CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

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Fifty-fourth meeting of the Standing Committee
Geneva (Switzerland), 2-6 October 2006

Interpretation and implementation of the Convention

Species trade and conservation issues

Elephants

MIKE BASELINE INFORMATION

1. This document has been prepared by the MIKE Central Coordinating Unit (CCU).

2. At its 12th meeting (Santiago, 2002), the Conference of the Parties amended the annotations under which the populations of *Loxodonta africana* of Botswana, Namibia and South Africa are included in Appendix II by allowing a single trade in registered raw ivory subject to several conditions, including "not before ... the MIKE programme has reported to the Secretariat on the baseline information", and "only after the Standing Committee has agreed that the ... conditions have been met".

3. At the same meeting, the Conference of the Parties adopted Decision 12.33 as follows:

   By its 49th meeting, the Standing Committee, in consultation with the MIKE Central Coordinating Unit and IUCN should define the geographical scope and the nature of the data that constitute the baseline information from MIKE that must be provided before any exports can be approved.

4. At its 49th meeting (Geneva, April 2003), the Standing Committee did adopt a baseline definition, which was clarified at its 53rd meeting (Geneva, June – July 2005). This definition is provided in Annex 1.

5. The present document includes a report on the baseline information as required by the agreed definition. It provides this information in two ways. Annex 2 comprises a summary table for each sub-region indicating whether the data required are available or not for each of the sites. A tick denotes the data are available. Where the data are deficient, the table indicates what is available and what is still required, e.g. five-month Law Enforcement Monitoring (LEM) data available, one month still required or survey underway, population estimate expected October 2006. The summary table also indicates where civil strife has prevented the collection of data .

6. Annex 3 provides the data on a site-by-site basis in regard to carcasses, patrol effort, population estimates and the influencing factor/site characteristic information. The latter information is presented in the form of a value in accordance with the approach reflected in Annex 4. The site information is grouped by sub-region. For each sub-region, the results of the preliminary analysis for the sites are given at the end of the sub-regional section. The analytical method used is provided in Annex 5.

7. In order to avoid any misunderstanding, the requirement of this report is to indicate the baseline information as set out in the definition. It provides the platform for continuing to collect the required information so that trends and changes become apparent over time and the analytical approach should assist in identifying why the change may be occurring. The analytical approach will therefore become more robust and more powerful as the data grow over time.

MIKE BASELINE INFORMATION

Pursuant to Decision 12.33, the Standing Committee adopted at its 49th meeting and clarified at its 53rd meeting, the following definition of MIKE baseline information:

Geographical scope

1. For Africa, the geographical scope will cover 45 sites as set out below.

2. For Asia, the geographical scope will cover 18 sites as set out below.

   In the circumstances that MIKE data can not be collected at some sites in countries such as Côte d'Ivoire or the eastern part of the Democratic Republic of the Congo, owing to civil strife, the situation will be inferred from ETIS data and other expert sources.

Nature of the data

For each reporting site, the following information would be presented:

1. at least one population survey, which must not predate the year 2000;

2. levels of illegal killing derived from a minimum of 12-months' (Africa) / 6-months' (Asia) data obtained from patrol forms and carcass forms and summarized in monthly reports;

3. a descriptive report on the patterns of influencing factors;

4. an assessment of the effort made in providing the illegal killing information; and

5. a preliminary baseline analysis of paragraphs 1 to 4 above.

Geographical scope

	Alternates		*Alternates*
West Africa – 16 sites		**Central Africa – 13 sites**	
Pendjari (BJ)	Parc W (BJ)	Bangassou (CF)	Salonga (CD)
Parc W (BF)	Parc W (NE)	Dzangha-S. (CF)	Virunga (CD)
Nazinga (BF)		Sangba (CF)	
Comoe (CI)		Boumba Bek (CM)	
Tai (CI)		Waza (CM)	
Marahoue (CI)		Nouabable-N (CG)	
Kakum (GH)		Odzala (CG)	
Mole (GH)		Garamba (CD)	
Ziama (GN)		Kahuzi-B. (CD)	
Sapo (LR)		Okapi (CD)	
Gourma (ML)		Minkebe (GA)	
Babah Rafi (NE)		Lope (GA)	
Sambissa (NG)		Zakouma (TD)	
Yankari (NG)			
Niokolo Koba (SN)			
Keran (TG)			
East Africa – 8 sites		**Southern Africa – 8 sites**	
Gash Setit (ER)	Meru (KE)	Chobe (BW)	Etosha (NA)
Elgon (KE)	Tsavo (KE)	Cahora Bassa (MZ)	
Samburu/L. (KE)	Katavi (TZ)	Niassa (MZ)	
Akagera (RW)	Tarangire (TZ)	Caprivi (NA)	
Ruaha (TZ)	Elgon (UG)	Kruger (ZA)	
Selous (TZ)		S. Luangwa (ZM)	
Murchison F. (UG)		Chewore (ZW)	
Q. Elizabeth (UG)		Nyami N. (ZW)	
South Asia – 10 sites		**South East Asia – 8 sites**	
E. Dooers (IN)	Chirang-R. (IN)	Xishuangbanna (CN)	Cardoman (KH)
Garo Hills (IN)	Deomali (IN)	Mondulkire (KH)	Nam Phui (LA)
Mayurbhanj (IN)	Dehang P. (IN)	Bukit Barisan (ID)	Kluang District (MY)
Shivalik (IN)	Niligiris (IN)	Way Kambas (ID)	She U Daung (MM)
Mysore (IN)	Yala (LK)	Gua Musang (MY)	Kuibiri NP (TH)
Wyanad (IN)		Alaungdaw K. (MM)	
Wilpattu (LK)		Salakphra WS (TH)	
Suklaphanta (NP)		Cat Tien (VN)	
Samchi (BT)			
Chunauti (BD)			

Country ISO codes used

ISO	Country name
BD	Bangladesh
BF	Burkina Faso
BJ	Benin
BT	Bhutan
BW	Botswana
CD	Democratic Republic of the Congo
CF	Central African Republic
CG	Congo
CI	Côte d'Ivoire
CM	Cameroon
CN	China
ER	Eritrea
GA	Gabon
GH	Ghana
GN	Guinea
ID	Indonesia
IN	India
KE	Kenya
KH	Cambodia
LA	Lao People's Democratic Republic
LK	Sri Lanka

ISO	Country name
LR	Liberia
ML	Mali
MM	Myanmar
MY	Malaysia
MZ	Mozambique
NA	Namibia
NE	Niger
NG	Nigeria
NP	Nepal
RW	Rwanda
SN	Senegal
TD	Chad
TG	Togo
TH	Thailand
TZ	United Republic of Tanzania
UG	Uganda
VN	Viet Nam
ZA	South Africa
ZM	Zambia
ZW	Zimbabwe

STATUS OF SITES IN RELATION TO THE BASELINE REQUIREMENTS

This annex provides a summary in the form of 6 Sub-regional tables indicating the baseline status of each site as anticipated by 30th September 2006.

The key to each table is as follows:

Green = Baseline Achieved
[Green] = Baseline Achieved but data not used in this revised report but will be used in any updated report subsequent to this one
Red = Further Data required to achieve baseline after September 2006
CS = Data not available due to civil strife

At the bottom of each table, there are sites shaded grey. This indicates those alternate sites that could be used if so required.

These tables indicate that the sites required to have a baseline in place in accordance with the definition have achieved that status in Africa and South Asia. This includes 4 sites in West Africa and 2 sites in Central Africa, where civil strife has prevented any data being collected. But in these six sites it has also proved impossible to infer anything as no indirect data exists with the exception of Garamba in D.R. Congo. The 2004 aerial sample survey produced a carcass ratio of 5.713%. 385 carcasses were estimated and classified as recent (less than 1 year old). The 2006 total aerial survey produced 543 carcasses with a carcass ratio of 12.39%. But of these carcasses 539 were classified as old or very old and only 4 as fresh or recent. This suggests that during 2004 and 2005, elephants were under poaching pressure, but this threat appears to have recently abated. The 2006 count produced an estimate of some 4000 elephants.

In South East Asia, 6 sites are not yet ready. 3 sites await the accumulation of 6 months LEM data, which should be available by end December 2006. The other 3 await their population estimates from ongoing surveys. Again it is anticipated that this information will be available by early 2007. All 6 will then be ready for their preliminary baseline analysis.

Country	Site	12 Months LEM Data	Carcass Data	Population Survey	Influencing Factor Information	Remarks
WEST AFRICA SUB REGION						
Benin	Pendjari	GREEN	GREEN	GREEN	GREEN	
Burkina Faso	Park W	GREEN	GREEN	GREEN	GREEN	
Burkina Faso	Nazinga	GREEN	GREEN	GREEN	GREEN	
Côte d'Ivoire	Comoe	CS	CS	CS	GREEN	
Côte d'Ivoire	Taï	CS	CS	GREEN	GREEN	
Côte d'Ivoire	Marahoue	CS	CS	GREEN	GREEN	
Ghana	Kakum	GREEN	GREEN	GREEN	GREEN	
Ghana	Mole	GREEN	GREEN	GREEN	GREEN	
Guinea	Ziama	GREEN	GREEN	GREEN	GREEN	
Liberia	Sapo	CS	CS	CS	GREEN	
Mali	Gourma	GREEN	GREEN	GREEN	GREEN	
Niger	Babah Rafi	GREEN	GREEN	GREEN	GREEN	
Nigeria	Sambissa	GREEN	GREEN	GREEN	GREEN	
Nigeria	Yankari	GREEN	GREEN	GREEN	GREEN	
Senegal	Niokolo Koba	GREEN	GREEN	GREEN	GREEN	
Togo	Keran	GREEN	GREEN	GREEN	GREEN	

Country	Site	12 Months LEM Data	Carcass Data	Population Survey	Influencing Factor Information	Remarks
Benin	Park W	GREEN	GREEN	GREEN	GREEN	Possible Alternate
CENTRAL AFRICA SUB REGION						
Cameroon	Boumba Bek	GREEN	GREEN	GREEN	GREEN	
Cameroon	Waza	GREEN	GREEN	GREEN	GREEN	
C.A.R.	Bangassou	GREEN	GREEN	GREEN	GREEN	
C.A.R.	Dzanga Sangha	GREEN	GREEN	GREEN	GREEN	
C.A.R.	Sangba	GREEN	GREEN	GREEN	GREEN	
Congo	Nouabale Ndoki	GREEN	GREEN	GREEN	GREEN	
Congo	Odzala	GREEN	GREEN	GREEN	GREEN	
D.R. Congo	Garamba	CS	CS	CS	CS	
D.R. Congo	Kahuzi Biega	CS	CS	CS	CS	
D.R. Congo	Okapi	GREEN	GREEN	GREEN	GREEN	
Gabon	Minkebe	GREEN	GREEN	GREEN	GREEN	
Gabon	Lope	GREEN	GREEN	GREEN	GREEN	
Chad	Zakouma	GREEN	GREEN	GREEN	GREEN	
D.R. Congo	Salonga	GREEN	GREEN	GREEN	GREEN	Possible Alternate
SOUTHERN AFRICA SUB REGION						
Namibia	Caprivi	GREEN	GREEN	GREEN	GREEN	
Botswana	Chobe	GREEN	GREEN	GREEN	GREEN	
South Africa	Kruger	GREEN	GREEN	GREEN	GREEN	
Zimbabwe	Nyami Nyami	GREEN	GREEN	GREEN	GREEN	
Zimbabwe	Chewore	GREEN	GREEN	GREEN	GREEN	
Zambia	South Luanga	GREEN	GREEN	GREEN	GREEN	
Mozambique	Niassa	GREEN	GREEN	GREEN	GREEN	
Mozambique	Cahorra Basa	GREEN	GREEN	GREEN	GREEN	
Namibia	Etosha	GREEN	GREEN	GREEN	GREEN	Possible Alternate
EAST AFRICA SUB REGION						
Eritrea	Gash Setit	GREEN	GREEN	GREEN	GREEN	
Kenya	Mt Elgon	GREEN	GREEN	GREEN	GREEN	
Kenya	Samburu/ Laikipia	GREEN	GREEN	GREEN	GREEN	
Rwanda	Akagera	GREEN	GREEN	GREEN	GREEN	
Tanzania	Ruaha	GREEN	GREEN	GREEN	GREEN	
Tanzania	Selous	GREEN	GREEN	GREEN	GREEN	
Uganda	Murchison Falls	GREEN	GREEN	GREEN	GREEN	
Uganda	Queen Elizabeth	GREEN	GREEN	GREEN	GREEN	
Tanzania	Tarangire	GREEN	GREEN	GREEN	GREEN	Possible Alternate
Tanzania	Katavi	GREEN	GREEN	GREEN	GREEN	Possible Alternate
Kenya	Tsavo	GREEN	GREEN	GREEN	GREEN	Possible Alternate
SOUTH ASIA SUB REGION						
Bangladesh	Chunati	GREEN	GREEN	GREEN	GREEN	
Bhutan	Samtse	GREEN	GREEN	GREEN	GREEN	
India	E. Dooers	GREEN	GREEN	GREEN	GREEN	

Country	Site	12 Months LEM Data	Carcass Data	Population Survey	Influencing Factor Information	Remarks
India	Garo Hills	GREEN	GREEN	GREEN	GREEN	
India	Mayurbhanj	GREEN	GREEN	GREEN	GREEN	
India	Mysore	GREEN	GREEN	GREEN	GREEN	
India	Shivalik	GREEN	GREEN	GREEN	GREEN	
India	Wyanad	GREEN	GREEN	GREEN	GREEN	
Nepal	Suklaphanta	GREEN	GREEN	GREEN	GREEN	
Sri Lanka	Wilpattu	GREEN	GREEN	GREEN	GREEN	
India	Chirang-Ripu	[GREEN]	[GREEN]	RED	GREEN	Uncertainty re 2005 population survey
India	Deomali	GREEN	GREEN	GREEN	GREEN	Possible Alternate
SOUTH EAST ASIA SUB REGION						
Cambodia	Mondulkire	GREEN	GREEN	RED	GREEN	Survey result expected by end 2006
Thailand	Selakphra	GREEN	GREEN	RED	GREEN	Survey result expected by end 2006
China	Xishuangbanna	GREEN	GREEN	GREEN	GREEN	
Malaysia	Gua Musang	GREEN	GREEN	RED	GREEN	Survey result expected in early 2007
Indonesia	Bukit Barisan NP	RED Dec 2006	RED Dec 2006	GREEN	GREEN	LEM reporting commenced June 2006
Indonesia	Way Kambas NP	RED Dec 2006	RED Dec 2006	GREEN	GREEN	LEM reporting commenced June 2006
Myanmar	Alangdaw Katapa NP	GREEN	GREEN	GREEN	GREEN	
Viet Nam	Cat Tien NP	[GREEN]	[GREEN]	GREEN	GREEN	6 months LEM by end Sept. 2006
Thailand	Kuibiri	GREEN	GREEN	RED	GREEN	Survey result expected by end 2006

SUMMARY AND STATISTICAL ANALYSIS OF BASELINE DATA

A3.1 The Data

The data consist of monthly carcass counts, including carcasses encountered by patrols as well as non-patrol encounters. Various law enforcement monitoring (LEM) statistics are also included in the data. The coverage of the data are shown in Table A3.1.1.

The LEM data include, for each month, numbers of man-hours spent on patrols on foot, vehicle, boat, observation posts and others; also recorded are the total number of patrols and total number of patrol hours. Data from the Samburu/Laikipia site in Kenya, having been collected by participatory methods rather than patrols, include a very different measure of LEM effort: number of community meetings.

In the preliminary analysis presented to CoP13 in 2004, differences between sites were accounted for by simply including Site as a factor in the analysis. When site differences were found, no attempt was made to causally ascribe those differences to any particular feature of sites. For the present analysis, a number of characteristics of sites (described below) have been compiled. Most of these are ordered categorical variables. They are referred to variously as site attributes or "influencing factors". Representing site differences in terms of attributes moves a step closer to assigning particular causal patterns explaining elephant mortality.

A3.2 Data Summaries

Summaries of the data are presented in Tables A3.2.1 – A3.2.4 at the end of this annex.

A3.3 Patterns of Influencing Factors

The number of potential site attributes, or influencing factors, is quite large and it would be useful to seek some simpler representation in terms of fewer variables. The idea is to lay the foundations for future analysis which is as simple as possible. Two approaches to this simplification are:

1. Decide on thematic groupings of the variables according to their meaning and devise a combined score for each group. This exercise would be carried out independently of the actual data on the attributes, being based solely on prior knowledge of the variables.

2. Use statistical methods to detect grouping of similar variables.

An attempt at the prior approach (1) is summarized in Table A3.3.1.

Table A3.3.1
An *a priori* thematic grouping of attributes

Group	Theme	Attribute variables
A	Ecosystem	X1
B	Human/elephant pressure	X2, X3, X4, X5, X6, X7, X17, X18, X19
C	Civil strife/conflict	X13, X14, X15
D	Degree of protection	X8, X9, X10, X11, X12, X20
E	Illegal trade pressures	X23, X24, X25, X26, X27, X28, X29
F	Elephant density	X16
G	CITES decisions	X30

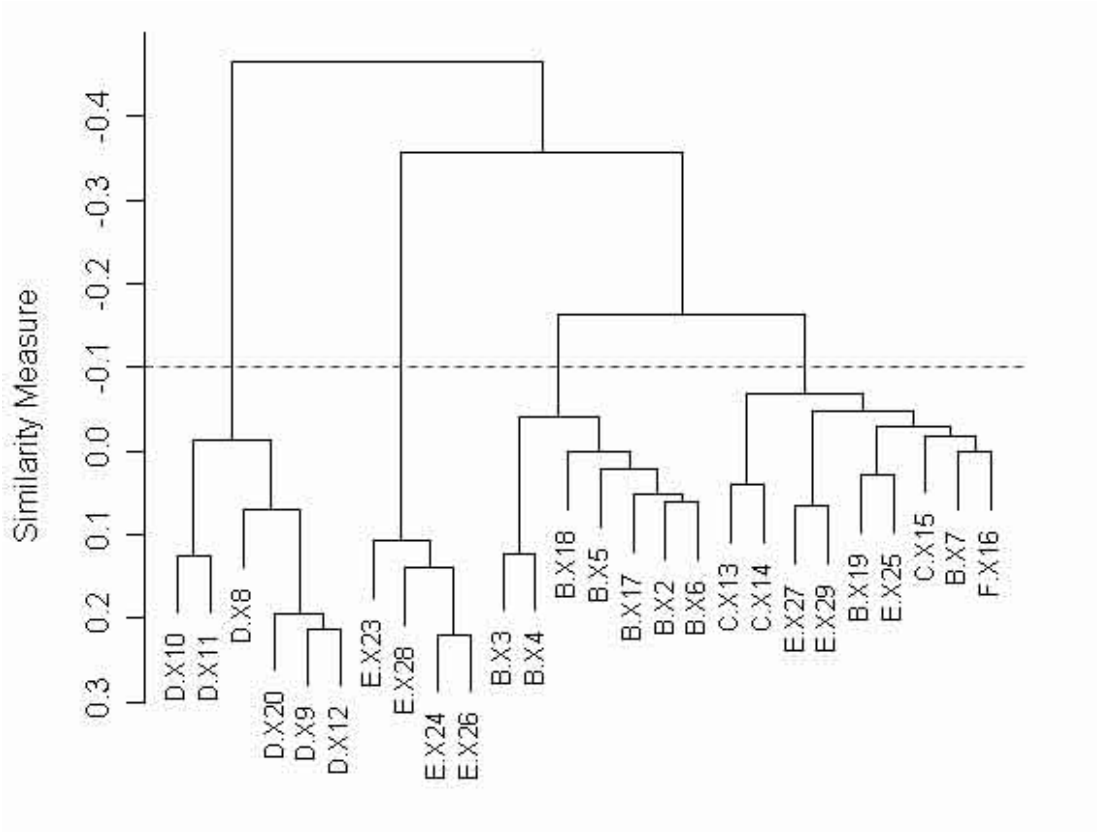
The statistical approach used for grouping the attributes was *variable clustering* (Harrell, 2006; Sarle, 1990). A hierarchical clustering of the variables is shown if Fig. A3.3.1. Variable X1 is a classification

variable and could not be utilized, and no data are currently available for X30, so it was also omitted from the analysis.

In the diagram, the groupings chosen in Table A3.3.1 are appended to the variable names. The broken line indicates a suitable level in the hierarchy to form the groups. This suggests that in broad terms there is strikingly good agreement between the *a priori* grouping and the variable clustering. The last group on the right is a residual group of variables with no clear associations with any others.

This offers hope that significant simplification will be possible in future analysis.

Fig. A3.3.1
Cluster analysis of site attributes



A3.4 Law Enforcement Effort

The MIKE process collects detailed information on law enforcement monitoring (LEM) effort. An important use for this information is to adjust for differential effort in making comparisons in measure of illegal killing between sites, or over time (Jachmann, 1998).

The variables on LEM effort that are available from most sites are, for each month:

- Total patrol hours
- Number of patrols
- Foot patrol man-hours
- Vehicle patrol man-hours
- Boat patrol man-hours
- Observation post man-hours
- Other patrol type man-hours.

To be useful, a measure of effort should be reasonably well correlated with carcass counts. Two such measures were found to be the total patrol hours and the sum of all of the man-hours for the different patrol types. Carcass counts (excluding non-patrol counts) were found to be slightly better correlated with total man-hours than with total patrol hours. Furthermore, the data for total man-hours was slightly

more complete and it was therefore chosen as the measure of effort used in subsequent analysis. No other combinations of the available variables afforded any improvement over this simple choice. Table A3.4.1 includes a summary of total man-hours for each site. The table also presents carcass counts (recorded on patrol) adjusted for LEM effort.

Carcass counts from the MIKE database include observations from non-patrol sources. Given the likely diversity of these sources, there is no obvious measure of effort. Consequently, all catch-effort analysis has been based on patrol data only.

The method of data collection at Samburu, which was based on participatory methods with communities and informants, is completely different from the patrol approach used elsewhere. The "number of community meetings" has been used as a measure of effort in the analysis of the Samburu data. This is not compatible with the LEM effort measure used for the patrol data, so the Samburu data has been analysed separately.

A3.5 Analysis of the Data

The aims of the data analysis are:

1. to identify those site attributes which tend to influence the rate of illegal killing of elephants; and

2. to use knowledge gained from (1) to enable a more refined assessment of the levels of illegal killing than could be obtained directly from the raw data.

Illegal killing must be assessed against the backdrop of elephant mortality from all possible causes. While direct estimates of overall mortality are not easy to obtain, an assumption of the present analysis is that the observed counts of carcasses derived from patrols will be a relative measure allowing comparisons, both spatial and temporal, to be estimated.

The present analysis is based on monthly totals of carcass counts. Future analyses may benefit from more detailed information at the level of individual patrols, when this information is collated. Such an analysis may be able to account for at least some of the likely bias in patrol data resulting from the strictly non-random nature of the data collection process.

A brief description of the statistical methods used in the analysis can be found in Annex 5.

There are important differences between the African and Asian sites, especially with regard to the nature of law enforcement patrols. The analysis was there fore done separately for each of the two regions.

A3.5.1 Analysis of African Sites

Overall carcass counts

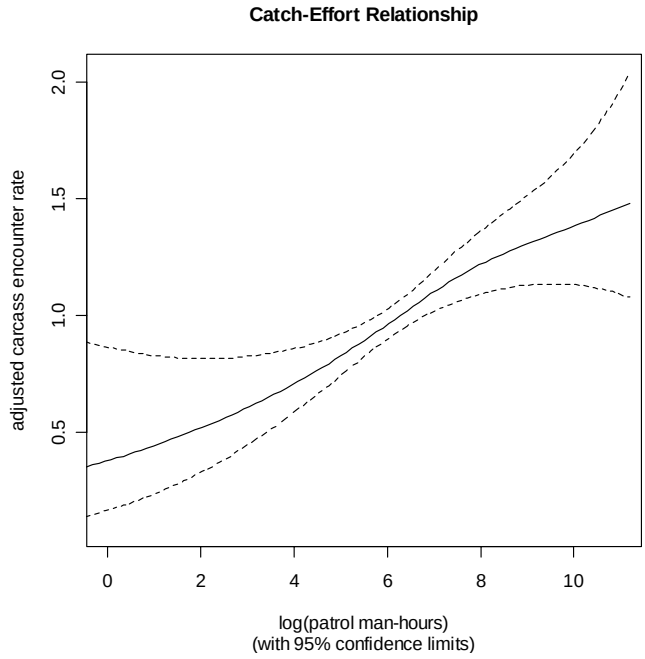
Carcass counts must be adjusted for LEM effort, so this part of the analysis is restricted to carcasses encountered by patrols.

The factors that influence carcass counts are:

- patrol effort (total man-hours),
- elephant population size,
- area of the site,
- X3, type of land use within the site,
- X27, corruption index,
- X29, illegal arms.

All of these influencing factors were statistically highly significant (with a significance level < 0.0001).

The estimated relationship between number of carcasses (after adjusting for area and elephant population size) and effort (man-hours) is summarized in the graph below.



Remarks on interpretation

1. The effect of X3 on carcass counts was found to be mostly due to a large number in the group X3 = 1, which is the group of sites where the main land use is for wildlife. This probably simply reflects the fact that there tend to be more elephants in these sites, and hence more carcasses.

2. The correlation of carcass counts with X27 was found to be positive. The variable X27 is the "corruption perceptions index" from Transparency International, and is higher where corruption is less. So more carcasses are found where corruption is lower. A possible interpretation is that this variable is likely to be a proxy variable for a variety of other characteristics, some of which may tend to be associated with greater law enforcement efficiency. This in turn may be related to more effective patrols.

3. Numbers of carcasses were significantly greater in sites which where is was known that frequent illegal arms trafficking occurs.

Illegal killing

A preliminary analysis was restricted to patrol data so that the effect of patrol effort could be assessed. Also, the analysis was confined to cases where there were non-zero carcass counts. The method used (see Annex 5) models the *proportion* of all carcasses that were found to be illegally killed.

LEM effort was found to be unrelated to the proportion illegally killed. Hence it is reasonable to use *all* carcass data (patrol and non-patrol) in the analysis of the proportion illegally killed.

Statistically significant effects were found to be:

- Sub-region,
- X5 - human access,
- X27 - corruption index,
- X9 - actual level of protection,
- X1 - ecosystem type.

There was no significant time trend apparent (except for the Samburu site which was analysed separately).

Illegal killing was found to be negatively correlated with the corruption index, indicating that higher levels of corruption are associated with more illegal killing.

Adjusted proportions of carcasses that were illegally killed

Sub-region	*Proportion illegal*
Central Africa	0.63
East Africa	0.57
West Africa	0.33
Southern Africa	0.19

Human access	*Proportion illegal*
Difficult	0.28
Fairly difficult	0.36
Fairly easy	0.47
Easy	0.61

Actual protection level	*Proportion illegal*
Strong	0.31
Reasonably good	0.36
Moderate – none	0.49

Ecosystem type	*Proportion illegal*
Mainly forest	0.55
Mainly savannah	0.31

The data from Samburu/Laikipia in Kenya were analysed separately because of the fundamentally different mode of data collection noted above (Section A3.4). There was a significant year effect on the proportion of carcasses that were illegally killed, as can be seen from the following table.

Samburu: Proportion of carcasses illegally killed (unadjusted)

Year	**2002**	**2003**	**2004**	**2005**	**Overall**
No. of carcasses	159	195	128	160	642
Proportion illegal	0.38	0.18	0.31	0.17	0.25

A3.5.2 Analysis of Asian Sites

Overall carcass counts

Following the same analytical approach as for the Africa region, the factors that influence carcass counts were found to be

- patrol effort (total man-hours),
- area of the site,
- X24, ivory trade regulations.

Illegal killing

The only influencing factor found to be associated with the proportion of carcasses illegally killed was X27, the corruption index (significance level = 0.03). The association was negative, again indicating that higher levels of corruption are associated with more illegal killing.

Further analysis of data from Asian sites will be possible in due course when more data become available.

A3.6 Levels of illegal killing

The following are requirements of a measure of illegal killing elephants for the purposes of monitoring:

1. the measure needs to be robust with respect to changing conditions over time and between sites and countries;

2. it should represent the underlying average trend in illegal killing, without responding too much to random fluctuations.

In an attempt to meet these requirements, the measure adopted is derived from the second of the above statistical models. This has the effect of adjusting for the effects of influencing factors and smoothing out the "noise" in the data. Since there was no significant time effect, the data from all available years for each site were used in estimating the level of illegal killing. The results are in Table A3.6.1.

The level of illegal killing is defined as the percentage of the total carcass count that can be expected, other things being equal, to have arisen from illegal killing, according to the model with its underlying assumptions. An key assumption is that the probability of detection of a carcass remains constant within a site. It is important to understand that this measure is a *relative index* and not an absolute measure of the amount of illegal killing. It should be adequate for the purposes of making comparisons between sites or over time.

The level of illegal killing, as measured by this index, is subject to considerable uncertainty, reflecting the uncertainties inherent in the data. Some sites are represented by quite low total carcass counts, while others are high. For reference, these counts are included in the table. The table also includes 95% confidence limits (truncated to be in the range 0 – 100%).

Where the observed total carcass count is zero, the level of illegal killing is necessarily assumed to be zero.

Differences with the Preliminary report provided in July 2006

There are a number of differences in the results of this analysis when compared with the preliminary one. For example, in the Tanzania sites in the table of levels of illegal killing (Table A3.6.1), the level for Rukwa Katavi has changed from 68 to 38. The reason is that the present analysis is based on a more complete dataset whereas the earlier one was provisional. With the data currently available, the preferred measure of LEM effort turns out to be total man-hours instead of total patrol hours. Different covariates emerge as being important partly because of this and partly because of additional records that have been supplied since the first analysis. This was anticipated and noted in the July report.

It can be anticipated that, as more information becomes available, further refinements to the analysis will become possible.

References

Harrell F.E. (2006). *Hmisc: Harrell Miscellaneous*. R package version 3.0-12. http://biostat.mc.vanderbilt.edu/s/Hmisc.

Jachmann H. (1998). *Monitoring illegal wildlife use and law enforcement in African savanna rangeland.* Wildlife Resources Monitoring Unit, Environmental Council of Zambia.

McCullagh P., Nelder J.A. (1989). *Generalized Linear Models (2nd edition)*. Chapman & Hall.

Sarle W.S. (1990). The VARCLUS Procedure. *SAS/STAT User's Guide, 4th Edition*. Cary NC: SAS Institute, Inc.

Table A3.1.1
Data coverage

Subregion	Country	Site	Start	End	Months
Central Africa	Cameroon	Boumba Bek	Jan 03	Dec 05	36
		Waza	Mar 03	Jun 05	28
	C.A.R	Bangassou	Oct 03	Dec 04	15
		Dzanga Sangha	Sep 03	Dec 05	28
		Sangba	Jul 03	Dec 04	18
	Chad	Zakouma	Jan 03	Dec 05	36
	Congo	Nouabale Ndoki	Jan 03	Mar 05	27
		Odzala	Jan 03	Dec 05	36
	D.R. Congo	Okapi	Apr 03	Jun 05	27
		Salonga	Feb 03	Dec 05	35
	Gabon	Lope	Jan 03	Dec 04	24
		Minkebe	Jan 03	Dec 05	36
East Africa	Eritrea	Gash Setit	Jan 02	Dec 04	36
	Kenya	Mt. Elgon (Kenya)	Jan 03	Dec 05	36
		Samburu Laikipia	Jan 02	Dec 05	48
		Tsavo East	Jan 03	Dec 05	36
		Tsavo West	Jan 03	Dec 05	36
	Rwanda	Akagera	Apr 04	May 06	26
	Tanzania	Rukwa Katavi	Jul 03	Jul 05	25
		Rungwa Ruaha	Jul 03	Jul 05	25
		Selous Mikumi	Oct 03	Sep 04	12
		Tarangire Manyara	Jul 03	Dec 04	18
	Uganda	Murchison Falls	Jan 01	Aug 04	44
		Queen Elizabeth	Jan 02	Mar 05	39
Southern Africa	Botswana	Chobe National park	Apr 00	Aug 06	73
	Mozambique	Cahora bossa	Jan 01	Dec 04	37
		Niassa	Jan 04	Dec 04	12
	Namibia	Caprivi Conservancy	Jan 03	Jun 04	18
		Etosha National Park	Jan 00	May 04	53
	South Africa	Kruger National Park	May 05	Jul 06	15
	Zambia	South Luangwa	Oct 00	Dec 03	29
	Zimbabwe	Chewore	Jan 00	Jul 03	27
		Nyami Nyami	Jan 00	Nov 03	35
West Africa	Benin	Parc W	May 03	Dec 05	32
		Pendjari	Apr 03	Sep 05	28
	Burkina Faso	Nazinga	Jul 03	Mar 06	33
		Parc W	Aug 03	Jul 06	13
	Ghana	Kakum	Jan 02	Dec 05	45
		Mole	Jan 03	Dec 05	36
	Guinea	Ziama	Jan 03	May 06	19
	Mali	Gourma	Apr 02	Apr 05	12
	Niger	Babah Rafi	May 02	Dec 05	12
		Parc W	Jul 02	Jan 06	14
	Nigeria	Sambisa	Jan 03	Aug 04	19
		Yankari	Feb 03	Dec 04	15
	Senegal	Niokolo Koba	Jul 03	Dec 04	16
	Togo	Keran	Apr 02	Dec 04	15

Subregion	Country	Site	Start	End	Months
South Asia	Bangladesh	Chunati Wildlife Reserve	Jan 05	May 06	17
	Bhutan	Samtse Forest Division	Jan 05	Jan 06	13
	India	Deomali E.R.	Apr 05	Mar 06	12
		Eastern Dooars E.R.	Feb 05	Mar 06	14
		Garo Hills E.R.	Feb 05	Dec 05	11
		Mayurbhanj E.R.	Apr 04	Jan 06	22
		Mysore E.R.	Jul 05	Mar 06	9
		Shivalik E.R.	Jan 05	Dec 05	11
		Waynad E.R.	Jul 04	Mar 06	21
	Nepal	Royal Suklaphanta W.R.	Jan 04	Dec 05	24
	Sri Lanka	Wilpattu N.P.	Jan 06	Jul 06	7
South East Asia	Cambodia	Mondulkiri	Jan 06	Jul 06	7
	China	Xishuangbanna	Nov 05	Jun 06	8
	Malaysia	Gua Musang	Jul 05	Apr 06	10
		Kluang	Jul 05	Apr 06	10
	Myanmar	Alaungdaw Kathapa	Jan 06	Jun 06	6
		Shwe U Duang	Jan 06	May 06	5
	Thailand	Selakpra	Oct 05	Jul 06	9
	Viet Nam	Cat Tien	Apr 06	Jun 06	3

Table A3.2.1
Total carcass counts (patrol and non-patrol) by site and year and number of months for which data available

carc: number of carcasses found
illegal: number of illegally killed carcasses found
months: number of months that these totals are based on

Country	Site	*Type*	2000	2001	2002	2003	2004	2005	2006
		Central Africa							
Cameroon	Boumba Bek	*carc*				19	5	3	
		illegal				9	4	3	
		months				12	12	12	
	Waza	*carc*				3	2	2	
		illegal				1	1	1	
		months				10	12	6	
C.A.R	Bangassou	*carc*				3	8		
		illegal				2	8		
		months				3	12		
	Dzanga Sangha	*carc*				10	9	6	
		illegal				10	4	6	
		months				4	12	12	
	Sangba	*carc*				5	1		
		illegal				4	1		
		months				6	12		
Chad	Zakouma	*carc*				28	29	11	
		illegal				17	24	4	
		months				12	12	12	
Congo	Nouabale Ndoki	*carc*				10	19	1	
		illegal				6	7	1	
		months				12	12	3	
	Odzala	*carc*				35	35	72	
		illegal				13	20	53	
		months				12	12	12	

Country	Site	*Type*	2000	2001	2002	2003	2004	2005	2006
D.R. Congo	Okapi	*carc*				20	10	10	
		illegal				20	9	9	
		months				9	12	6	
	Salonga	*carc*				2	56	4	
		illegal				0	36	1	
		months				11	12	12	
Gabon	Lope	*carc*				6	4		
		illegal				4	1		
		months				12	12		
	Minkebe	*carc*				14	11	8	
		illegal				12	9	5	
		months				12	12	12	
		East Africa Country							
Eritrea	Gash Setit	*carc*			3	3	1		
		illegal			0	1	0		
		months			12	12	12		
Kenya	Mt. Elgon (Kenya)	*carc*				7	7	1	
		illegal				6	5	0	
		months				12	12	12	
	Samburu Laikipia	*carc*			159	195	128	160	
		illegal			60	36	40	27	
		months			12	12	12	12	
	Tsavo East	*carc*				42	45	37	
		illegal				4	11	14	
		months				12	12	12	
	Tsavo West	*carc*				40	20	23	
		illegal				14	8	3	
		months				12	12	12	
Rwanda	Akagera	*carc*					0	0	0
		illegal					0	0	0
		months					9	12	5
Tanzania	Rukwa Katavi	*carc*				12	20	6	
		illegal				9	15	3	
		months				6	12	7	
	Rungwa Ruaha	*carc*				10	6	2	
		illegal				1	1	1	
		months				6	12	7	
	Selous Mikumi	*carc*				9	11		
		illegal				2	2		
		months				3	9		
	Tarangire Manyara	*carc*				7	11		
		illegal				1	0		
		months				6	12		
Uganda	Murchison Falls	*carc*		3	0	10	2		
		illegal		2	0	10	1		
		months		12	12	12	8		
	Queen Elizabeth	*carc*			3	1	8	1	
		illegal			0	1	3	0	
		months			12	12	12	3	

Country	Site	*Type*	2000	2001	2002	2003	2004	2005	2006
				Southern Africa					
Botswana	Chobe National park	carc	5	18	0	59	73	153	82
		illegal	0	0	0	0	5	7	6
		months	5	12	12	12	12	12	8
Mozambique	Cahora bossa	carc		7	1	3	2		
		illegal		4	0	1	2		
		months		12	1	12	12		
	Niassa	carc					14		
		illegal					0		
		months					12		
Namibia	Caprivi Conservancy	carc				8	6		
		illegal				2	0		
		months				12	6		
	Etosha National Park	carc	18	18	24	19	1		
		illegal	1	0	0	1	0		
		months	13	11	12	12	5		
South Africa	Kruger National Park	carc						35	27
		illegal						0	0
		months						8	7
Zambia	South Luangwa	carc	11	16	4	8			
		illegal	4	9	1	5			
		months	3	8	6	12			
Zimbabwe	Chewore	carc	2	14	2	5			
		illegal	0	0	0	0			
		months	11	12	2	2			
	Nyami Nyami	carc	13	10	3	7			
		illegal	8	7	2	2			
		months	11	12	6	6			
				West Africa					
Benin	Parc W	*carc*				0	4	0	
		illegal				0	2	0	
		months				8	12	12	
	Pendjari	*carc*				1	3	0	
		illegal				1	1	0	
		months				7	12	9	
Burkina Faso	Nazinga	*carc*				0	1	5	1
		illegal				0	0	0	0
		months				6	12	12	3
	Parc W	*carc*				1	0		0
		illegal				0	0		0
		months				4	6		3
Ghana	Kakum	*carc*			2	3	6	2	
		illegal			1	0	0	0	
		months			9	12	12	12	
	Mole	*carc*				1	4	4	
		illegal				1	2	2	
		months				12	12	12	
Guinea	Ziama	*carc*				1	2	0	0
		illegal				1	2	0	0
		months				10	6	2	1
Mali	Gourma	*carc*			3	1	1	2	
		illegal			0	0	0	0	
		months			3	3	2	4	

Country	Site	*Type*	2000	2001	2002	2003	2004	2005	2006
Niger	Babah Rafi	*carc*			0	0	0	0	
		illegal			0	0	0	0	
		months			3	3	3	3	
	Parc W	*carc*			0	3	3	0	0
		illegal			0	1	2	0	0
		months			1	4	4	4	1
Nigeria	Sambisa	*carc*				1	3		
		illegal				1	0		
		months				11	8		
	Yankari	*carc*				10	2		
		illegal				3	1		
		months				11	4		
Senegal	Niokolo Koba	*carc*				0	1		
		illegal				0	0		
		months				6	10		
Togo	Keran	*carc*			0	0	0		
		illegal			0	0	0		
		months			4	4	7		
		South Asia							
Bangladesh	Chunati Wildlife Reserve	*carc*						0	1
		illegal						0	0
		months						12	5
Bhutan	Samtse Forest Division	*carc*						0	0
		illegal						0	0
		months						12	1
India	Deomali E.R.	*carc*						0	2
		illegal						0	0
		months						9	3
	Eastern Dooars E.R.	*carc*						8	0
		illegal						1	0
		months						11	3
	Garo Hills E.R.	*carc*						2	
		illegal						0	
		months						11	
	Mayurbhanj E.R.	*carc*					12	17	1
		illegal					0	2	0
		months					9	12	1
	Mysore E.R.	*carc*						30	3
		illegal						4	1
		months						6	3
	Shivalik E.R.	*carc*						2	
		illegal						0	
		months						11	
	Waynad E.R.	*carc*					2	8	0
		illegal					0	1	0
		months					6	12	3
Nepal	Royal Suklaphanta W.R.	*carc*					0	0	
		illegal					0	0	
		months					12	12	
Sri Lanka	Wilpattu N.P.	*carc*							30
		illegal							1
		months							7

Country	Site	*Type*	2000	2001	2002	2003	2004	2005	2006
		South East Asia							
Cambodia	Mondulkiri	*carc*							0
		illegal							0
		months							7
China	Xishuangbanna	*carc*						0	1
		illegal						0	0
		months						2	6
Malaysia	Gua Musang	*carc*						0	0
		illegal						0	0
		months						6	4
	Kluang	*carc*						0	0
		illegal						0	0
		months						6	4
Myanmar	Alaungdaw Kathapa	*carc*							2
		illegal							2
		months							6
	Shwe U Duang	*carc*							1
		illegal							0
		months							5
Thailand	Selakpra	*carc*						1	0
		illegal						0	0
		months						2	7
Viet Nam	Cat Tien	*carc*							0
		illegal							0
		months							3

Table A3.2.2
Elephant population estimates and densities

Subregion	Country	Site	Year	Method	Area	NumEl	Density
Central Africa	Cameroon	Boumba Bek	2004	DC	2485	318	0.13
		Waza	2002	GS	1700	475	0.28
	C.A.R	Bangassou	2004	DC	12000	1000	0.08
		Dzanga Sangha	2004	DC	4347	869	0.34
		Sangba	2005	AS	167	3	0.02
	Chad	Zakouma	2005	AS	3050	4000	1.30
	Congo	Nouabale Ndoki	2003	DC	4200	2652	0.66
		Odzala	2005	DC	13000	13545	1.00
	D.R. Congo	Okapi	2000	DC	13720	3808	1.90
		Salonga	2004	DC	36000	1186	0.05
	Gabon	Lope	2005	DC	4486	2350	0.65
		Minkebe	2004	DC	7560	22678	3.10
East Africa	Eritrea	Gash Setit	2003	IE (AT)	5275	96	0.02
	Kenya	Mt. Elgon (Kenya)	2002	IE (IR)	899	139	0.15
		Samburu Laikipia	2002	AT	30093	5447	0.18
		Tsavo East	2005	AT	11747	6395	0.54
		Tsavo West	2005	AT	15949	3918	0.25
	Rwanda	Akagera	2002	AT	3475	39	0.01
	Tanzania	Rukwa Katavi	2002	AS	13365	5732	0.43
		Rungwa Ruaha	2002	AS	36071	24685	0.68
		Selous Mikumi	2002	AS	89417	63039	0.71
		Tarangire Manyara	2004	AT	12000	1890	0.16
	Uganda	Murchison Falls	2002	AT	5044	692	0.14
		Queen Elizabeth	2002	AT	2499	998	0.40

Subregion	Country	Site	Year	Method	Area	NumEl	Density
Southern Africa	Botswana	Chobe National park	2004	AS	12672	35359	2.79
	Mozambique	Cahora bossa	2003	AS	2621	1628	0.62
		Niassa	2004	AS	42612	12477	0.29
	Namibia	Caprivi Conservancy	2004	AS	2274	2803	1.23
		Etosha National Park	2004	AS	18551	2057	0.11
	South Africa	Kruger National Park	2005	AT	22990	14669	0.64
	Zambia	South Luangwa	2002	AS	8448	4459	0.53
	Zimbabwe	Chewore	2003	AS	1737	4111	2.37
		Nyami Nyami	2001	AS	4637	4089	0.88
West Africa	Benin	Parc W	2003	AT	5872	56	0.01
		Pendjari	2003	AT	2826	713	0.25
	Burkina Faso	Nazinga	2003	AT	940	548	0.58
		Parc W	2003	AT	3300	740	0.22
	Ghana	Kakum	2004	DC	366	164	0.45
		Mole	2002	AS	2839	368	0.13
	Guinea	Ziama	2004	DC	455	214	0.47
	Mali	Gourma	2002	AT	27750	322	0.01
	Niger	Babah Rafi	2005	IE(IR)	430	17	0.04
		Parc W	2003	AT	2200	85	0.04
	Nigeria	Sambisa	2006	AT	518	0	0.00
		Yankari	2006	AT	2244	348	0.16
	Senegal	Niokolo Koba	2006	IE(AS)	9130	2	0.00
	Togo	Keran	2003	AT	1402	0	0.00
South Asia	Bangladesh	Chunati Wildlife Reserve	2003	GT	77.64	16	0.21
	Bhutan	Samtse Forest Division	2006	IR	20.6	12	0.58
	India	Deomali E.R.	2005	GS	953.4	107	0.11
		Eastern Dooars E.R.	2005	DC	978	537	0.61
		Garo Hills E.R.	2005	GS	1318.9	360	0.27
		Mayurbhanj E.R.	2005	DC	3214	1190	0.80
		Mysore E.R.	2005	DC	6724	6320	0.94
		Shivalik E.R.	2005	GS	824	416	0.51
		Waynad E.R.	2005	DC	1200	882	0.94
	Nepal	Royal Suklaphanta W.R.	2005	IR	305	23	0.08
	Sri Lanka	Wilpattu N.P.	2004	GT	1317	1076	0.82
South East Asia	Cambodia	Cardamom			4103		
		Mondulkiri			4294		
	China	Xishuangbanna	2006	DC	2400	165	0.07
	Indonesia	Bukit Barisan Selatan	2001	DC	3568	498	0.14
		Way Kambas	2001	DC	1235	180	0.15
	Lao	Nam Phui			1516		
	Malaysia	Gua Musang			1000		
		Kluang			800		
	Myanmar	Alaungdaw Kathapa	2001	DC	1605	23	0.01
		Shwe U Duang			326		
	Thailand	Kuiburi			969		
		Selakpra			858		
	Viet Nam	Cat Tien	2001	DC	742	10	0.01

Legend:

AS = Aerial Sample Count
AT = Aerial Total Count
DC = Line Transect Dung Count
IR = Individual Recognition
GT = Ground Total Count
GD = Genetic Dung Count
GS = Ground Sample Count
IE = Informed Estimate

Table A3.2.3
Site Attributes
(see Annex 4 for details of codings)

Country	Site	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20
Central Africa																					
Cameroon	Boumba Bek	A	2	1	1	2	2	1	2	2	5	4	4	5	2	1	0.13	1	3	4	4
	Waza	D	2	1	1	4	2	3	1	2	1	3	3	1	1	1	0.28	2	2	4	3
C.A.R.	Bangassou	B	4	5	4	3	5	2	5	5	5	5	5	2	2	2	0.08	3	4	4	5
	Dzanga Sangha	A	3	1	1	2	4	1	1	3	4	3	4	5	2	1	0.34	4	3	4	2
	Sangba	D	2	5	2	4	2	2	2	2	4	4	3	5	2	1	0.02	2	2	4	2
Chad	Zakouma	D	3	1	1	4	3	3	1	2	3	4	2	1	2	1	1.30	3	2	4	2
Congo	Nouabale Ndoki	A	3	1	1	2	2	1	1	1	5	4	3	5	2	1	0.66	2	2	4	3
	Odzala	B	3	1	1	2	3	1	1	3	4	4	3	5	2	1	1.00	2	2	4	3
D.R. Congo	Okapi	A	3	4	1	3	4	1	1	4	4	4	2	1	2	4	1.90	2	4	4	4
	Salonga	A	3	1	1	1	4	1	1	4	5	4	4	1	1	4	0.05	2	4	4	4
Gabon	Lope	A	3	2	1	3	3	1	1	3	3	3	3	1	1	1	0.65	3	3	4	3
	Minkebe	A	2	3	1	2	3	1	1	2	5	4	3	5	4	1	3.10	2	2	4	2
East Africa																					
Eritrea	Gash Setit	D	3	5	3	3	4	2	5	5	5	4	5	5	2	2	0.02	2	2	1	5
Kenya	Mt. Elgon (Kenya)	A	2	1	1	1	4	3	1	3	4	3	1	5	3	1	0.15	1	2	1	1
	Samburu Laikipia	D	3	5	3	2	3	2	3	3	3	2	1	1	1	2	0.18	4	2	4	3
	Tsavo East	D	3	1	2	3	1	2	1	1	2	2	1	2	4	1	0.54	3	2	4	1
	Tsavo West	D	3	1	2	3	1	2	1	1	2	2	1	1	4	1	0.25	4	2	4	1
Rwanda	Akagera	D	3	1	2	1	5	2	4	4	4	4	3	5	3	2	0.01	2	2	1	3
Tanzania	Rukwa Katavi	D	2	1	2	2	1	2	1	2	2	3	1	2	3	1	0.43	2	2	3	2
	Rungwa Ruaha	D	2	1	1	2	1	2	1	2	3	3	1	1	1	1	0.68	2	2	1	3
	Selous Mikumi	D	2	1	2	2	1	2	1	2	2	3	1	2	3	1	0.71	2	2	3	2
	Tarangire Manyara	C	2	4	3	3	1	1	1	1	2	3	1	2	1	1	0.16	2	2	1	1
Uganda	Murchison Falls	C	2	2	1	3	1	1	1	1	2	3	1	3	1	4	0.14	1	2	1	2
	Queen Elizabeth	C	3	2	1	3	1	1	1	1	4	3	1	1	3	4	0.40	3	2	3	2
Southern Africa																					
Botswana	Chobe National park	D	2	1	1	2	2	2	1	1	1	2	1	5	3	1	2.79	4	2	1	2
Mozambique	Cahora bossa	D	3	5	3	4	5	1	2	4	2	5	4	5	4	1	0.62	4	3	3	4
	Niassa	D	3	5	3	3	4	1	2	4	3	4	4	5	4	1	0.29	4	2	3	4
Namibia	Caprivi Conservancy	D	4	5	3	3	5	2	3	2	2	5	2	5	2	2	1.23	5	3	2	3
	Etosha National Park	D	2	1	1	1	1	4	1	1	1	1	1	1	1	1	0.11	2	1	1	2
South Africa	Kruger National Park	D	3	1	1	1	2	2	1	1	1	1	1	5	4	1	0.64	2	1	1	1
Zambia	South Luangwa	D	3	5	3	4	5	2	2	3	1	3	2	1	2	1	0.53	4	3	2	4
Zimbabwe	Chewore	D	2	5	3	4	5	2	2	3	1	3	2	5	2	1	2.37	5	3	2	2
	Nyami Nyami	D	3	5	3	4	5	1	2	3	1	4	2	4	2	1	0.88	5	3	2	2
West Africa																					
Benin	Parc W	D	2	1	1	3	3	2	3	3	4	4	4	5	2	1	0.01	2	2	2	4
	Pendjari	D	2	1	1	2	2	2	2	2	3	3	2	5	2	1	0.25	2	2	1	3
Burkina Faso	Nazinga	D	2	1	1	2	2	2	2	2	3	3	3	5	2	1	0.58	2	2	1	3
	Parc W	D	2	1	1	3	2	2	3	3	3	3	3	5	2	1	0.22	2	2	1	4
Ghana	Kakum	A	3	1	1	2	4	1	2	2	3	2	2	1	2	1	0.45	3	2	1	2
	Mole	D	2	1	1	3	3	2	3	3	3	3	3	1	2	1	0.13	3	2	1	3
Guinea	Ziama	A	2	1	1	3	3	1	4	4	4	4	4	5	3	2	0.47	3	2	1	4
Mali	Gourma	D	2	5	2	4	4	3	4	4	4	3	4	1	2	1	0.01	3	2	1	4
Niger	Babah Rafi	D	2	5	2	4	4	3	4	4	5	3	4	5	2	1	0.04	3	2	1	4
	Parc W	D	2	1	1	3	2	2	3	3	3	3	3	5	2	1	0.04	2	2	1	3
Nigeria	Sambisa	C	2	1	1	3	3	2	4	4	4	4	4	1	2	1	0.00	4	2	3	4
	Yankari	C	2	1	1	3	2	2	4	4	3	3	3	1	2	1	0.16	2	2	1	2
Senegal	Niokolo Koba	C	2	1	1	3	2	2	4	4	3	3	4	5	2	1	0.00	2	2	1	3
Togo	Keran	C	1	4	2	4	3	2	4	4	5	4	4	1	2	1	0.00	2	2	3	4

Country	Site	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20
								South Asia													
Bangladesh	Chunati Wildlife Reserve	C	4	4	2	4	5	2	2	2	3	3	1	1	1	2	0.21	4	2	1	3
Bhutan	Samtse Forest Division	A	3	5	2	4	2	2	2	3	5	5	4	5	5	2	0.58	3	2	1	4
India	Deomali E.R.	A	3	5	3	3	3	1	8	4	5	5	4	2	3	2	0.11	2	2	1	4
	Eastern Dooars E.R.	B	4	5	2	4	5	2	1	1	3	2	1	5	2	2	0.61	5	2	1	1
	Garo Hills E.R.	A	4	5	4	4	4	2	1	4	5	5	4	2	4	2	0.27	4	3	3	4
	Mayurbhanj E.R.	A	4	4	2	3	3	2	1	1	3	3	1	1	1	2	0.80	4	2	1	1
	Mysore E.R.	A	4	5	2	4	3	2	1	1	2	2	2	1	1	1	0.94	4	3	5	2
	Shivalik E.R.	A	4	5	2	4	4	2	1	1	1	2	1	1	1	1	0.51	4	3	4	1
	Waynad E.R.	A	4	5	3	4	5	1	1	1	2	2	1	1	1	1	0.94	5	2	3	1
Nepal	Royal Suklaphanta W.R.	B	4	1	1	4	4	2	1	1	3	3	1	5	2	3	0.08	2	2	1	1
Sri Lanka	Wilpattu N.P.	B	4	5	4	4	4	1	3	3	2	3	3	1	1	2	0.82	5	3	5	2
								South East Asia													
Cambodia	Cardamom	B	2	4	2	4	4	2	4	5	4	4	4	5	5	1		3	3	1	4
	Mondulkiri	B	2	4	2	4	3	2	4	4	4	4	4	5	5	1		3	2	1	3
China	Xishuangbanna	A	3	1	1	3	4	2	1	2	3	2	2	5	3	1	0.07	2	2	2	2
Indonesia	Bukit Barisan Selatan	A	3	1	1	2	2	2	4	4	4	4	5	5	3	1	0.14	3	2	1	5
	Way Kambas	A	3	1	1	3	5	2	1	1	2	2	2	1	1	1	0.15	2	2	1	2
Lao	Nam Phui	A	3	1	1	3	5	2	1	1	2	2	2	1	1	1		2	2	1	2
Malaysia	Gua Musang	A	4	4	3	4	5	3	3	3	3	3	3	2	1	1		4	4	2	3
	Kluang	A	4	4	3	4	5	2	3	3	3	3	3	1	1	1		4	4	2	3
Myanmar	Alaungdaw Kathapa	A	2	1	1	2	2	2	1	3	5	4	4	2	1	1	0.01	2	2	1	3
	Shwe U Duang	A	2	1	1	2	2	2	1	3	5	4	4	2	1	1		2	2	1	3
Thailand	Kuiburi	A	3	1	1	4	5	1	2	2	2	3	2	5	2	1	0.64	3	3	1	2
	Selakpra	A	3	1	1	4	5	1	1	2	3	3	2	2	1	1		3	3	1	2
Viet Nam	Cat Tien	A	3	1	1	3	3	1	1	2	3	3	2	2	1	1	0.01	2	2	1	3

Table A3.2.4
Country Attributes

Subregion	Country	X23	X24	X25	X26	X27	X28	X29
Central Africa	Cameroon	4	5	4	5	2.2	4	3
	C.A.R	3	6	5	6	2.5	5	3
	Chad	3	6	1	6	1.7	4	3
	Congo	4	5	4	5	2.3	4	3
	D.R. Congo	5	6	5	6	2.1	5	4
	Gabon	4	5	4	5	2.9	4	1
East Africa	Eritrea	1	5	1	1	2.6	5	2
	Kenya	2	2	1	1	2.1	3	3
	Rwanda	2	2	1	1	3.1	4	3
	Tanzania	2	2	1	1	2.9	3	2
	Uganda	2	2	1	1	2.5	3	3
South Africa	Botswana	1	1	1	2	5.9	3	2
	Mozambique	3	3	3	3	2.8	4	2
	Namibia	1	1	1	1	4.3	2	1
	South Africa	1	1	1	1	4.5	2	2
	Zambia	2	3	3	3	2.6	4	1
	Zimbabwe	3	2	3	3	2.6	4	1

Subregion	Country	X23	X24	X25	X26	X27	X28	X29
West Africa	Benin	2	2	1	2	2.9	4	2
	Burkina Faso	1	2	1	2	3.4	3	2
	Côte d'Ivoire	4	2	3	2	4.0	5	3
	Ghana	1	2	1	2	3.5	3	2
	Guinea	1	2	1	2	1.9	4	2
	Liberia	1	2	3	2	4.0	5	3
	Mali	2	2	1	2	3.0	4	2
	Niger	1	2	1	2	2.4	4	2
	Nigeria	5	2	4	2	1.9	4	2
	Senegal	4	2	1	2	3.2	4	2
	Togo	2	2	1	2	2.6	4	2
South Asia	Bangladesh	3	5	2	5	1.7	4	2
	Bhutan	2	4	1	1	2.7	3	2
	India	1	1	1	1	2.9	2	2
	Nepal	1	1	1	1	2.5	2	2
	Sri Lanka	1	1	1	1	3.2	3	2
South East Asia	Cambodia	3	4	1	3	2.3	4	3
	China	5	2	1	2	3.2	1	3
	Indonesia	3	2	1	5	2.2	5	3
	Lao	2	5	1	3	3.3	5	3
	Malaysia	2	2	1	1	5.1	4	2
	Myanmar	4	5	3	5	1.8	5	4
	Thailand	5	5	1	3	3.8	4	2
	Viet Nam	4	4	1	3	2.6	3	2

Table A3.4.1
Carcass counts adjusted for LEM effort: no. of carcasses per 1,000 man-hours on patrol
(patrol data from patrols with non-zero effort only)

MH: total number of man-hours spent on patrol
carc: number of carcasses found per 1,000 man-hours
illegal: number of illegally killed carcasses found per 1,000 man-hours

Country	Site	*Type*	2000	2001	2002	2003	2004	2005	2006
		Central Africa							
Cameroon	Boumba Bek	*MH*				6121	15674	2847	
		carc				1.96	0	1.05	
		illegal				1.14	0	1.05	
	Waza	*MH*				2033	1369	1373	
		carc				1.48	1.46	1.46	
		illegal				0.49	0.73	0.73	
C.A.R	Bangassou	*MH*				257	770		
		carc				11.67	10.38		
		illegal				7.78	10.38		
	Dzanga Sangha	*MH*				3720	9386	6778	
		carc				1.88	0.96	0.89	
		illegal				1.88	0.43	0.89	
	Sangba	*MH*				6032	4972		
		carc				0.83	0.20		
		illegal				0.66	0.20		
Chad	Zakouma	*MH*				7228	6622	3086	
		carc				3.32	4.38	3.56	
		illegal				1.94	3.62	1.30	

Country	Site	*Type*	2000	2001	2002	2003	2004	2005	2006
Congo	Nouabale Ndoki	*MH*				10964	29965	3696	
		carc				0.64	0.43	0.27	
		illegal				0.46	0.13	0.27	
	Odzala	*MH*				18633	11880	14608	
		carc				1.82	2.95	4.93	
		illegal				0.70	1.68	3.63	
D.R. Congo	Okapi	*MH*				101107	179395	82757	
		carc				0.19	0.06	0.12	
		illegal				0.19	0.05	0.11	
	Salonga	*MH*				89	3826	6749	
		carc				0	14.38	0.59	
		illegal				0	9.15	0.15	
Gabon	Lope	*MH*				1244	2547		
		carc				4.02	0		
		illegal				3.22	0		
	Minkebe	*MH*				5315	6473	4439	
		carc				2.45	1.54	0.45	
		illegal				2.07	1.24	0.23	
		East Africa							
Kenya	Mt. Elgon (Kenya)	*MH*				13885	12525	15668	
		carc				0.50	0.56	0.06	
		illegal				0.43	0.40	0	
	Samburu Laikipia[†]	*Mtgs*			57	92			
		carc			2.79	2.12			
		illegal			1.05	0.39			
	Tsavo East	*MH*				101064	108416	168128	
		carc				0.42	0.28	0.18	
		illegal				0.04	0.06	0.07	
	Tsavo West	*MH*				147231	176658	241644	
		carc				0.15	0.08	0.08	
		illegal				0.05	0.03	0.01	
Rwanda	Akagera	*MH*					2833	12154	3307
		carc					0	0	0
		illegal					0	0	0
Tanzania	Rukwa Katavi	*MH*				9229	26122	11334	
		carc				0.87	0.73	0.53	
		illegal				0.76	0.54	0.26	
	Rungwa Ruaha	*MH*				5084	12534	6139	
		carc				1.97	0.24	0.33	
		illegal				0.20	0.08	0.16	
	Selous Mikumi	*MH*				6406	11160		
		carc				1.40	0.90		
		illegal				0.31	0.18		
	Tarangire Manyara	*MH*				7828	16901		
		carc				0.26	0.24		
		illegal				0	0		
Uganda	Murchison Falls	*MH*		24793	19245	44763	39820		
		carc		0.12	0	0.22	0.03		
		illegal		0.08	0	0.22	0.03		
	Queen Elizabeth	*MH*			5716	3875	7901	2348	
		carc			0.35	0.26	0.63	0	
		illegal			0	0.26	0.25	0	
		Southern Africa							
Botswana	Chobe National park	*MH*		4673	13816 2	20477	3836	4010	5184
		carc		3.85	0	2.54	12.25	34.66	14.27
		illegal		0	0	0	0.26	1.75	0.77

[†] *Samburu Laikipia: Data are number of meetings held in the year (*Mtgs*) and the number of carcasses (*carc*) and the number illegally killed (*illegal*) found per meeting.*

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
Mozambique	Niassa	*MH*					37464		
		carc					0.37		
		illegal					0		
Namibia	Etosha National Park	*MH*	133518	29042	25408	12696	13678		
		carc	0.07	0.48	0.47	0	0.07		
		illegal	0	0	0	0	0		
South Africa	Kruger National Park	*MH*						491515	398524
		carc						0.07	0.07
		illegal						0	0
Zambia	South Luangwa	*MH*			32460	224365			
		carc			0	0.01			
		illegal			0	0.01			
Zimbabwe	Chewore	*MH*	5092	1776					
		carc	0	0					
		illegal	0	0					
	Nyami Nyami	*MH*	1762	3483	244				
		carc	0	0	0				
		illegal	0	0	0				
		West Africa							
Benin	Parc W	*MH*				4582	4003	4306	
		carc				0	1.00	0	
		illegal				0	0.50	0	
	Pendjari	*MH*				6687	6940	784	
		carc				0.30	0.43	0	
		illegal				0	0.14	0	
Burkina Faso	Nazinga	*MH*				707	9005	27550	9781
		carc				0	0	0.18	0.10
		illegal				0	0	0	0
	Parc W	*MH*				168	119		28
		carc				5.96	0		0
		illegal				0	0		0
Ghana	Kakum	*MH*			8685	8522	10829	1626	
		carc			0.23	0.35	0.55	1.23	
		illegal			0.12	0	0	0	
	Mole	*MH*				2953	5092	29	
		carc				0.34	0.79	140.35	
		illegal				0.34	0.39	70.18	
Guinea	Ziama	*MH*				1066	1203	226	732
		carc				0.94	1.66	0	0
		illegal				0.94	1.66	0	0
Mali	Gourma	*MH*			608	187	64		
		carc			4.94	5.35	0		
		illegal			0	0	0		
Niger	Babah Rafi	*MH*			33			35	
		carc			0			0	
		illegal			0			0	
	Parc W	*MH*			270	600	503	2549	396
		carc			0	5.00	0	0	0
		illegal			0	1.67	0	0	0
Nigeria	Sambisa	*MH*				4725	4996		
		carc				0	0.60		
		illegal				0	0		
	Yankari	*MH*				14795	1956		
		carc				0.68	1.02		
		illegal				0.20	0.51		
Senegal	Niokolo Koba	*MH*				608	777		
		carc				0	1.29		
		illegal				0	0		
Togo	Keran	*MH*			339	107	507		
		carc			0	0	0		
		illegal			0	0	0		

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
		South Asia							
Bangladesh	Chunati Wildlife Reserve	*MH*						720	360
		carc						0	2.778
		illegal						0	0
Bhutan	Samtse Forest Division	*MH*						834	36
		carc						0	0
		illegal						0	0
India	Deomali E.R.	*MH*						62590	19535
		carc						0	0.102
		illegal						0	0
	Eastern Dooars E.R.	*MH*						611833	125764
		carc						0.013	0
		illegal						0.002	0
	Garo Hills E.R.	*MH*						21040	
		carc						0	
		illegal						0	
	Mayurbhanj E.R.	*MH*					84694	589107	40995
		carc					0.083	0.017	0.024
		illegal					0	0.002	0
	Mysore E.R.	*MH*						223759	150170
		carc						0.098	0.020
		illegal						0.018	0.007
	Shivalik E.R.	*MH*						257587	
		carc						0.004	
		illegal						0	
	Waynad E.R.	*MH*					216217	395221	120034
		carc					0.009	0.005	0
		illegal					0	0	0
Nepal	Royal Suklaphanta W.R.	*MH*					256645	178735	
		carc					0	0	
		illegal					0	0	
Sri Lanka	Wilpattu N.P.	*MH*							34552
		carc							0
		illegal							0
		South East Asia							
China	Xishuangbanna	*MH*						1472	607
		carc						0	1.646
		illegal						0	0
Malaysia	Gua Musang	*MH*						185	237
		carc						0	0
		illegal						0	0
	Kluang	*MH*						718	497
		carc						0	0
		illegal						0	0
Myanmar	Alaungdaw Kathapa	*MH*							69
		carc							28.860
		illegal							28.860
	Shwe U Duang	*MH*							138
		carc							0
		illegal							0
Thailand	Selakpra	*MH*						27	393
		carc						37.453	0
		illegal						0	0
Viet Nam	Cat Tien	*MH*							293
		carc							0
		illegal							0

Table A3.6.1
Levels of Illegal Killing

Subregion	Country	Site	Level (%)	No. of carcasses	Lower 95% limit	Upper 95% limit
Central Africa	Cameroon	Boumba Bek	55	27	30	80
		Waza	60	7	29	92
	C.A.R.	Bangassou	100	11	71	100
		Dzanga Sangha	71	25	45	98
		Sangba	62	6	31	92
	Chad	Zakouma	66	68	47	86
	Congo	Nouabale Ndoki	38	30	24	53
		Odzala	62	142	50	75
	D.R. Congo	Okapi	78	40	55	100
		Salonga	71	62	52	89
	Gabon	Lope	90	10	54	100
		Minkebe	67	33	43	91
East Africa	Eritrea	Gash Setit	14	7	0	42
	Kenya	Mt. Elgon (Kenya)	42	15	22	62
		Samburu Laikipia[†]	24	642	20	28
		Tsavo East	28	124	21	35
		Tsavo West	28	83	21	35
	Rwanda	Akagera	0	0	0	0
	Tanzania	Rukwa Katavi	39	38	26	51
		Rungwa Ruaha	39	18	26	51
		Selous Mikumi	39	20	26	51
		Tarangire Manyara	32	18	20	44
	Uganda	Murchison Falls	61	15	32	90
		Queen Elizabeth	61	13	32	90
Southern Africa	Botswana	Chobe National park	5	390	2	7
	Mozambique	Cahora bossa	27	13	7	46
		Niassa	25	14	6	44
	Namibia	Caprivi Conservancy	6	14	0	11
		Etosha National Park	4	80	0	8
	South Africa	Kruger National Park	0	62	0	0
	Zambia	South Luangwa	49	39	27	71
	Zimbabwe	Chewore	34	23	19	49
		Nyami Nyami	34	33	19	49
West Africa	Benin	Parc W	57	4	1	100
		Pendjari	43	6	0	85
	Burkina Faso	Nazinga	0	7	0	0
		Parc W	0	1	0	0
	Ghana	Kakum	24	13	5	43
		Mole	32	9	6	58
	Guinea	Ziama	100	3	0	100
	Mali	Gourma	0	7	0	0
	Niger	Babah Rafi	0	0	0	0
		Parc W	50	6	0	100
	Nigeria	Sambisa	33	4	1	66
		Yankari	33	12	1	66
	Senegal	Niokolo Koba	0	1	0	0
	Togo	Keran	0	0	0	0

[†] *The year effect was significant for Samburu. The estimated proportion of illegally killed is derived from a different model than the other sites.*

Subregion	Country	Site	Level (%)	No. of carcasses	Lower 95% limit	Upper 95% limit
South Asia	Bangladesh	Chunati Wildlife Reserve	0	1	0	0
	Bhutan	Samtse	0	0	0	0
	India	Deomali E.R.	0	2	0	0
	India	Eastern Dooars E.R.	13	8	0	37
	India	Garo Hills E.R.	0	2	0	0
	India	Mayurbhanj E.R.	7	30	0	16
	India	Mysore E.R.	15	33	2	28
	India	Shivalik E.R.	0	2	0	0
	India	Waynad E.R.	10	10	0	30
	Nepal	Royal Suklaphanta	0	0	0	0
	Sri Lanka	Wilpattu N.P.	3	30	0	10
S.E. Asia	Myanmar	Alaungdaw Kathapa	100	2	0	100
	China	Xishuangbanna	0	1	0	0

SITE ATTRIBUTES / INFLUENCING FACTORS

A descriptive report on the influencing factors for each site would be cumbersome to include in this baseline report. The information is therefore presented in the form of a score in accordance with the approach in Table 3 below. Most of the attributes listed are provided as ordered categorical variables. By representing site differences in terms of attributes, the MIKE monitoring process moves a step closer to linking a change in an attribute (or attributes) to a change in elephant mortality.

Table 1 shows the site-level attributes that have been compiled so far.

Table 1
Site level attributes

X1	Ecosystem/Habitat
X2	Adjacent Land Use
X3	Land Use within site – type
X4	Land Use within site – impact
X5	Human Access
X6	Human Population Pressure
X7	Water Availability
X8	Land Tenure System – legal
X9	Land Tenure System – actual
X10	Tourism Activities
X11	Research Activities
X12	Wildlife Management
X13	International Border Proximity
X14	Cross-border incursions
X15	Civil/Military Conflict
X16	Elephant Population Densities
X17	Elephant/Human Conflict
X18	Development Activities
X19	Illegal Killing History
X20	LEM Effort – cover

Table 2 shows country-level attributes that are thought to have a bearing on illegal activities at the site level.

Table 2
Country level attributes

X23	Ivory Trade Patterns – scale
X24	Ivory Trade Patterns – regulation
X25	Elephant Meat Trade Patterns – scale
X26	Elephant Meat Trade Patterns – regulation
X27	Corruption Levels
X28	Judicial Severity
X29	Illegal Arms/Drug Trafficking

Table 3 shows the scoring system used in providing attribute values.

Table 3
Attribute scoring system

X1	A = Forest; B = Forest/Savanna; C = Savanna/Forest; D = Savanna
X2	1 = Elephant friendly; 2 = Relatively friendly; 3 = Relatively unfriendly; 4 = Unfriendly
X3	1 = Wildlife; 2 = Includes Forestry; 3 = Includes mining; 4 = Includes agriculture; 5 = includes Settlement
X4	1 = Elephant friendly; 2 = Relatively friendly; 3 = Relatively unfriendly; 4 = Unfriendly
X5	1 = Difficult; 2 = fairly difficult; 3 = fairly easy; 4 = easy
X6	1 = Very low; 2 = Low; 3 = Medium; 4 = High; 5 = Very high
X7	1 = Plentiful; 2 = Seasonally good; 3 = Seasonally poor; 4 = Scarce
X8	1 = Strong legal protection; 2 = Reasonably good legal protection; 3 = Moderate legal protection; 4 = Weal legal protection; 5 = No legal protection
X9	1 = Strong actual protection; 2 = Reasonably good actual protection; 3 = Moderate actual protection; 4 = Weak actual protection; 5 = No actual protection
X10	1 = High activity; 2 = Relatively high; 3 = Relatively low; 4 = Low; 5 = None
X11	1 = High activity; 2 = Relatively high; 3 = Relatively low; 4 = Low; 5 = None
X12	1 = Uniformly well developed; 2 = Patchily well developed; 3 = Moderately developed; 4 = Poorly developed; 5 = None
X13	1 = > 100km away; 2 = < 100km away ; 3 = < 50 km away; 4 = < 20 km away; 5 = Adjacent
X14	1 = None; 2 = Occasional; 3 = Low regularity; 4 = High regularity; 5 = Frequently
X15	1 = None; 2 = Intermittent; 3 = Frequent; 4 = Constant
X16	Estimated population density from most recent survey
X17	1 = None; 2 = Small No. of incidences; 3 = Moderate No. of incidences; 4 = Frequent number of incidences; 5 = High No, of incidence
X18	1 = Elephant friendly; 2 = Relatively friendly; 3 = Relatively unfriendly; 4 = Unfriendly
X19	1 = Low regular offtake in last 5 years; 2 = Declining offtake in last 5 years; 3 = Moderate regular offtake in last 5 years; 4 = Increasing offtake in last 5 years; 5 = High regular offtake in last 5 years
X20	1 = High uniform cover; 2 = High but patchy cover; 3 = Moderate cover; 4 = Poor cover; 5 = No cover
X23	1 = No trade in country; 2 = Country used for illegal transit; 3 = active small scale market; 4 = Active medium scale market; 5 = Active large scale markets
X24	1 = Fully regulated and implemented; 2 = Fully regulated, partially implemented; 3 = Fully regulated, no implementation 4 = Partially regulated and implemented; 5 = Partially regulated, no implementation; 6 = No regulation
X25	1 = No trade in country; 2 = Country used for illegal transit; 3 = active small scale market; 4 = Active medium scale market; 5 = Active large scale markets
X26	1 = Fully regulated and implemented; 2 = Fully regulated, partially implemented; 3 = Fully regulated, no implementation; 4 = Partially regulated and implemented; 5 = Partially regulated, no implementation; 6 = No regulation
X27	Corruption perception index values provided by Transparency International
X28	1 = High; 2 = Relatively Good; 3 = Medium; 4 = Relatively weak; 5 = Poor
X29	1 = None; 2 = Intermittent; 3 = Frequent; 4 = Constant

The word 'friendly' is defined in terms of risk to an elephant being killed, i.e 'friendly' is the low risk end and 'unfriendly' is the high risk end. These values have been attributed by the Sub-regional Support Officers in order to optimize consistency, given that the SSOs know the sites well and are less likely to be defensive in regard to any attribute score. It is recognized that the list of attributes is large and it will be helpful, in due course, to seek some simpler representation in terms of fewer variables. This will become possible as the data set grows over time and the analysis becomes more comprehensive and robust. The site attribute list therefore will be reviewed after the first few rounds of analysis.

NOTES ON THE STATISTICAL METHODS USED IN THE ANALYSIS

A5.1 Variable clustering

The clustering of site attribute variables was done using Harrell's version of the hierarchical clustering algorithm (Harrell, 2006). The distance measure was Hoeffding's D-statistic and the clustering method was Ward's method.

A5.2 Analysis of carcass counts

Method: Poisson regression with overdispersion (McCullagh & Nelder, 1989), with patrol carcass counts as response.

Africa significant effects:
log(el. pop.) ($P < 0.0001$)
log(total man-hours) ($P < 0.0001$)
area of site ($P < 0.0001$)
X3 (type of land use within the site) ($P < 0.0001$)
X27 (corruption index) ($P < 0.0001$)
X29 (illegal arms) ($P < 0.0001$)

Asia significant effects:
log(total man-hours) ($P = 0.003$)
area of site ($P < 0.0001$)
X24 (ivory trade regulations) ($P < 0.0001$)

A5.3 Analysis of illegal killing

Method: Poisson regression with total number of carcasses as offset (so that the response is effectively the *proportion* of all carcasses that were illegally killed).

First model: investigated the effect of LEM effort and other variables on the proportion illegally killed from patrol data only. Overdispersion was not observed, and LEM effort was not significant. (Presumably this is because LEM effort would affect both numerator and denominator of the ratio of illegally killed to total carcass count.)

Second model: based on all carcass data (patrol and non-patrol) together, to assess the importance of potential influencing factors. Analysis confined to cases (months) with non-zero total carcass counts; Samburu excluded.

Africa significant effects:
Sub-region ($P = 0.04$)
X5 (human access) ($P = 0.0007$)
X27 (corruption index) ($P = 0.0009$)
X9 (actual level of protection) ($P = 0.005$)
X1 (ecosystem type) ($P = 0.007$)

Asia significant effects:
X27 (corruption index) ($P = 0.03$)

A5.4 Defining Levels of illegal killing

The level of illegal killing (defined in Annex 3) was obtained from the fitted values from the last model above. These were calculated for each site by setting the total number of carcasses to 100.