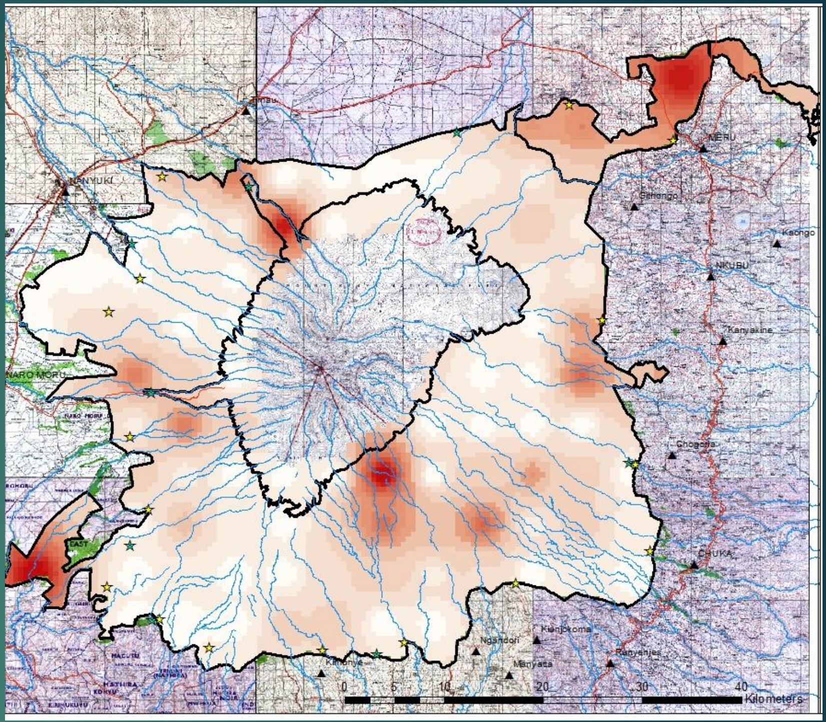


Human impact sign, 2013



This negative correlation is less distinct on MK, suggesting that poaching is not the biggest threat. HE overlap is important, suggesting that competition for land is the more pressing problem



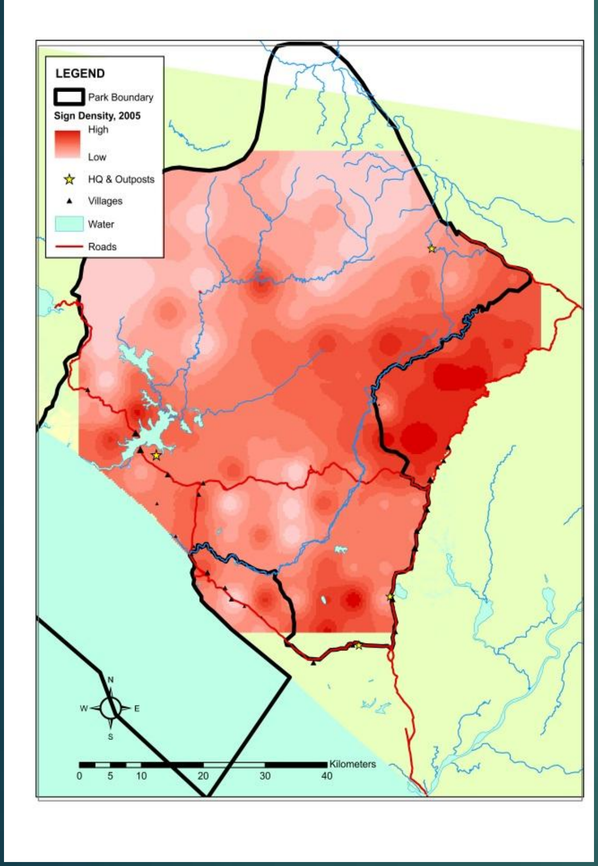


Direct Obs	events	Ind	dung	Carcass
Elephants	4	33	644	3
Buffalo	1	1	38	1
Zebra	1	10	2	0
Eland	0	0	0	2
Bushbuck	2	2	8	0
Suni	0	0	26	0
Baboons	1	17	0	0
Colobus	5	29	0	0
Sykes monkeys	1	5	0	2
Bushpig	0	0	6	0
Leopard	1	1	1	0
Hyena	0	0	9	0
TOTAL	**16**	**98**	**734**	**8**

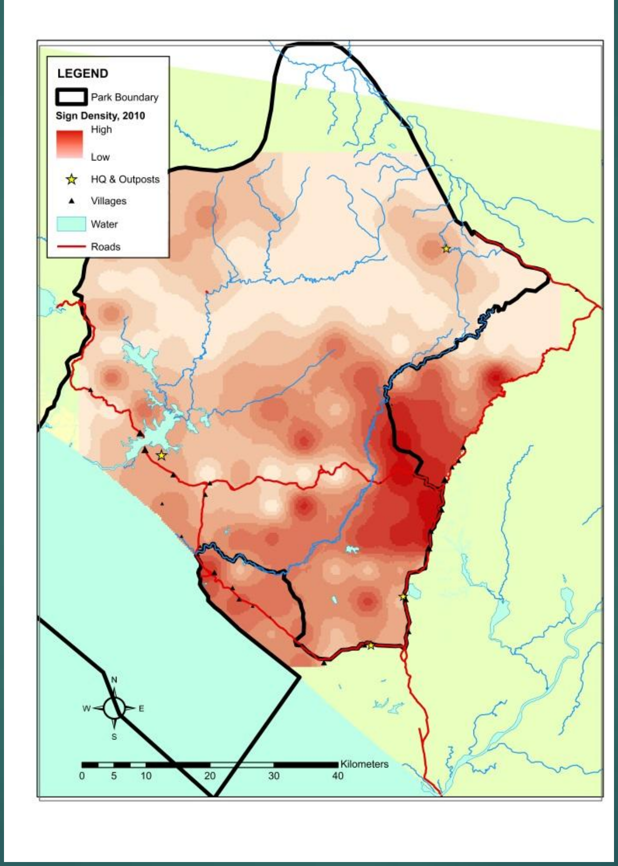
Illegal Impact	Nbr
Cattle herds and/or grazing damage	218
Fire damage	77
Poaching (snares/traps)	68
Logged trees	61
Charcoal	24
Honey/ hives	11
Marihuana Plantations	2
TOTAL	**461**

Total Line transect censuses should ideally be repeated every 3 years, allowing to identify changes over time

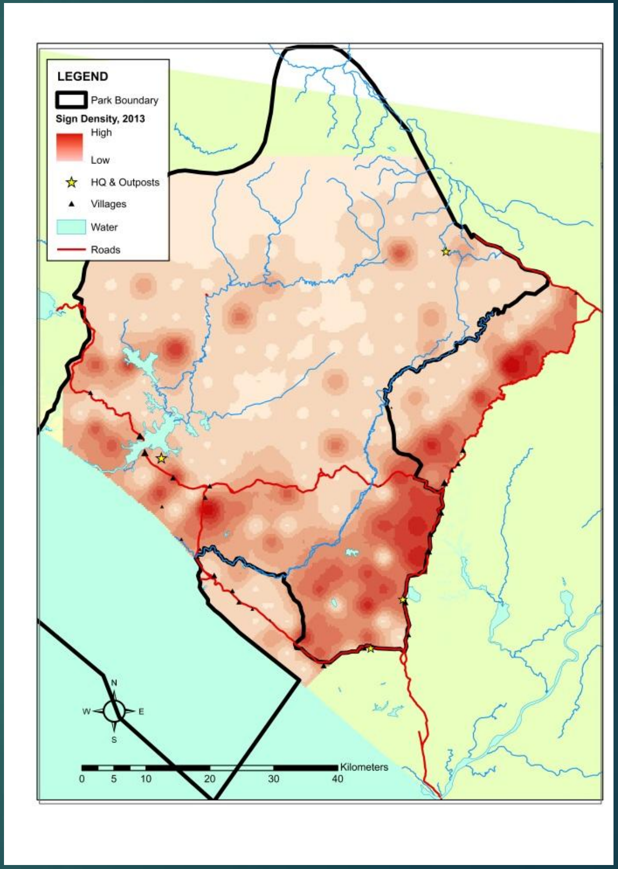
Human footprint, 2005



Human footprint, 2010



Human footprint, 2013



PRO'S OF TOTAL LINE-TRANSECT FOOT SURVEYS

Like aerial surveys, forest surveys allow to guide land-use planning.

In areas where human densities are low, plans can focus on sustainable land-uses to allow HE co-habitation

In areas where human densities are very high, fences and corridors may be an option to exclude elephants from human lands AND to avoid human encroachment and destruction of PA's

BUT

Fences and corridors can become a problem when placed at random:

- Fences can cause habitat fragmentation within isolated PA's
- Corridors may not be used by elephants when not taking into account natural habitat occupation and elephant movements (ie. Tsavo)

Thank you for your attention