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

Forty-first meeting of the Standing Committee
Geneva (Switzerland), 8-12 February 1999

Issues relating to species

Elephants

ESTABLISHMENT OF AN INTERNATIONAL SYSTEM FOR MONITORING ILLEGAL KILLING

Introduction

1. This paper presents a long-term, site-based, international system for monitoring the illegal killing of elephants in Africa and Asia, as called for in Resolution Conf. 10.10, adopted at Harare.

2. The document attached (Annex 1) has been prepared by the IUCN/SSC African and Asian Elephant Specialist Groups, under a consultancy contract to the CITES Secretariat. (Regrettably, owing to the length of the report, which was written in English, it has not been possible to provide complete versions in French and Spanish. However, the Executive Summary has been translated into these languages.) The Secretariat believes that the system presented here satisfies the requirements of Decision 10.1, Decision 10.2 and Resolution Conf. 10.10 for monitoring illegal hunting.

Resolution Conf. 10.10

3. Resolution Conf. 10.10 deals with a number of topics under the title of 'Trade in Elephant Specimens'. The part relevant to the present document reads as follows:

   '*The Conference of the Parties..... Regarding monitoring of illegal hunting of and trade in elephant specimens AGREES that:*

   a) a comprehensive, international monitoring system shall be established under the supervision and direction of the Standing Committee with the objectives of:

      i) measuring and recording current levels and trends of illegal hunting and trade in ivory in African and Asian range States, and in trade entrepots;

      ii) assessing whether and to what extent observed trends are a result of changes in the listing of elephant populations in the CITES appendices and/or the resumption of legal international trade in ivory; and

      iii) establishing an information base to support the making of decisions on appropriate remedial action in the event of any problems with compliance or potential detriment to the species; and

Proposal for Establishing a Long Term System for Monitoring the Illegal Killing of Elephants (MIKE)

Prepared by the IUCN/SSC African and Asian Elephant Specialist Groups

Important
Please note that this document provides a costing model for the proposed elephant monitoring system. It is based on assumptions and estimates as well as hard data. It should not be taken as a final procurement or implementation budget.

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1 Executive summary

This proposal describes a long-term system for monitoring the illegal killing of elephants in Africa and Asia that is currently under development by the IUCN Species Survival Commission's African (AfESG) and Asian (AsESG) Elephant Specialist Groups. This system is being designed and developed at the request of the Parties to CITES.

In response to the adoption of Res. Conf. 10.10 and the related decisions, Dec.10.1 and Dec.10.2 (Annex 1), taken at the tenth Conference of the Parties to CITES in Harare in June 1997, the IUCN/SSC's AfESG and AsESG began work on the required monitoring system over the past year. This development has taken place through dedicated workshops and extensive consultations.

As mandated in the resolution, the monitoring system is designed to measure and identify trends in the illegal killing of elephants in Africa and Asia, to determine changes in these trends and to assess whether and to what extent these trends are a result of changes in the status of African elephant populations within CITES.

Data requirements, the process of selecting sample survey sites, data collection and compilation mechanisms and the system's organisational structure are described in this document. The preferred sampling scenario (Scenario 3) comprises 45 sites across the African region and 15 sites across Asia. The sites have been selected through a complex statistical process designed to detect significant levels of illegal killing with an acceptable degree of precision. Two other scenarios for Africa covering fewer sites, have also been developed but provide relatively lower precision without commensurate cost savings. The site selection process for Asia is underway at the time of writing.

The system - Monitoring the Illegal Killing of Elephants (MIKE) - is based on population surveys in each site every two years coupled with more regular collection of continuous data sets from the sample sites. Range State governments, NGO personnel working at the sites and members of the AfESG and AsESG will collect, compile and report data and provide logistical support. Survey teams will be hired or recruited locally according to need. Existing survey and data collection capability and capacity will be utilised fully where it is available.

A permanent Technical Support and Data Processing Unit will need to be established to provide training and to build capacity of personnel within the Range States to collect and compile data at the site, national, sub-regional and regional level. The Unit itself will provide the appropriate methodologies and protocols for data collection, oversee the overall compilation of data from both Africa and Asia, analyse and interpret these data, and report to governments, IUCN, CITES and other parties as required.

Regardless of the scenario selected, fixed one-off costs to establish the MIKE system across Africa and Asia are estimated at US$742,383. The indicative annual recurrent costs for the preferred Scenario 3 are approximately US$2,350,000 per year.

As this system is an entirely new initiative it will require institutional, material and financial support from both Range State governments and donor agencies.

2 Background to the process

2.1 CITES Decisions

At the tenth meeting of the Conference of the Parties to CITES, held in Harare in June 1997, the decision was made to transfer the African elephant populations of Botswana, Namibia, and Zimbabwe from CITES Appendix I to Appendix II and to allow limited commercial trade in raw ivory from these countries to Japan in 1999 (see Decision 10.1). A second decision was taken to allow the registration and disposal of ivory stocks in all African elephant Range States (see Decision 10.2). Before trade or sale under these decisions can occur, several conditions must be met, including the development of international monitoring systems for illegal killing of elephants and for illegal trade in ivory and other elephant products.

The Parties also adopted CITES Res. Conf. 10.10 which included a description of the required systems for monitoring of illegal hunting of and trade in elephant products which stated that:

" a) a comprehensive international monitoring system shall be established under the supervision and direction of the Standing Committee with the objectives of:
   i) measuring and recording current levels and trends of illegal hunting and trade in ivory in African and Asian range states, and in trade entrepots;
   ii) assessing whether and to what extent observed trends are a result of changes in the listing of elephant populations in the CITES appendices and/or the resolution of legal international trade in ivory; and
   iii) establishing an information base to support the making of decisions on appropriate remedial action in the event of any problems with compliance or potential detriment to the species; and

b) this monitoring system shall be in accordance with the framework outlined in Annex 1 [of Res. Conf. 10.10] for monitoring of illegal trade in ivory and other elephant specimens and in Annex 2 [of Res. Conf. 10.10] for monitoring of illegal hunting in elephant range states."

The Resolution requests that not only is a measurement of levels and trends required but also that the causes of any changes in these levels be assessed. For the issue of causality to be addressed, additional information is needed to help determine whether or not changes in these levels and trends are the result of decisions taken by the Parties to CITES, or due to other factors.

The Parties called upon the IUCN Species Survival Commission's African (AfESG) and Asian (AsESG) Elephant Specialist Groups and the TRAFFIC Network to assist in the development and implementation of the required international monitoring systems for the monitoring of illegal hunting and trade in elephant specimens. The present proposal is in direct response to the decisions and resolutions as they pertain to the illegal killing of elephants.

2.2 Required actions taken to date

IUCN/SSC began the formal process of developing this system in December 1997 when, together with TRAFFIC, they convened an expert workshop to address the technical aspects of their design and implementation. The required international monitoring system was conceived as having two components one for the monitoring of legal and illegal trade in elephant products and the second for the monitoring of illegal killing of elephants. The information

collected from these two systems would later be integrated to allow the assessment called for by the Parties.

TRAFFIC is now developing an enhanced trade monitoring system. The new system, the Elephant Trade Information System (ETIS), will expand the present capabilities of TRAFFIC's existing Bad Ivory Database System (BIDS) and move towards the development of an integrated trade monitoring information system.

Development of the illegal killing system has proved a bigger task, as there is currently no international monitoring system of any kind in place. Therefore, the design and development of this system required starting from scratch. Over the past year, the system for monitoring the illegal killing of elephants (MIKE) has been developed by IUCN/SSC's African and Asian Elephant Specialist Groups through dedicated workshops and extensive consultations. A key decision was that the system must be developed on the basis of individual sites and that these sites must form an unbiased, representative sample across the African and Asian elephant Range States.

In March 1998, IUCN/SSC and TRAFFIC presented their initial recommendations to the 40th meeting of the CITES Standing Committee in London. With regard to the monitoring of illegal killing, it was recommended that a two-tiered process be put in place. The first tier to deal with the question of interim reporting between the tenth Conference of the Parties in June 1997 and the 41st meeting of the Standing Committee in February 1999 and the second to deal with the further development of a long-term monitoring system.

The interim step includes the implementation of a system of national level reporting and the development of a system for the verification of unofficial, independent reports of illegal killing. The implementation of these two interim actions is to be undertaken by the CITES Secretariat. The compilation of national data, rather than site-specific data, was chosen for the interim reporting system since this information is all that may be accessible in the short time available and may provide insights to the decisions to be taken in February 1999. With the assistance of IUCN/SSC, a notification was drafted and sent to the Parties on 30 June 1998 (No. 1998/30). This notification supplied the necessary form for national level reporting and instructions for its completion. The establishment of the system for verifying unofficial reports is currently underway at the Secretariat.

The Standing Committee further agreed that the IUCN/SSC should continue the work it has started to develop the second stage, a plan for the long-term, site-based monitoring of illegal killing (MIKE) and funds were committed from the CITES Trust Fund to support these actions. Since that time, IUCN/SSC has completed the site selection exercise, continued to refine the data collection protocols and the overall design of the system and begun the development of a full funding proposal for MIKE. The details of the proposed system and the preliminary estimated cost of its full implementation for Africa and Asia are summarised in this document. Estimated costs of the central technical co-ordination unit are provided.

The next step will be for the relevant range states, the CITES Secretariat, IUCN and TRAFFIC to agree on the final form of these international reporting and monitoring systems. The Secretariat will then report this agreement to the 41st meeting of the Standing Committee in February 1999.

3 Description of the proposed long term monitoring system (MIKE)

The long-term monitoring system of the illegal killing of elephants would be established under the auspices of CITES with technical assistance from IUCN/SSC. The goals of this system are to promote the on-going collection of data necessary to:

- determine real trends in illegal killing of elephants
- determine changes in these trends over time
- determine the causes of these changes over time, and
- to integrate appropriate analyses of such information with that of ETIS to assist decision-making by Range States and other Parties to CITES.

The analysis involved in such a system is complex and involves many factors, occurring at many levels and in many places. In spite of the difficulties associated with collecting the necessary data and conducting the types of analyses required, it is considered feasible through the establishment of a well-designed, site-specific, long-term monitoring system. The general characteristics of such a system are described in this document.

The proposed MIKE system is based predominantly on existing capacity within Range State management authorities, the memberships of the AfESG and AsESG and among NGO staff working in the field.

3.1 Required data sets

The system is designed to acquire, compile and process relevant information. The data collection efforts need, to the extent possible, to collect the required information in a systematic, standardised format (see Annex 2 and 3).

Data needs include, but may not be limited to:

- elephant population numbers and trends
- mortality rates
- law enforcement (search and deterrent) effort, in terms of budgets, staffing, vehicles and equipment
- other measurable, external factors including:
  - presence or recent cessation of civil strife in or near the site or in neighbouring countries
  - increasing levels of human activity (e.g. large-scale development projects or settlement schemes)
  - other illegal activity or trade in other illicit commodities
  - effectiveness of law enforcement effort and the judiciary
  - proximity of the site to international boundaries
  - illegal killing of elephants and other wildlife in nearby areas
  - extent of community involvement in conservation
- other qualitative or proxy data such as:
  - notable changes in elephant behaviour or distribution patterns

. numbers of poaching camps found within the site
. intelligence reports from the local area
. changes in the profile of illegal hunters.

The system's success will depend on regular counts of live elephants and/or carcasses in the selected sites (see Annex 3). Such counts will be carried out, on average, every two years to ensure up-to-date information for future meetings of the Conference of the Parties to CITES. Additional data on measures of search and deterrent efforts, external factors and other qualitative or proxy information will be collected more regularly to ensure that the questions posed by the Parties can be answered in a satisfactory manner.

3.2 Selection of sites

All data for MIKE will be collected on a site-specific level, rather than at a national level. This will ensure that all information used in the analyses, including survey data, measures of mortality, measures of search and deterrence effort and measures of other external factors, are closely associated with the specific area.

The process of selecting sites for MIKE implementation was overseen by the AfESG and AsESG and involved a number of steps. For Africa, a minimum of one and a maximum of three sites per Range State were proposed by members of the AfESG. For Asia, a minimum of one site per Range State was proposed. (For Cambodia, where the current status of elephants is unknown, no sites were proposed). These sites were then scored against a set of criteria designed to provide a balanced, representative sample across the continent (see Annex 4).

Proposed sites were scored against the following balancing criteria:

- sub-region
- forest and savannah
- high and low law enforcement effort
- inside and outside protected areas
- with and without recent or on-going civil strife in or around the site
- close to or distant from an international border
- availability of existing data prior to 1990
- relatively large elephant populations for the sub-region
- with and without a history of illegal killing in the area
- government co-operation
- long tenure of existing staff in key positions
- single agency control over site management
- involved in either CITES Decision 10.1, 10.2 or both; and
- varying levels of community involvement in conservation.

Following the scoring of the proposed sites, a transparent and impartial process for the final selection of sites was carried out by an independent team of statisticians. The proposed sites were numbered, to maintain their confidentiality, and then analysed on the basis of the balancing criteria. Complex statistical techniques were used to ensure that reasonable levels of precision are generated from the proposed sampling scheme.

The three scenarios on which MIKE is based cover three progressively more robust, yet representative samples across the range states.

As there are no previous data on the levels of variability within and between sites, it is difficult to determine the exact degree of precision that the system will provide. However, this precision will improve with time and continuous sampling. A conservative estimate of the power of the three scenarios at present is:

Scenario	Number of sites	Power of estimate
Scenario 1	23 sites	~ 90% change of detecting 55% change
Scenario 2	38 sites	~90% chance of detecting 43% change
Scenario 3	60 sites	~90% chance of detecting 33% change

Scenario 3, which provides approximately twice the precision of Scenario 1, is considered to be the favoured approach. Although a more precise estimation of changes in illegal killing may be desirable, a more extensive sampling scenario would be prohibitively expensive. A scenario that is more limited may preclude any reasonable ability to discern important changes or fully analyse the questions under consideration.

The actual location and individual identity of sites is subject to considerations of confidentiality, since it could defeat the purpose of the entire system for their identity to become widely known. In the worst case, poachers with access to this information could deliberately avoid the selected sites or otherwise skew the results of such a continent-wide overview. Wherever possible, the sampling design provides alternative sites, of equal validity, chosen from the overall group of proposed sites. However, it is important to note that choosing one of the alternative sites may disturb the overall representative balance of the sample. For example, changing - adding or deleting - a site from one sub-region would entail a re-balancing adjustment in sites from other sub-regions to preserve the objective and statistical integrity of the selection process.

3.3 Data collection and compilation

The process of collecting data on illegal killing in the field is complex and depends upon the type of site to be surveyed, additional types of data to be collected and on the presence of existing capability on the ground.

For example, establishing population sizes and trends in each site will require the entire spectrum of counting methods because the representative sample for Africa and Asia includes savannah, forest and mixed-habitat sites, of varying sizes and accessibility. For the purposes of this proposal, no assumptions have been made regarding the required number or availability of formal survey teams or the need to establish such teams where they may not yet exist. The cost of conducting the appropriate surveys at each site has simply been calculated at a regular frequency of every two years.

In some countries, for example Kenya, South Africa and Zimbabwe, well established and regular counts are carried out by the existing management authorities in a number of sites and these could provide contributions to MIKE. Such existing capacity is generally found in savannah sites using aerial counting methods. But in many sites, particularly those in forest habitats, counts will need to be arranged as required and teams assembled specifically for the purpose. In such cases, a locally based team may need to be established. In other

circumstances, it may be more practical to establish formal teams that could be shared among sites within a country and even between countries.

As the primary focus of MIKE is the sites from which data are to be collected, each site will require a nominated person, probably an existing employee of the government management authority or an NGO currently working at the site, to act as the MIKE liaison. This person, the MIKE data collection officer, will be responsible for the collection of all data, in a standardised format, for further compilation and transmission to the next level. These data will include the results of population surveys as well as regular monitoring data, such as search and deterrent effort, budgets, external factors and other qualitative or proxy information. The data collection officers will turn these data over to the next step of compilers for onward transmission to the central MIKE data processing unit. An average of 50% of the person's time has been assumed for work related to MIKE.

The data collection officers may also be involved in the logistics of the surveys every other year. Specifics of the role include:

- participating in surveys
- procuring of field equipment
- collection of all required data in a standardised format
- training of field assistants
- reporting of site survey results; and
- compiling data and liasing with national or sub-regional compilers

For countries with two or more sites, a national compiler may be required. This person would again be a staff member of the government management authority, a member of the AfESG/AsESG or an employee of a locally active NGO, not necessarily based at one of the MIKE sites. There will be a further need for one or more individuals to assist with the compilation of data at the sub-regional and regional (in the case of Asia) level for onward transmission and reporting to the central data processing unit of MIKE. At all of these levels, national, sub-regional and regional compilers, participation in MIKE might require up to 25% of their time. This is costed on a time-based consultancy or secondment.

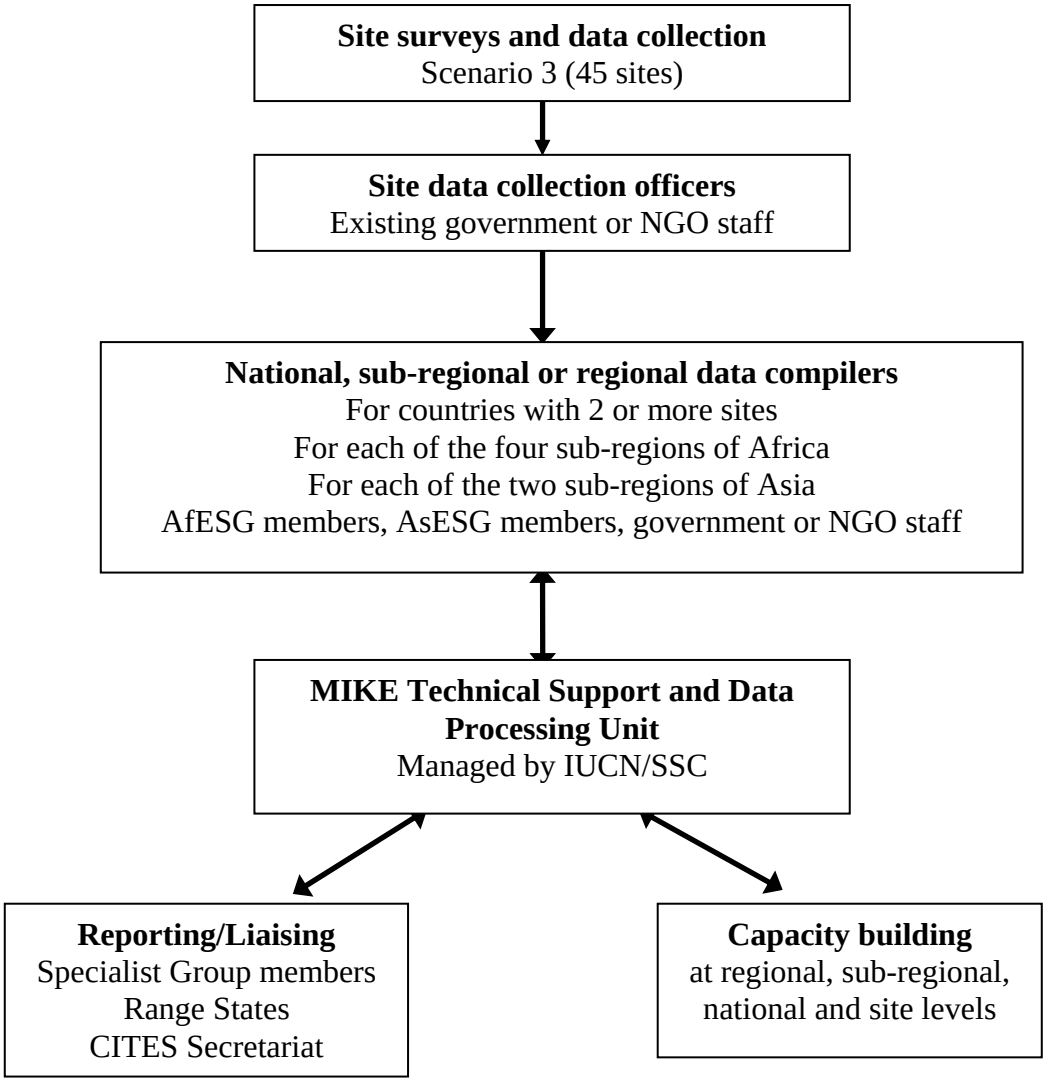
The national, sub-regional or regional compilers would take on the following functions:

- planning and designing national, sub-regional or regional data collection protocols
- advising and supervising MIKE data collection officers at the sites
- training of site staff including survey team leaders and members
- helping to co-ordinate and arrange site survey efforts
- compiling data for the country, sub-region or region
- forwarding data to the central data processing unit
- managing the budgets
- procuring of field and office equipment; and
- liasing with the central unit and the relevant Range States authorities.

The core of the system will be a central Technical Support and Data Processing Unit. The functions are described below but a key role is the provision of training and technical support to the data collectors and compilers mentioned above at regional, sub-regional, national and site levels. This unit would also provide overall co-ordination to the entire survey and data

collection process, as well as carrying out the reporting function for MIKE. The organisational structure is outlined in Figure 1, below.

Figure 1. The organisational structure of MIKE



3.4 Technical support and data processing unit

The establishment and implementation of MIKE will require IUCN/SSC to establish a special unit, in collaboration with the Secretariats of their AfESG and the AsESG, to co-ordinate and oversee the technical aspects of the development and operation of the long-term monitoring system. This would be a permanent technical support and data processing unit, based in a convenient location for ease of access to and communication with the regional, sub-regional, national compilers and the site-based officers involved in the data collection and compilation. Due to the long-standing presence of the AfESG Secretariat and the African Elephant Database, Nairobi has been proposed as the site for establishing this Unit.

The unit would be staffed as follows:

- Head of unit
- Information technologist
- Support assistant.

The functions of this unit would be to:

- co-ordinate the implementation of MIKE in Africa and Asia
- develop data collection and compilation protocols and information management procedures for data on illegal killing of elephants from a representative sample of sites throughout elephant Range States in Africa and Asia
- oversee statistical analysis and technical interpretation of data relating to illegal killing of elephants (including consultation with the AfESG and AsESG memberships)
- provide technical assistance and capacity building to Range States and others in the development of on-going monitoring programmes in the field, and for analytical capability at the national and site levels
- provide regular reports to CITES and participating countries as well as responding to official requests for information
- ensuring full integration with ETIS
- evaluate the MIKE system regularly; and
- recommend and implement changes and improvements, as required.

3.5 Capacity building

A vital component of the programme is to ensure that the Range States and site-based personnel possess the necessary skills to ensure the effectiveness, sustainability and, where possible, expansion of the MIKE system. For this reason, a programme of capacity building and training has been built into the system. This programme would be co-ordinated by the proposed Technical Support and Data Processing Unit, using a combination of their own resources and those of consulting experts.

The main thrust of the capacity building programme would be the development of training curricula and workshops to be held in each of the four sub-regions once a year for the compilers and site collection officers. A key element of this would be a 'training of trainers' approach designed to permit a cascade effect so that participants would be qualified to run their own workshops at the country or site level.

An important objective would be to ensure a consistent, standardised approach to data collection. In addition, a great deal of expertise is available regarding counting and survey methodologies and these skills need to be shared widely amongst the Range States. Providing technical advice, for example with regard to survey methods and logistics, would be an important function of the Technical Support and Data Processing Unit, quite separate from the formal training programme.

3.6 Integration of the Information from MIKE and ETIS

Data collected from MIKE would need to be integrated with the Elephant Trade and Information System (ETIS) managed by TRAFFIC. Similar methods of analysis should be used within each system, and it might be valuable to involve the same analytical experts in examining the data from each system. IUCN and TRAFFIC would work together in

identifying independent analytical experts, and developing methodologies to ensure that each exercise benefits as much as possible from shared understanding of the data and problems within each system. The final interpretation of what is happening to elephants and the trade over time should involve some interpretation of analytical efforts from each system. Any formal reports to the CITES Standing Committee or future Conferences of the Parties should include joint interpretation of the information from each system.

To ensure the integration and most efficient operation of the two systems, the responsibility for overseeing them, and for any joint output of analysis and interpretation rest with IUCN and TRAFFIC at their respective international Secretariats. Since TRAFFIC is formally a part of IUCN's Global Programme and there is already a close working relationship between the Secretariats on matters relating to CITES, this integration should be efficient and effective.

3.7 Reporting and auditing

Expected outputs of the illegal killing monitoring information system would include:

- CITES reports - regular and special reports to the CITES Secretariat and, as and when necessary, the CITES Standing Committee or the Conference of the Parties
- site or country reports - country-specific reports to the elephant Range States to assist them in understanding their own individual situation
- donor reports - regular reporting as required by donors, and
- liaison with TRAFFIC's ETIS.

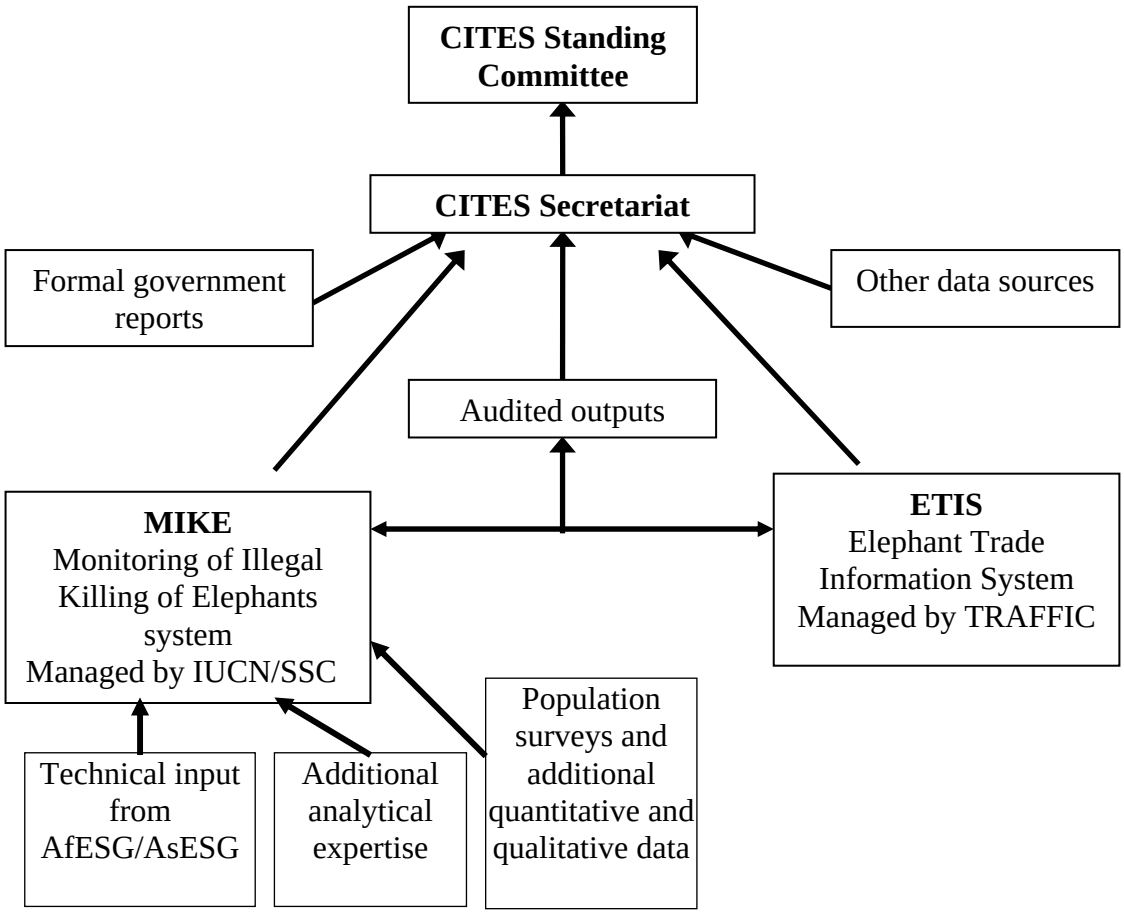
3.7.1 Reporting structure

The reporting structure for MIKE is laid out in Figure 2, below.

3.7.2 Independent audit

There is legitimate concern that vesting responsibility in the same organisations for developing both monitoring systems and for interpretation of the information gathered, risks incorporating a particular bias in the information presented to CITES for decision-making. While IUCN and TRAFFIC are regarded as the primary international organisations with both the breadth of expertise and perspective on issues relating to CITES and elephants necessary for taking on the responsibilities for these two systems, several steps might be taken to guarantee objectivity and transparency throughout the process, including the possibility of an independent external audit of the entire system.

Figure 2. The reporting structure of MIKE



4 Costing

A full analysis of costs is provided in Annex 5 and summarised below. The assumptions on which the current costings have been based are as follows.

4.1 Assumptions

The costs of the MIKE system have been derived under the major headings of:

1 set-up costs
2 population surveys
3 data collection and compilation
4 technical support and data processing, reporting and audit
5 capacity building.

4.1.1 Set-up costs

At the site and national level, costs assume existing office accommodation and furnishing. The provision of computing equipment and power supply (as needed) for all site data collection officers, national and sub-regional compilers and full set-up costs for the central data processing unit, including staff recruitment costs, have been included. Costs of outfitting survey teams are included in the population survey component.

4.1.2 Population surveys

It is intended that population surveys, either by ground or aerial methods, will be conducted every other year in the 45 MIKE sites in Africa and the 15 sites in Asia. Costs have been estimated according to the type of count, the area that must be covered and the designated sampling intensity to be applied.

For each scenario, the sites were categorised according to type (savannah or forest) and survey method (aerial sample, aerial total, ground, dung). For each survey method, a cost per square kilometre was built up from the appropriate cost elements such as staff costs, equipment, rations, fuel, aircraft or vehicle hire, number of transects surveyed, etc. The total field data collection costs therefore are based on the product of total transect survey length and survey cost per linear kilometre.

For sample counts in Africa, costs have been based on a sampling intensity of 21%, which is considered to give results of the highest confidence level (Said, *et al.* 1995) under conditions in Africa. Direct ground sample counts in Asia are based on sampling intensity of 30%, using techniques previously documented to census elephants in Asian habitats (Karanth and Sunquist, 1992; Varman and Sukumar, 1995), while dung counts in Asian sites are based on sampling intensity of 40% (Dawson and Dekker 1991; Varman *et al*, 1995).

This takes no account of logistical questions regarding the number of teams in the field, nor of the presence or otherwise of survey capability in any given location.

4.1.3 Data collection and compilation

No new staff appointments are assumed. Rather, the project would contract and finance existing government or NGO staff or members of the AfESG/AsESG to collect and compile the required data.

For Africa, at the site level, 50% of one person's time is assumed, and 25% at the national, sub-regional or regional (Asia) level. For the purpose of this proposal, costs have assumed to be uniform throughout the Africa region.

In Asia, one full-time staff person would be assigned as the site officer at each of the 15 sites as well as full time positions for national and sub-regional compilers

The costings have been calculated on the basis of the following human resource requirements.

	Africa	**Asia**
Number of data collection officers (on site):	45	15
Number of national compilers:	11	2
Number of sub-regional compilers:	4	2

A provision for team training has been included in the budget for Capacity Building.

4.1.4 Technical support, data processing and reporting

The costs of maintaining this unit were based on staff costs of three full time employees (assumed two expatriates recruited and one hired locally) plus typical office running costs in Nairobi, Kenya. Costs such as co-ordination, travel, attendance at meetings, report production and distribution, and external audit have also been included in this component.

4.1.5 Capacity building

The costs are based on six sub-regional workshops per year, employing a specialist consultant for up to one month each time, and up to 12 national or site-based workshops per year. In practice, it may be possible to run some of these workshops in conjunction with other scheduled meetings.

4.2 Annual cost estimates for three scenarios in Africa

Summaries for annual recurrent budgets for the three scenarios examined are shown below. A full breakdown of these budgets is provided in Annex 5. All figures are quoted in US$ unless otherwise specified.

TABLE 1. Estimated annual recurrent costs for sampling in Africa and Asia.

	For 60 sites
Population surveys	
- *survey/count expenses incl. staff costs, equipment, provisions, fuel aircraft charges, etc.*	1,153,986
Data collection and compilation	
- *staff cost contributions/consultancy fees for site officers and compilers, equipment, communication and reporting*	713,909
Technical support and data processing unit	
- *staff costs, office running costs, report production and distribution, travel and meetings, external audit*	306,475
Capacity building	
- *consultancy fees and travel, workshop expenses, training materials, participants' travel and expenses*	179,228
Total (US $$)	**2,353,597**

4.3 Estimated overall costs for preferred Scenario 3

As Scenario 3 provides the best level of precision, at a relatively advantageous cost, in addressing the requirements of the Parties (see Annex 1), the following summary costs are presented for this scenario only. Table 2 outlines fixed, one-off set-up costs and annual recurrent costs for operations in Years 1-6. Annual recurrent expenditure increases have been assumed at an average of 5% per annum.

TABLE 2. Budget for Years 1 through 6, including set-up costs.

Set-up costs	Annual recurrent costs		Refit costs	Total system costs
	Yr. 1	Yrs. 2-6	Yr. 3/4	
742,383	2,353,597	9,930,753	334,814	13,361,547

Table 3, below, provides a breakdown of the expenditure in a survey year by sub-region for Scenario 3. The percentage breakdown for each sub-region includes survey costs, equipment costs, data collection and compilation costs, technical support and data processing unit/reporting costs as well as capacity building.

TABLE 3.
Breakdown of annual recurrent expenditure for Scenario 3, by sub-region for Year 1.

Sub-region	US$	Percentage
East Africa	427,169	18
Central Africa	462,543	20
West Africa	557,004	24
Southern Africa	405,569	17
South Asia	269,167	11
Southeast Asia	232,144	10
Total	**2,353,597**	

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Annex 1: Relevant Decisions and Resolutions from CITES COP 10

CITES Decisions 10.1 & 10.2
CITES Resolution Conf. 10.10

10.1 Conditions for the resumption of trade in African elephant ivory from populations transferred to Appendix II at the 10th meeting of the Conference of the Parties

Part A
Trade in raw ivory shall not resume unless:

a) deficiencies identified by the CITES Panel of Experts (established pursuant to Resolution Conf. 7.9, replaced by Resolution Conf. 10.9) in enforcement and control measures have been remedied;
b) the fulfilment of the conditions in this Decision has been verified by the CITES Secretariat in consultation with the African regional representatives on the Standing Committee, their alternates and other experts as appropriate;
c) the Standing Committee has agreed that all of the conditions in this Decision have been met;
d) the reservations entered by the range States[1] with regard to the transfer of the African elephant to Appendix I were withdrawn by these range States prior to the entry into force of the transfer to Appendix II;
e) the relevant range States[1] support and commit themselves to international co-operation in law enforcement through such mechanisms as the Lusaka Agreement;
f) the relevant range States[1] have strengthened and/or established mechanisms to reinvest trade revenues into elephant conservation;
g) the Standing Committee has agreed to a mechanism to halt trade and immediately re-transfer to Appendix I populations that have been transferred to Appendix II[2] , in the event of non-compliance with the conditions in this Decision or of the escalation of illegal hunting of elephants and/or trade in elephant products owing to the resumption of legal trade;
h) all other precautionary undertakings by the relevant range States in the supporting statements to the proposals adopted at the 10th meeting of the Conference of the Parties have been complied with; and
i) the relevant range States[1] , the CITES Secretariat, TRAFFIC International and any other approved party agree to:
    i) an international system for reporting and monitoring legal and illegal international trade, through an international database in the CITES Secretariat and TRAFFIC International; and
    ii) an international system for reporting and monitoring illegal trade and illegal hunting within or between elephant range States, through an international database in the CITES Secretariat, with support from TRAFFIC International and institutions such as the IUCN/SSC African Elephant Specialist Group and the Lusaka Agreement.

Part B
a) If all of the conditions in this Decision are met, the Standing Committee shall make available its evaluation of legal and illegal trade and legal offtake pursuant to the implementation of Resolution Conf. 10.10 as soon as possible after the experimental trade has taken place.

Notes from the Secretariat
[1] This is understood to mean the States whose populations of African elephant have been transferred to Appendix II [as in paragraph h)].

[2] This decision is in conflict with the text of the Convention. The mechanism for the transfer of species (including populations) from Appendix II to Appendix I is specified in Article XV of the Convention. Any such transfer can be done only if it is proposed by a Party and is agreed by the Conference of the Parties, either at a regular meeting or by the postal procedure, and will enter into force only 90 days after the proposal is adopted by the Conference. An appropriate action for the Standing Committee would be to request a Party (such as the Depositary Government) to submit the required proposal.

b) The Standing Committee shall identify, in co-operation with the range States, any negative impacts of this conditional resumption of trade and determine and propose corrective measures.

10.2. Conditions for the disposal of ivory stocks and generating resources for conservation in African elephant range States

a) The African elephant range States recognise:
   i) the threats that stockpiles pose to sustainable legal trade;
   ii) that stockpiles are a vital economic resource for them;
   iii) that various funding commitments were made by donor countries and agencies to offset the loss of assets in interest of unifying these States regarding the inclusion of African elephant populations in Appendix I;
   iv) the significance of channelling such assets from ivory into improving conservation and community-based conservation and development programmes;
   v) the failure of donors to fund elephant conservation action plans drawn up by the range States at the urging of donor countries and conservation organizations; and
   vi) that, at its ninth meeting, the Conference of the Parties directed the Standing Committee to review the issue of stockpiles and to report back at the 10th meeting.

b) Accordingly, the African elephant range States agree that all revenues from any purchase of stockpiles by donor countries and organizations will be deposited in and managed through conservation trust funds, and that:
   i) such funds shall be managed by Boards of Trustees (such as representatives of governments, donors, the CITES Secretariat, etc.) set up, as appropriate, in each range State, which would direct the proceeds into enhanced conservation, monitoring, capacity building and local community-based programmes; and
   ii) these funds must have a positive rather than harmful influence on elephant conservation.

c) It is understood that this decision provides for a one-off purchase for non-commercial purposes of government stocks declared by African elephant range States to the CITES Secretariat within the 90-day period before the transfer to Appendix II of certain populations of the African elephant takes effect. The ivory stocks declared should be marked in accordance with the ivory marking system approved by the Conference of the Parties in Resolution Conf. 10.10. In addition, the source of ivory stocks should be given. The stocks of ivory should be consolidated in a pre-determined number of locations. An independent audit of any declared stocks shall be undertaken under the auspices of TRAFFIC International, in co-operation with the CITES Secretariat.
d) The African elephant range States that have not yet been able to register their ivory stocks and develop adequate controls over ivory stocks require priority assistance from donor countries to establish a level of conservation management conducive to the long-term survival of the African elephant.
e) The African elephant range States therefore urge that this matter be acted upon urgently since any delays will result in illegal trade and the premature opening of ivory trade in non-proponent range States.
f) This mechanism only applies to those range States wishing to dispose of ivory stocks and agreeing to and participating in:
   i) an international system for reporting and monitoring legal and illegal international trade, through an international database in the CITES Secretariat and TRAFFIC International; and
   ii) an international system for reporting and monitoring illegal trade and illegal hunting within or between elephant range States, through an international database in the CITES Secretariat, with support from TRAFFIC International and institutions such as the IUCN/SSC African Elephant Specialist Group and the Lusaka Agreement.

Resolution Conf. 10.10 Trade in Elephant Specimens

RECALLING Resolution Conf. 9.16, adopted by the Conference of the Parties at its ninth meeting (Fort Lauderdale, 1994);
NOTING that the African elephant *Loxodonta africana* was transferred from Appendix II to Appendix I at the seventh meeting of the Conference of the Parties (Lausanne, 1989) but some populations were transferred back to Appendix II, under certain conditions, at the 10th meeting (Harare, 1997);

THE CONFERENCE OF THE PARTIES TO THE CONVENTION

Regarding definitions

AGREES that:

a) the term 'raw ivory' include all whole elephant tusks, polished or unpolished and in any form whatsoever, and all elephant ivory in cut pieces, polished or unpolished and howsoever changed from its original form, except for 'worked ivory'; and

b) 'worked ivory' be considered readily recognizable and that this term shall cover all items made of ivory for jewellery, adornment, art, utility or musical instruments (but not including whole tusks in any form, except where the whole surface has been carved), provided that such items are clearly recognizable as such and in forms requiring no further carving, crafting or manufacture to effect their purpose;

Regarding marking

RECOMMENDS that whole tusks of any size, and cut pieces of ivory that are both 20 cm or more in length and one kilogram or more in weight, be marked by means of punch-dies or, where this is not practicable, with indelible ink, using the following formula: country-of-origin two-letter ISO code, serial number for the year in question/the last two digits of the year and the weight in kilograms (e.g. KE 127/9714). This number is to be placed at the "lip mark", in the case of whole tusks, and highlighted with a flash of colour;

Regarding control of internal ivory trade

RECOMMENDS to those Parties in whose jurisdiction there is an ivory carving industry that is not yet structured, organized or controlled and to those Parties designated as ivory importing countries, that comprehensive internal legislative, regulatory and enforcement measures be adopted to:

a) register or license all importers, manufacturers, wholesalers and retailers dealing in raw, semi-worked or worked ivory products; and

b) introduce recording and inspection procedures to enable the Management Authority and other appropriate government agencies to monitor the flow of ivory within the State, particularly by means of:

   i) compulsory trade controls over raw ivory; and

   ii) a comprehensive and demonstrably effective reporting and enforcement system for worked ivory;

Regarding monitoring of illegal hunting of and trade in elephant specimens

AGREES that:

a) a comprehensive, international monitoring system shall be established under the supervision and direction of the Standing Committee with the objectives of:

   i) measuring and recording current levels and trends of illegal hunting and trade in ivory in African and Asian range States, and in trade entrepots;

   ii) assessing whether and to what extent observed trends are a result of changes in the listing of elephant populations in the CITES appendices and/or the resumption of legal international trade in ivory; and

   iii) establishing an information base to support the making of decisions on appropiate remedial action in the event of any problems with compliance or potential detriment to the species; and

b) this monitoring system shall be in accordance with the framework outlined in Annex 1 for monitoring of illegal trade in ivory and other elephant specimens and in Annex 2 for monitoring of illegal hunting in elephant range States;

Regarding assistance to elephant range States

RECOMMENDS that Parties assist range States to improve their capacity to manage and conserve their elephant populations through improved law enforcement, surveys and monitoring of wild populations;

Regarding quotas for and trade in raw ivory

RECOMMENDS that:

a) each State that has a population of African elephants and wishes to authorize export of raw ivory establish, as part of its management of the population, an annual export quota for raw ivory expressed as a maximum number of tusks;

b) each export quota be communicated to the CITES Secretariat in writing by 31 December for the next calendar year;

c) Parties ensure that significant amounts of confiscated ivory are notified separately to the Secretariat and are not incorporated in quota submissions;

d) the CITES Secretariat assist in the implementation of the quota system by: reviewing information submitted on each quota, together

with any information received about the status of the population in question; discussing any concern with the relevant State; and, if there is no cause for concern, communicating the current quota to the Parties not later than 31 January of each year;

e) the Secretariat maintain its Ivory Trade Control Procedures Manual and that the Parties follow the procedures for quota submissions documented in this Manual;

f) if the quota is not submitted by the deadline, the State in question have a zero quota until such time as it communicates its quota in writing to the Secretariat and the Secretariat in turn notifies the Parties;

g) no export, re-export or import of raw ivory be authorized unless it is marked in accordance with this Resolution or in accordance with the Secretariat Manual;

h) Parties accept raw ivory from producer States only where the export permit was issued in a year for which a quota for the State in question has been communicated to the Parties in accordance with this Resolution;

i) Parties may accept raw ivory from a producer non-party State only if a quota for that State has been reviewed by the Secretariat and communicated to the Parties and if the Secretariat has received from the State an annual report on its ivory trade, and if the State meets all the other conditions in this Resolution and Article X of the Convention (as interpreted by Resolutions of the Conference of the Parties);

j) in compiling their annual reports, producer party and non-party States that have authorized the export of raw ivory relate such exports to their quota for any given year, providing the Secretariat with as much relevant information as possible, including, as a minimum, the number of whole or substantially whole tusks and their individual weights and identification numbers;

k) all Parties maintain an inventory of the stock of raw ivory held within their territory, and that they inform the Secretariat of the level of this stock each year before 31 January, indicating the source of the ivory; and

l) Parties assist the Secretariat to ensure that the duties set out in this Resolution are carried out;

Regarding resources required for implementation of this Resolution

APPEALS to all governments, non-governmental conservation organizations and other appropriate agencies to provide funds for the resources required in the Secretariat and producer States to ensure that the recommendations in this Resolution can be effectively implemented; and

REPEALS Resolution Conf. 9.16 (Fort Lauderdale, 1994) – Trade in African Elephant Ivory.

Annex 1

Monitoring of Illegal Trade in Ivory and Other Elephant Specimens

1. Introduction

In order to monitor and record levels of illegal trade in ivory and other elephant specimens on a global basis, there is a need for a system to collect and compile law enforcement data on seizures and confiscations. The Conference of the Parties recognizes the Bad Ivory Database System (BIDS) established by TRAFFIC for this purpose in 1992. Currently, BIDS contains the details of more than 4,000 ivory seizures, representing nearly 100 tonnes of ivory from over 40 countries around the world since 1989.

The Conference of the Parties further recognizes that BIDS has been useful in assessing ivory trade developments since its seventh meeting (Lausanne, 1989). The African Elephant Range State Dialogue Meeting (Dakar, 1996) agreed that illegal trade in ivory is a concern and improvements in enforcement and management capacity should be a priority for all African elephant range States. It also agreed that all CITES Parties should provide information about ivory seizures to TRAFFIC for inclusion in its database.

Although further development and refinement are necessary, BIDS is designated as the appropriate instrument for monitoring the pattern and measuring the scale of illegal trade in ivory and other elephant specimens.

2. Scope

BIDS will include the details of law enforcement records for seizures or confiscations of elephant ivory and other elephant specimens which have occurred anywhere in the world since 1989.

3. Methods

Data and information on illegal trade in elephant ivory and other elephant specimens will be collected by TRAFFIC using a refined version of the existing BIDS. In this regard, a standardized methodology for the collection of data will be developed, including, but not limited to, information on:

- source of information
- date of seizure
- type of transaction
- country of seizure
- country of origin
- country of export
- country of destination/import
- type of ivory and quantity
- mode of transport
- *modus operandi*
- profile of offenders/suspects
- status of cases in the courts
- law enforcement effort.

A data collection format will be designed by TRAFFIC and circulated to all Parties by the CITES Secretariat within 90 days of this Resolution taking effect.

4. Data collection and compilation

BIDS will be managed and co-ordinated by TRAFFIC from an appropriate location in Africa.

All Parties should provide information on seizures and confiscations of ivory or other elephant specimens in the prescribed format to TRAFFIC within 90 days of their occurrence. In addition, law enforcement agencies in States not-party are also requested to provide such information.

TRAFFIC will oversee collection of data, ensure data quality and consistency, and provide training in data collection and information management techniques to designated officials around the world as appropriate.

5. Data analysis and interpretation

The analysis and interpretation of data will be co-ordinated by TRAFFIC in association with the CITES Secretariat and institutions involved with monitoring elephant poaching (see Annex 2).

6. Reporting

TRAFFIC will produce a comprehensive report to each meeting of the Conference of the Parties.

7. Intersessional remedial action

In the event that there is a need for urgent intersessional action, TRAFFIC will report to the Standing Committee via the Secretariat as appropriate.

8. Funding

A funding mechanism will be established to ensure that BIDS is fully operational.

Monitoring of Illegal Hunting in Elephant Range States

1. Introduction

In order to address the concerns of many elephant range States, it is necessary to establish a system through which the impact of CITES decisions with respect to elephants and trade in elephant specimens can be measured. Of primary importance is the establishment of a simple system of international reporting of incidents of illegal hunting as a baseline against which changes in trends can be detected.

It is recognized that such measurement must consist of two elements. The first of these is the monitoring of parameters relevant to the issue, such as the pattern and scale of illegal killing, the pattern and scale of illegal trade in ivory, the effort and resources being applied to detection and/or prevention and the monetary value of illegally traded ivory, as well as other factors that might affect these parameters, such as civil strife, the flow of illegal arms and ammunition, loss of habitat and drought.

The second element is the determination of whether or noth there is a causal relationship between changes in these parameters and the decisions of the Conference of the Parties with regard to elephants.

The overall aim is to build institutional capacity within the range States for the long-term management of their elephant populations.

2. Scope and methodology

The monitoring system will include elephant range States in both Africa and Asia and trade entrepots.

It will be based on a standardized methodology for the reporting of illegal hunting by CITES Management Authorities in range States and for monitoring in specific sites or areas. A database and a standard reporting protocol will be established by the CITES Secretariat in consultation with IUCN/SSC and TRAFFIC, for approval by the Standing Committee.

Sites will be selected on the basis of representative sampling (since it is neither possible nor practical to cover all range States) and will include a variety of habitat types, geographical regions and protected and non-protected areas. The sites for inclusion in the system will be selected through the range State representation within the IUCN/SSC African Elephant Specialist Group (AfESG) and the Asian Elephant Specialist Group (AsESG).

For countries wishing to include in the monitoring system sites other than the selected ones, it will be possible and desirable to contribute data voluntarily on additional sites.

3. Data collection and compilation

Data collection will cover the following topics:

- elephant population data/trends
- incidence and patterns of illegal hunting
- measures of the effort and resources employed in detection and prevention of illegal hunting and trade.

Data and information on illegal trade in ivory will be collected by TRAFFIC using a refined version of their existing BIDS (Bad Ivory Database System) (see Annex 1).

The CITES Secretariat will request/sub-contract technical support from AfESG and AsESG to:

a) select sites for monitoring as representative samples;

b) develop a standardized methodology for data collection analysis;

c) provide training to designated officials in countries with selected sites and to CITES Management Authorities of elephant range States;

d) collate and process all data and information from all sources identified; and

e) provide a report to the CITES Secretariat for transmission to the Standing Committee and Parties to CITES.

4. Funding

Substantial funding will be required for the above activities.

Annex 2: Data requirements

Population numbers and trends

It will be necessary to have reliable and repeated updates. This information should be collected and analysed in accordance with criteria developed by AfESG and AsESG. Any population numbers to be used in such an analysis must be collected within carefully defined areas that should, wherever possible, be identical to the areas in which mortality data are collected. Due to the possible long-term effects of poaching on elephant population dynamics, data on population age and sex structure should also be collected. This is especially true for Asian elephants since only males carry ivory .

Mortality rates

Reliable measures of elephant mortality from illegal killing can only be derived if there is some measure of the effort put into searching for elephant carcasses. This can be accomplished using standardised measures of carcasses found per unit of searching time, carcasses per live elephant or carcasses per unit area. To the extent possible, the search rate should represent an adequate coverage of the area and not be comprised of repeated and saturated searching of the same area.

There are four broad categories of data collection on elephant mortality:

- carcass counts or ratios from aerial surveys
- carcass counts from ground surveys corrected for effort
- total number of elephant carcasses reported and
- proxy data.

While the first two categories can, in principle, provide unbiased estimates, the latter two cannot and, therefore, must be considered qualitative but admissible information. Proxy data are indirect measures of illegal hunting that can act as surrogates for undetected carcasses in an area.

Carcass counts from aerial surveys

Techniques for deriving carcass ratios from aerial surveys are well established. However, the skill and training level of observers and the type of survey may affect reliable sighting of elephant carcasses from the air. As a result, carcass ratios can only be reliably used for comparison within and between sites if the methodology remains constant. In addition, because of the relatively low detection rate of carcasses from the air, this method is only likely to pick up very substantial changes in rates of illegal killing. Likewise, the technique cannot be used in forested areas, where data on illegal killing are most deficient. It may be possible to monitor individual forest clearings, where poaching incidents seem to concentrate, from the air in a systematic manner but these techniques have yet to be developed.

Carcass counts from ground surveys

The most useful and unbiased estimates of elephant mortality have come from a small number of detailed, long-term studies relying on detection of elephant carcasses by foot patrols. Provided patrols do not return to areas already covered over a short-time scale (i.e. double counting), then there should be a linear relationship between the number of carcasses reported

and the true number of carcasses in the area. However, in order to use these carcass counts in an analysis they must be corrected for the effort put into searching for them. The most meaningful measure of may be obtained by measuring the number of carcasses per distance covered by patrols.

Other methods may be used as less direct measures of the same thing. These include: the number of individuals involved in searching per unit area; the expenditure per unit area or the effective time spent patrolling per unit area or an accurately defined measure of the time spent on intelligence investigations leading to the sighting, or interception of carcasses within a given site.

Concern has been expressed about the effectiveness of these techniques in forest conditions. While carcasses in savannahs may be detected from distances of over a kilometre on the ground, detection distances in many forested areas are less than 50m. Thus, with a similar carcass density, one would get much lower carcass counts in forests compared to savannas. Therefore, in order to get sufficient data, forest patrols would need to cover long distances to sample large enough areas. While forest monitoring programmes may adopt reconnaissance surveys, rather than detailed transect surveys, to more efficiently and effectively search the area, there may be more benefit to tracking population trends (i.e. changes in changes in indices of numbers of live animals) rather than carcass numbers.

Total number of carcasses/incidents reported

Most reporting on elephant mortality at both national and site level currently consists of a rough compilation of illegal killing incidents uncorrected for search or detection effort. Such information is difficult to analyse and may result in misleading or incorrect interpretation. For example, a breakdown in law enforcement (i.e. searching effort on the ground) may lead to an increase in illegal killing levels but a reduction in detection and reporting or, conversely, an increase in law enforcement and detection efficiency may lead to an apparent, but false, increase in measures of illegal killing. Incident reporting at a national level is dependent on good communication between staff of the national wildlife authority at local and national levels, as well as with other law-enforcement agencies. A clearly defined scheme to validate and rank such data by quality and reliability will need to be developed if it is to be used in any meaningful assessment of illegal killing trends.

Measures of search and deterrent effort

Several studies have demonstrated that one of the most important factors determining levels of illegal killing is the amount of effort devoted to law enforcement. This effort can be measured either in terms of staffing levels and/or budgets.

Staffing levels

Measures of staffing levels must be site-specific and, to the extent possible, directly related to the area where elephant population numbers and elephant mortality rates are also being measured over time. Although some staff involved in law enforcement may be stationed permanently outside the area in question, these should be excluded since it would be too complicated to assess the proportion of their time spent in a particular area or to apportion it in any meaningful way. Instead, there should be a yes/no category for presence of a centrally located, national-level specialised wildlife law enforcement unit (e.g. a strike force, special operations branch or anti-poaching unit) and/or a specialised wildlife intelligence unit.

1. *Total personnel numbers*

   Total staff should include the entire staff of the government wildlife management authority based within and working at the site.

2. *Total search and deterrent (law-enforcement) personnel numbers*

   For the purpose of determining the number of individuals actually on-the-ground who could be directly or indirectly performing a search and/or deterrent function in a specific site location, it is necessary to include several categories of government and non-government personnel.

   i) Government field staff

   Government field staff include: specialist anti-poaching personnel, armed game scouts/rangers and officers who may take part in interceptions, unarmed staff (including scouts, drivers and government research staff) who patrol and may contribute to detection and deterrence, and intelligence staff (including underground agents and informants). Staff excluded form the field category include: direct support staff such as mechanics and radio operators, and indirect support staff such as clerks, cleaners, secretaries, gate-keepers and casual labourers.

   ii) Non-government field staff

   Non-government field staff include: community game guards, field-based conservation NGO staff, independent researchers and field-based employees working within hunting concessions (including hunters, scouts, trackers, gun-bearers and drivers).

Budget

1 *National level*

Budget information requested at the national level would be in two categories:

i) Total recurrent costs for the primary governmental conservation agency. In most cases this would be the national wildlife management authority. This budget may include donor funding that passes through the conservation agency, though this should be specified.

ii) Other sources of government agency funding contributing to national conservation efforts. This may have to be estimated where another agency, such as police, army, or forest department has a specific, field-based conservation programme with law-enforcement implications. Donor contributions to recurrent budgets would also be included here but should be specified.

2 *Site-specific level*

Budget information needed at a site-specific level, on an annual basis, would include the following total recurrent expenditure for the site in question, total salary costs for total personnel, total salary costs for search and deterrent personnel, number of functioning (roadworthy) vehicles, bonuses and incentives (e.g. for capture of illegal hunters, recovery of ivory), and law-enforcement expenditure, excluding bonuses and incentives.

The salary costs should be calculated for all government field staff listed above. Recurrent costs for law enforcement expenditure at a site level should include field allowances, housing allowances, personal equipment (e.g. uniforms, tents, sleeping bags), funds for vehicles/aircraft and running costs for vehicles/aircraft. While actual expenditure budget information is preferred, if it is not available, allocation budgets may have to be used.

External factors

While difficult to quantify, it is clear that there are many external factors operating on the African and Asian continents that may have a direct impact on the illegal killing of elephants. Therefore, there must be some attempt to measure these factors and to integrate them into any assessment of causality of trends in illegal killing or changes in these trends. These factors can become quantifiable variables by establishing relative scales of measurement or simple presence/absence records for a specific site. These external factors may include, but are not limited to:

1 *Civil strife*
The presence or recent cessation of civil strife near or in site or in a neighbouring country is inevitably linked to a rise in general lawlessness. This may be accompanied by an increase in the availability of arms and ammunition or the establishment of large numbers of refugees within or near the site accompanied by a significant rise in the illegal use of the resources within. Elephants are particularly susceptible to illegal hunting under such conditions.

2 *Increasing levels of human activity*
Development activities, such as large-scale timber extraction or the construction of roads and dams, are often accompanied by increased human settlement by both nationals and foreign individuals employed by or associated with these activities. Increases in human population densities at or near the site may increase the potential for and rate of illegal off-take of elephants within the site.

3 *Effectiveness of law enforcement effort and the judiciary*
In countries where law enforcement and the judiciary are weak, the chances of detection and capture as well as the likelihood and severity of punishment if apprehended are generally low. In such countries, there may be a greater degree of lawlessness and this may be associated with many illegal activities, including the killing of elephants for their ivory.

4 *Levels of other criminal activity*
It is believe that illegal ivory changes hands in much the same way as other contraband commodities. Therefore, the presence of individuals dealing in other contraband commodities near the site could stimulate illegal killing in several ways. First, the existence of an easy trade route already established for other commodities makes ivory trafficking relatively easy and, second, the consequences of a lull in the trade of other contraband commodities could result in an increased pressure for ivory.

5 *Spread of poaching*
Heavy illegal killing taking place in neighbouring areas or countries may provide an early warning sign within the site in question. Historically, elephant killing has spread from one area to the next as elephant populations are depleted by illegal off-take.

6 Proximity to international boundaries
Sites located immediately adjacent to international boundaries are at greater risk to illegal incursions of all sorts, including elephant hunting. Such sites may be particularly prone to cross-border hunting where individuals strike within the site and then retreat across

international boundaries making it difficult for wildlife management authorities or police to pursue.

7 Extent of community involvement in conservation
One potentially positive external factor is the relative involvement of local communities in conservation efforts relating to the site. As beneficiaries of revenues or other benefits derived from the site and active participants in community conservation initiatives, local communities may act as a powerful deterrent to illegal activities (including illegal elephant hunting).

Qualitative or proxy data

Even where carcasses are not directly counted, there may be other qualitative sources of information which indicate a change in rates of illegal killing. These may include but are not limited to:

- changes in the profile of illegal hunters (e.g. use of automatic weapons vs. home-made weapons, or a change from local illegal hunters to ones from other countries)
- numbers of poaching camps found within the site
- behaviour of elephants within the site (e.g. changes in their distribution patterns from the norm or obvious changes in their response to human proximity), or
- intelligence reports regarding the arrival of known criminals, inquiries in the local communities or market places about the availability of ivory or reports of planned poaching raids within the site.

Draft standard data collection form and completion instructions

A draft of the standardised data collection form, together with notes for completion, is given on the following pages.

Monitoring of Illegal Killing of Elephants
Elephant Mortality Site Data

Data Collection Form

Section A: General information

1. Name and address of respondent _____
   (i) _____
   (ii) _____
   (iii) _____
   (iv)_____
   (v) _____
2. Reporting period covered (dd/mm/yy) start ___/___/___ end ___/___/___
3. Location of site
   _____
   _____
4. Geographical co-ordinates
   a) Reference point: _____
   b) Longitude: _____ Latitude: _____
5. Boundaries: Reference point: _____
   i) Longitude: _____ Latitude: _____
   ii) Reference point: _____
   iii) Longitude: _____ Latitude: _____
   iv) Reference point: _____
   v) Longitude: _____ Latitude: _____
   vi) Reference point: _____
   vii) Longitude: _____ Latitude: _____
   6. Please continue on a separate sheet if necessary and possible.
   Please attach a map of the site, with the boundary line clearly marked.
7. Size of area _____km^2
8. Land use within and adjacent to the site. Rank in order of predominance.

Land use type	Within site	Adjacent to site
protected area		
CBNRM		
extensive pastoralism		
extensive subsistence agriculture		
intensive pastoralism		
intensive agriculture		
settled area		

Section B: Population numbers and trends

1. Is the site for which mortality data being reported the same as an input zone for the African elephant database? □ yes □ no
   If no, fill in attached AED form.

Section C: Method of collection of mortality information

1. What are the main ways that dead elephants are located? Tick one or more of the boxes.
   a) During aerial surveys. □ Go to Section D
   b) During regular, routine foot patrols. □ Go to section E.
   c) During opportunistic observations by foot, aircraft, or vehicle, from reports by members of the public/staff or tourists, or some combination of these techniques. □ Go to section F.

Section D: Carcass ratios from aerial surveys

If the aerial survey, is a total count, then go to 1, if a sample count, then go to 2.

1. Total count
   a) Starting date of survey (dd/mm/yy)? ___/___/___
   b) Area covered _____km^2
   c) Total hours flown _____
   d) Total number of carcasses observed: _____
   e) Number in age categories:
      i) fresh _____
      ii) recent _____
      iii) old _____
      iv) very old _____
   f) Total number of live elephants observed _____

If there was more than one total count conducted during the reporting period, please report the same data as in D.1 above on a separate sheet(s) and attach to this form

2. Sample count
   a) Starting date of survey (dd/mm/yy) ___/___/___
   b) Area covered _____km^2
   c) Transect sampling technique □ systematic □ random
   d) Total length of transects _____
   e) Average transect width _____
   f) Estimates of numbers: Note - Please supply raw data in addition to numbers provided below.
      i) Calculation method: □ Jolly I □ Jolly II □ other: specify _____
      ii) Estimated total number of carcasses
      _____+/- _____(95% confidence limits, if available)
      iii) Estimated number of fresh and recent carcasses.
      _____+/- _____(95% confidence limits)
      iv) Estimated number of live elephants.
      _____+/- _____(95% confidence limits)

If there was more than one sample count conducted during the reporting period, please report the same data as in D.1 above on a separate sheet(s) and attach to this form

Section E: Carcass counts from regular ground patrols

1. Measures of numbers of dead elephants
   a) Total number of carcasses recorded in reporting period _____
   b) Number in age categories:
      i) fresh _____
      ii) recent _____
      iii) old _____
      i) very old _____
   c) Cause of death: total number poached _____
      natural causes _____
      unknown _____
   d) Number from which tusks have been hacked _____
      from which tusks have been pulled _____
      found with tusks intact _____
2. Measures of effort put into patrolling

   Fill in one or both of these measures.
   a) Total number of effective patrol days _____days
   b) Total distance covered by patrols _____km
   c) Area covered by patrols _____km^2

Section F: Opportunistic reports of mortality

1. Total number of recent dead elephants recorded _____
2. Number from which tusks have been hacked _____
3. Number from which tusks have been pulled _____
4. Number found with tusks intact _____
5. Sources of data and their trends:

Data source (units of effort)	*Change since last reporting period* (+, =, -)
a. Opportunistic ground patrols (effective days)	
b. Opportunistic air patrols (patrol hours)	
c. Vehicle patrols (total kilometres patrolled)	
d. Staff on general duties (no. of active staff – see H.1.a)	
e. Local residents (incentives for conservation)	
f. Tourists, safari hunters (number)	
g. Researchers (number)	
h. Intelligence operations (number)	

6. Who reports the most carcasses? Score on a scale of 1-8.
   a) Opportunistic ground patrols _____
   b) Air patrols _____
   c) Vehicle patrols _____
   d) Staff carrying out general duties _____
   e) Local residents _____
   f) Tourists, safari hunters _____
   g) Researchers _____
   h) Intelligence operations _____

Section G: Qualitative or proxy data

Indicate if any of the following have occurred in the site during the current reporting period, and give details.

1. Changes in the profile of illegal hunters

Information on illegal killers	*Yes/no*	*Change since last reporting period* (+, =, -)
a. number of illegal killers (if no, go to G.2)		
b. use of automatic weapons		
c. use of home-made weapons		
d. number of local people killing illegally		
e. number of citizens from outside site killing illegally		
f. number of foreigners from killing illegally		
g. number of poaching camps		

2. Changes in elephant behaviour

Information on elephant behaviour	*Yes/no*	*Change since last reporting period* (+, =, -)
a. change in distribution pattern (if no, go to b)		
i. dispersed across site		
ii. concentrated in few areas within site		
b. change in group sizes (if no, go to c)		
i. forming small herds		
ii. forming large herds		
c. change in response to people (if no go to 3.)		
i. nervous when hearing voices		
ii. nervous when hearing vehicles		

3. Changes in frequency of intelligence reports

Information in intelligence reports on:	*Yes/no*	*Change since last reporting period* (+, =, -)
a. arrivals of known criminals within or near the site		
b. ivory available in local villages of markets		
c. planned raids within the site		

Section H: Staffing levels

List numbers of staff under the following headings

Personnel type	Number
1. Wildlife authority staff	
a) Armed game scouts/rangers	
b) Unarmed game scouts/rangers involved in patrolling	
c) Other field staff	
d) strike force/special operation unit operating full- or part-time	
e) specialist intelligence officers operating full- or part-time	
2. Community game guards	
3. Field-based conservation NGO staff	
4. Researchers	
5. Field based employees in hunting concessions	
Total personnel numbers	

Section I: Budgets

1. Total recurrent expenditure for site US$_____
2. Total field running costs US$_____
3. Salary costs for site

Personnel type	Salary during reporting period
1. Wildlife authority staff	
a) Armed game scouts/rangers	
b) Unarmed game scouts/rangers involved in patrolling	
c) Other field staff	
d) strike force/special operation unit operating full- or part-time	
e) specialist intelligence officers operating full- or part-time	
2. Community game guards	
3. Field-based conservation NGO staff	
4. Researchers	
5. Field based employees in hunting concessions	
Total salary costs	

1. Total amount paid in bonuses US$_____
2. What are bonuses paid for?

Reason for bonus payments	Yes/no
Extra efforts made	
Successful captures, leading to prosecution, of poachers	

Section J: Vehicles

1. Number of functioning vehicles

Type of vehicle	Number
Small 4WD, e.g. Land Rover or Cruiser	
Supply lorries	
Troop carriers	

1. Number of operational aircraft _____
2. Number of operational patrol boats _____

Section K: External factors

1. Activities

For each category, indicate whether the activity has occurred or was present during the reporting period (yes/no), at what level it occurs (high/medium/low) and whether it has changed since the previous reporting period (+,=,-).

Activity	**Occurred?**	**Level**	**Change**
a) Civil strife			
b) Development activities, such as logging, dam building			
c) Civil law enforcement & judiciary			
d) Illegal activities other than elephant poaching:			
i. Poaching of other species			
ii. Illegal drug trade			
iii. Illegal arms trade			
iv. Gem-stone smuggling			
e) Elephant poaching in neighbouring areas/countries			
f) Community involvement in conservation			

Monitoring of Illegal Killing of Elephants

Elephant Mortality Site Data

Data Collection Form Completion Notes

Please fill in a separate form for each reporting period for which you have information on a particular site.

Section A: General Information about the site

1. Name and address. Details of the individual responsible for collating and ensuring the validity of the data provided on the form.
2. A "reporting period" is defined as the period of time over which the information provided is considered valid. This would normally be a calendar year, but could be either a shorter or longer period. You should specify the start and end dates for the period, in the format dd/mm/yy. E.g. 01/01/96 for 1 January 1996.
3. Location of site: Give the nationally/ internationally recognised name for the site, including a description of its geographical location within the country(ies). For example, Parc W in northern Benin/ eastern Burkina Faso/ south-western Niger.
4. Geographical co-ordinates.
   a) Reference point. The predominant administrative centre or the approximate geographical centre of the site, identified as such. For example: Chobe NP headquarters, administrative centre.
   b) Longitude and latitude of reference point. Record in degrees and decimal minutes (to one decimal place?). For example: 25° 9.4' E, 17° 48.6'S
5. Boundaries. If possible, describe by giving reference points as landmarks (giving geographical co-ordinates as in point A.4.b) the outer limits of the site over which the information has been collected and can be considered valid. Please attach a map of the site, showing clearly the boundary line, and indicating the scale.
6. Size of site. Area in km^2 of the site included within the boundaries noted in point A.5.
7. Predominant land use within and adjacent to the site. Designation as:
   - -protected area – national park, game reserve, private or local government/ parastatal reserve
   - -community-based natural resource management (CBNRM)
   - -extensive subsistence pastoralism, with scattered settlements
   - -extensive subsistence agriculture, with scattered settlements
   - -intensive pastoralism, commercial ranching with fencing (including intensive game farming)
   - -intensive agriculture
   - -settled area

Section B: Population numbers and trends.

This is intended to provide data on elephant population increases or decreases. Such data are normally provided by AfESG members to the Africa Elephant Database and updated on a regular basis. If no data for the site were submitted to the last AED update, or if new data have become available in the interim, please submit it now using the attached AED form.

Section C: Method(s) of collection of mortality information

1. This section is intended to note the method(s) of collecting mortality information in the site. If mortality is recorded in more than one way, for example if there is information from aerial surveys, but also all dead elephants found on the ground are recorded, fill in two or more of sections D to F.

Section D: Carcass ratios from aerial surveys

1. Total counts
   a) Starting date of survey. This is intended to give an idea of the time of year of the survey. The date information is given in the standard notation (dd/mm/yy) as in A.2 above.
   b) Area covered. The total area on the ground for which an estimate is attempted by the survey.
   c) Total hours flown. The sum of durations of all the individual flights in the survey.
   d) Total number of carcasses observed. These should be recorded in the age categories described below, with the following criteria[1]:
      i) *fresh**:*** still has flesh beneath the skin, giving the body a rounded appearance, vultures are probably present, and a liquid pool of body fluids is still moist on the ground.
      ii) *recent* (<1 year old**):** presence of an open rot patch around the body, skin usually present, bones relatively unscattered
      iii) *old* (>1 year old): clean white bones (some skin may be present in arid areas), no rot patch or vegetation is regrowing
      iv) *very old:* bones cracking and turning grey, skeletons difficult to see from the air
   e) Total number of live elephants observed. The sum of all elephants counted during individual flights in the survey, ensuring there is no double-counting. Note reporting in Section B above.

If there was more than one total count conducted during the reporting period, please report the same data as in all points of D.1 above on a separate sheet(s) and attach to this form

2. Sample counts
   a) same comment as in D.1.a above applies
   b) same comment as in D.1.b above applies
   c) Please indicate whether the transect sampling technique is **systematic** – transects evenly spaced along the baseline -- or **random**-- transects evenly spaced along the baseline.

[1] from Douglas-Hamilton, I. (1996) Counting Elephants from the Air – Total Counts. in: K. Kangwana (ed.) *Studying Elephants.* AWF Technical Handbook Series No 7.

d) Total length of transects. The sum of all individual transects flown, reported in km.

e) Average width of transects. The overall average of the estimated width of all individual transects, in metres.

f) Estimates of the population numbers of carcasses and live elephants:

Please supply raw data in addition to the summary data provided. Raw data should be in the form of separate counts for each transect, or whatever sampling unit is appropriate. The reason for this is that the most likely method of global analysis will consist of multi-level modelling and for this, data must be available at each level of sampling.

i) Calculation method. Report the method used to derive population estimates[2]. If the method is other than Jolly Method I or II, please indicate, giving details on a separate sheet if necessary.

ii) Total number of carcasses. Report the estimate calculated for carcasses of all categories.

iii) Fresh and recent carcasses. Report the estimate calculated for carcasses of "fresh" and "recent" categories, as defined in D.1.d above.

iv) Live elephants. Report the estimate for total live elephants. Note Section B above.

If there was more than one sample count conducted during the reporting period, please report the same data as in D.1 above on a separate sheet(s) and attach to this form

Section E: Carcass counts from ground patrols
Report only carcasses found during the course of patrols

1. Measures of numbers of dead elephants

a) Total number of dead elephants. (only record elephants believed to have died within one year of the date of finding.

b) Criteria: fresh or recent, as in D.1.d above.

c) Cause of death. Total numbers known or suspected with good reason to have been poached or died

natural causes, or those for which no cause of death can be determined.

d) Evidence of poaching from the fate of the ivory carried. Report number from which tusks have been hacked, pulled or left intact.

7. Measures of effort put into patrolling

Fill in one or both of these measures.

a) Effective patrol days. This is the summation over the reporting period of the total number of days, i.e. more than six hours/day, that each ground patrol has spent in the field, on foot away from vehicles. Thus it does not include time spent at a base camp, away from base camp but not on active patrol or on placement to the patrol site.

b) Total distance covered by patrols. This is the summation over the reporting period of the total distance marched by each patrol group during effective patrol days. Distance marched can be measured by plotting patrol routes on maps and measuring.

c) Area covered by patrols. This is the geographical area over which the responsible authority considers is covered effectively by patrols. The area should be covered as

[2] see Mubugua, S. (1996) Counting Elephants from the Air – Sample Counts. in: K. Kangwana (ed.) *Studying Elephants.* AWF Technical Handbook Series No 7.

evenly and regularly as possible: repeated visits to the same small areas will not be comparable to more evenly timed patrols over a broader area.

Section H: Staffing levels

2. Wildlife Authority staff, c) Other field staff. This may include researchers, drivers, wardens etc., but should exclude support staff such as radio operators, mechanics, clerks, cleaners, secretaries, gate keepers and casual labourers.

6. Field based employees in hunting concessions. This may include hunters, scouts, trackers, gun-bearers and drivers.

Section I: Budgets

4. Total recurrent expenditure for area. This includes all salaries, operating costs for vehicles, camps etc, and replacement costs for vehicles and other equipment.
5. Total field running costs. This should include field allowances, housing allowances, personal equipment (e.g. uniforms, tents, sleeping bags), purchase of vehicles/aircraft, and running costs for vehicles/aircraft.

Annex 3: Methods of counting elephants

Numbers and distributions of animal species, along with information on habitat and land use parameters, are essential for drawing up management and conservation plans and making informed decisions. This section gives a brief description of the four main methods of obtaining data on elephant numbers (*taken from Studying Elephants, African Wildlife Foundation 1996).*

Elephant census techniques fall into two classes. The first comprises those surveys where the elephants themselves are counted. These are 'direct counts'. The second class includes surveys where signs of elephants (dung-piles, tracks, feeding signs) are counted. These are 'indirect counts'.

Direct counts of elephants can either be carried out from the air or from the ground. In savannah habitats, aerial counts remain the most effective means of elephant census (*Douglas-Hamilton et al. 1992*). There are two kinds of aerial counts: sample counts and total counts. In a sample count only part, or a sample, of the area is searched and counted, and the number of animals in the whole area is then estimated from the number in the sampled area (*Norton-Griffiths 1978*). In a total count, on the other hand, the whole of the designated area is searched, and it is assumed that all groups are located and counted accurately (*Norton-Griffiths 1978*).

Aerial sample methods are today widely used for censusing elephants and monitoring their movement and habitat use. It is also only by aerial methods that areas that are not accessible on the ground can be censused. The choice of whether to use total or sample aerial counts will depend on the area to be covered, the size of the populations and the resources available in terms of trained manpower, aircraft, funding and time available. Sample counts tend to be cheaper than total counts, simply because only part of the area is searched. Total counts are, however, suitable in relatively small study areas (of the order of 1,000 km^2), and the results are easy to understand because they are not confounded by the statistical assumptions of sample counts.

Where it is impossible to count elephants directly, as in the extensive forests of Asia and west and central Africa, signs of elephants such as dung piles are used to provide an estimate of elephant numbers.

Elephants themselves can be counted from the ground either on foot or from a vehicle. Ground counts from vehicles are practicable and give excellent results in small to medium sized areas where the country can be traversed by vehicles, and where the vegetation is reasonably open and the animals tame to vehicles (*Norton-Griffiths 1978*). Carrying out counts on foot is not common nowadays, but where resources are limiting they can provide good information on a population.

The appropriate technique to use in counting elephants, thus depends on the type of habitat (i.e. vegetation density and topography), the size of the area to be surveyed, the elephant density, and also the type of estimate required. Does one need an accurate estimate, one that approaches the true population size, but may have wide confidence limits, or does one need a precise estimate, one that may be biased, but has narrow confidence limits?

Managers require an accurate estimate, preferably at regular intervals, for a population subject to legal off-take, in the form of safari hunting and culling operations. In most cases, however, a precise estimate will be sufficient, and will enable one to monitor population trends.

Counting elephants from the air - sample counts

In a sample count, only part of the study area is searched and a count made. A series of samples, which are representative of the study area are taken (*Cochran 1963; Campbell 1967; Norton-Griffiths 1978*). The study area, or the census zone, is the whole area for which the elephant population count is to be carried out, e.g. national park, district, etc, while the sample zone is that part of the census zone in which the elephants are actually searched for and counted. The total number of elephants in the census zone is then extrapolated from the number counted in the sample zone.

In a sample count, we take a few observations, but the conclusions we draw have a wider application. In other words, we observe a sample, but apply the conclusions to a population. For example, the assumption might be that if 10% of the area is sampled, then it will contain 10% of the elephants in the census zone.

The foregoing would hold if elephant distribution and vegetation conditions were uniform, in which case any kind of sample would give similar results. However, elephant numbers and distributions are far from uniform in any one census area. Similarly, elephants will be more easily seen, and thus counted, in open areas as opposed to thickly vegetated country. The sample zone, i.e., that portion of the census zone in which the elephants are counted, must, therefore, reflect any variations as much as possible.

The census zone is divided into sample units which are chosen at random, meaning that every one unit, *n*, has an equal chance of being selected for sampling from the possible *N* such units in the census zone (*Cochran 1963; Norton-Griffiths 1978*). The sample zone is, therefore, randomly distributed in the census zone, thus, theoretically, representing the variations in elephant numbers and distribution.

The population estimate of the elephants is then calculated, based on the average counted number of animals in the sample units. Since the units are randomly selected, the average number of elephants per unit in the sample will correspond to the average number in the whole population. The total population estimate is then obtained by multiplying the sample mean by the total number of units in the census zone.

Sample counting assumes that the area actually sampled (sample zone) contains a corresponding percentage of the ‘true’ population in the census zone. Due to various factors, however, this may not be the case. To start with, elephants (as indeed other animals), are not evenly distributed. Thus, different sample units in the census zone will contain varying numbers of elephants. It follows then that different population estimates will be obtained depending on the units selected for sampling, i.e. there will be large numbers of alternative estimates. This result is due to what is referred to as sampling error, and the larger the variation in numbers of elephants between the units, the larger the range of alternative estimates or confidence limits. Sampling error results from the uneven distribution of animals and the sampling technique used (*Norton-Griffiths 1978*).

In addition to sampling error, biases also affect the population estimates. Biases are errors in one direction, e.g. underestimating. They result from various factors - such as spotting and counting, photo counting, aircraft operations, etc.

At this point let us examine the words accuracy and precision. Consider a hypothetical population of 94 elephants. Suppose that during three different surveys, we get 50, 72 and 160 elephants, giving an average of 94; alternatively we could also get 92, 97 and 93, also giving an average of 94. The latter is more precise, as the 'true' population lies within a narrow range, i.e. the confidence limits are low. On the other hand, an accurate estimate is very near the 'true' population, but the confidence limits may be wide.

Whether we aim for an accurate or precise estimate is determined by the objectives of the survey. Accurate estimates are more important if a culling operation is to take place, while precise ones are important for detecting changes in population trends. The ideal estimate would be one that is both accurate and precise.

Stratification

Elephants tend to be clumped in distribution, such that even when sample units are randomly selected, the estimate will have high variances. Stratification or division into areas or strata of more or less homogenous elephant density reduces the variance. Stratification can also be carried out according to vegetation type or density or other major sources of variation. Through stratification, sampling effort can be more efficiently allocated to areas of greater interest or ecological importance. The strata so identified are then sampled separately and the estimates combined for the entire census zone (*Cochran 1963*).

Counting elephants from the air - total counts

Total counting of elephants has been adopted in many national parks, reserves and other parts of the elephants' range in Africa. One of the reasons that total aerial counting of elephants wins favour is that elephants, being large animals, are relatively easy to spot and count compared to other animals.

The aim of an elephant total aerial count is to scan the entire surface of a selected census area, and to record the position and number of each elephant or group of elephants. A total count is similar to sample block counts but in this case the blocks, when joined, cover the whole census zone.

The flight lines should be designed with the intention of being able to spot all the elephant groups and individuals; there are a number of variations as to how this may be done.

Errors can arise in failing to spot elephant groups, counting them inaccurately, or in double counting the same groups. These errors can be greatly reduced by training and careful attention to technique.

The census zone should be divided into discrete counting blocks. By common practice these are usually defined by features such as roads, cut-lines, mountains, protected area boundaries or rivers. Rivers, however, are unsuitable as block boundaries because they tend to attract concentrations of elephants. A movement of elephants across the river while the count is going on could cause that group either to be double-counted, or to be missed altogether. It is

better to use watersheds as boundaries, as is done in the Kruger National Park in South Africa, because elephants tend to be relatively sparsely distributed near them.

A block should usually be of a size that can easily be covered by one aircraft in one flying day. In the case of Kenya's Tsavo National Park, blocks vary in size from 500km^2 to 1,500km^2, but the average size is 1,100km^2. Each flight crew should be allocated one or more blocks to be counted per day and should be provided with flight maps of the blocks. In the Tsavo elephant count of 1994 flight crews on average spent 5.5 hours a day counting with another 13 hours flying to and from the block. Scanning rates on average were 210km/hr (*Douglas-Hamilton et al. 1994*)

These days it is highly desirable to use a Geographical Positioning System (GPS) in the aircraft, both to assist in navigation and for recording waypoints (a waypoint is the location of an observation point along one's line of flight).

Estimating forest elephant abundance by dung counts

Dung counts are the most common type of indirect census method for counting elephants. Since the early 1980s, as interest quickened in the status of elephants in the forests of west and central Africa, more and more dung counts have been conducted. In the late 1980s researchers in India and then in Southeast Asia turned to dung counts for estimating the numbers of Asian elephants. The proliferation of forest elephant surveys on both continents has stimulated the rapid evolution of dung survey techniques. These methods have been described previously by Barnes and Jensen (1987), Dawson and Dekker (1992), and Barnes (1993).

Many of the concepts involved in dung counts are similar to those already described in aerial surveys, i.e. one goes through the same stages of stratification, arranging the layout of transects within each stratum, collecting the data on the transects, and then analysing the data. However, with dung counts one then has the further problem of converting estimates of dung-pile numbers into estimates of elephant numbers.

A major difference between direct counts of elephants and dung counts is that the methods for direct counts have been worked out and standardised, and the improvements now consist of fine-tuning. On the other hand, the general methods of dung counts are still evolving.

A dung survey can be used in two ways. First, one may use dung as an index of elephant abundance or relative distribution. This can provide **a** considerable amount of valuable information about the biology of elephants in your study area (e.g. Barnes *et al.* 1991). For many purposes you do not need an estimate of the actual number of elephants. An estimate of the number of dung-piles, the relative distribution of dung-piles, or changes in the number of dung piles over a period of years will give you all the information you need to manage the survey area.

The second option is to translate the dung data into numbers of elephants. To do this will require considerably more time and effort.

To obtain an estimate of elephant numbers you will have to go through four stages:

1 estimate the numbers of dung-piles, or the density of dung-piles per km^2
2 estimate the defecation rate of elephants
3 estimate the mean rate of dung decay
4 combine the above three estimates to give an estimate of elephant numbers or the density of elephants.

Transect counts

The simplest form of estimation of numbers from observation data uses linear extrapolation. That is, having surveyed a defined area within a region, such as a transect with a fixed width, and assuming that all the animals within that area have been seen, applying the calculated density to the whole region. This method produces the best results in open country where there is no visibility problem. In all other cases the method will be inadequate in at least two ways that result in error in the estimate of animal abundance:

i) it is difficult to define accurately the area that has been surveyed; and

ii) one assumes that all individuals have been seen in the surveyed area. This assumption, however, is not realistic when using a transect of fixed width in woodland habitats, for instance. In this case the population estimates will be negatively biased, that is, one will estimate fewer elephants than there actually are in an area.

These problems can be overcome by using variable fixed-width transects, whereby the width of the transect is adjusted according to the vegetation density. In open country, the width of the transect may be as much as 500m, while in areas of dense vegetation the fixed width may be reduced to 100m. This technique, however, has the same sources of error as the fixed-width method described above. King's method was the first technique to use this variable visibility profile, taking the average sighting distance as half the effective strip width or half the width of the strip censused. Although the method is weak and usually produces overestimates of density (*Norton-Griffiths 1978*), it does not require much training to carry out the field procedure and the data analysis.

Line-transect counts

In line-transect sampling the observer progresses through the area following a straight line of known length (transect). He or she records each animal, notes the distance of the animal from the observer when spotted and using a compass, its bearing, which is then converted to a sighting angle relative to the transect. As a result, the observer is able to calculate the perpendicular distance of each animal from the transect. The width of the transect is not fixed and changes constantly according to the visibility or density of the vegetation along that particular segment of the transect. The width of the transect also differs for each species of animal when multispecies counts are conducted.

The data from a line-transect survey are a set of distances and angles and the resultant sample size itself (i.e., number of groups seen and number of transects walked). The set of distances and angles are transformed to a set of perpendicular distances of the elephants from the transect line. These perpendicular distances are then used in a statistical model to calculate the elephant density for the area. The basic idea underlying such a model is that the probability of detecting an elephant decreases as its distance from the transect line increases.

The major advantage of the line-transect sampling technique is the relative ease of its implementation in the field. The placement of transect lines may be either temporary or permanent. Permanent transect lines, delineated by markers, should be considered if the transects are to be surveyed periodically. Use of permanent transects enables pairing of the data for the analysis of differences in density over time and thereby increases the power of such analyses. When the survey areas have been selected, the layout of transects must be determined. That layout will depend on statistical design requirements, but considerations of logistics, supplies and access will in practice often determine the final survey design.

Direct counts of elephants from the ground

The most direct way to estimate the abundance of an elephant population is to count all individuals in a defined area. An estimate of population density is obtained simply by dividing the number counted by the size of the area censused, and the density figure obtained in this way can then be applied to surrounding areas with similar characteristics, such as soil types and vegetation. Census methods based on this approach are usually called quadrant, plot or strip sampling methods.

Defining an area or establishing a plot and then counting all the elephants within it on foot or from a vehicle can be very time consuming and impractical, and certainly impossible if the target elephant population is mobile or if individuals are widely scattered. As an alternative, transect and line-transect methods have been devised to estimate animal abundance. Both can be carried out on foot or from a vehicle, and the principles that apply are very similar to those used in estimating elephant abundance using dung counts.

Notes on estimating elephant mortality in forest habitats *(Richard Barnes, pers.comm.)*

There are two major problems that must be confronted in designing an elephant monitoring system for central Africa. The first problem is that, unlike savannah regions of east and southern Africa, there is no well-developed method for detecting elephant carcasses. Although some methods (e.g. foot patrols or aerial reconnaissance of forest clearings) show promise, there is currently little or no data available on the rate at which elephant carcasses can be detected with a given method. Without this data on carcass encounter rate, it is impossible to estimate how much field effort will be required at each site in order to amass a sample large enough to estimate trends in the rate of illegal killing with any confidence.

Thus, until more research on carcass detection rates is collected, the best method available for detecting changes in the rate of illegal killing will be to monitor the size of populations at the selected sites.

Well-developed methods for forest elephant population monitoring currently exist, and are increasingly sensitive to changes in elephant abundance. In fact, these methods are now sensitive enough so that, with a reasonable amount of field effort, changes in population size of the magnitude commonly observed in heavily poached areas can be detected. More importantly, data are already available for estimating the amount of field effort necessary to detect changes of abundance of a stipulated magnitude. Furthermore, one newly developed population monitoring method ('forest reconnaissance' or 'recce') uses a field protocol quite similar to the foot patrols commonly used for carcass detection.

This means not only that once carcass detection methods are developed it may be possible to implement population monitoring and carcass detection simultaneously, but that the training and infrastructure investment necessary to implement population monitoring should all apply equally well to carcass detection. Note also that because the visibility of elephants is extremely low in forest areas, the live animal encounter rate figure used in carcass ratio estimator of killing rate may need to be replaced with the dung counts used by population monitoring methods. We expect that with more research it will become more efficient to use carcasses.

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Annex 4: Selection of a representative sample of sites

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1 OBJECTIVES

The aim of this exercise is to obtain a representative samples of sites from elephant range states for use in the proposed new information system MIKE (Monitoring the Illegal Killing of Elephants).

Representatives of range states were invited to submit lists of potential sites. The African and Asian Elephant Specialist Groups (AfESG and AsESG) compiled these lists and pre-selected a total of 69 sites from African elephant range states and 30 from Asian elephant range states. These lists of sites are supplied with data on criteria to assist in the site selection. These criteria follow the recommendations of the Workshop on the Monitoring of Trade in Elephant Products and Illegal Killing of Elephants held by TRAFFIC and IUCN/SSC in Nairobi (8-12 December 1997).

The idea is to use the available information to select a sample of sites to be used for MIKE which is as far as possible representative and "balanced" with respect to the criteria, and which is determined according to an objective and transparent method of selection.

2. METHODOLOGY

The sampling procedure was conducted completely separately for African and Asian range states.

African sites

After ensuring that the available data were completed as far as possible, the selection criteria were prioritised in consultation with the IUCN/SSC.

The Nairobi Workshop Report organised the criteria into two lists: list (a) consisting of factors which are thought likely to affect the incidence of illegal killing, and list (b) comprising other factors which will affect the ability to collect data from the sites. Criteria in the first list were regarded as having the role of stratification criteria for a stratified sample design, although for reasons explained below, the usual methods of sampling within strata were not appropriate. A system of numerical weights, reflecting the prioritisation of criteria, was devised for the factors of list (b). The information contained in these factors was thus condensed into a single score which was used for rating the sites according to the difficulty of collecting monitoring data. The weighted averages of these scores were computed for each sub-region and the score was re-scaled to the range 0 – 100, a lower score representing the least difficult site. The factors used in list (b), and the weights used are given in Annex I.

After examination of the available data, the stratification criteria (list (a)), and the coding used in subsequent analysis, were as follows:

Sub-region: East, West, Central and Southern Africa.

Ivory trade:whether or not there is a significant domestic ivory trade and, if so, whether it is legal/illegal and local/international. The ivory trade data were coded

0 = no trade

1 = legal trade

2 = illegal trade (or both legal and illegal)

The data on local/international were not utilised because they were rather uncertain and (after consultation) thought to be less important.

CITES registration:whether or not the country was involved in the CITES COP 10 decisions (10.1 and 10.2); coded 0 for "no" and 1 for "yes".

Habitat type:savannah or forest habitat (a few sites were listed as both).

Enforcement capacity: low (0) or high (1).

Protection:whether or not the site is (or lies in) a protected area; coded 0 for "non-protected" and 1 for "protected".

Civil strife:sites where there is current or recent civil strife (including in neighbouring areas); coded 0 for "no" and 1 for "yes".

Hunting:sites with a history of heavy illegal killing pressure were coded 1, otherwise 0.

It was decided (after consultation) that the size of elephant populations was also a possible candidate for inclusion as a stratification criterion. This variable was primarily included in list (b), but including it in list (a) also would have little effect on the overall results if, in the event, it turned out to be unimportant for stratification. It was therefore used in both lists.

The sizes of elephant populations differ widely between the four African sub-regions. For this reason, and also because there is confounding of habitat type with sub-region, the sampling exercise was carried out separately for each of the sub-regions.

Uncertainties in the data on population sizes were dealt with by further enquiries and, in some cases, by reference to the African Elephant Database (Said *et al*, 1995). The coding scheme was as follows:

East and Southern Africa

0	= low	< 1,000
1	= med	1,000 – 9,999
2	= high	10,000 +

Central Africa

0	= low	< 1,000
1	= med	1,000 – 4,999
2	= high	5,000 +

West Africa

0	= low	< 100
1	= med	100 – 499
2	= high	500 +

Within each sub-region, there are thus seven stratification criteria to be used for selecting a sample. These (with their numbers of levels) are: ivory trade (3), CITES reg (2), enforcement cap (2), protection (2), civil strife (2), hunting (2) and population (3). The complete cross-classification would therefore contain $3^2 \times 2^5 = 288$ cells. The normal procedure for constructing a stratified sample would be to select a random sample of units (sites) within each cell in the stratification table, usually with probabilities proportional to size, or according to some similar rule. In the present case, with an initial list of only 69 sites, this procedure would clearly be impossible.

What is required is a method which makes optimal use of the information contained in the stratification data to produce a sample which is the most representative that can be attained, given the constraints outline above. The procedure adopted here was first to split the sites into groups which, according to the stratification criteria, are as different from each other as possible, while the individual sites within each group are as similar as possible. This was achieved by means of hierarchical cluster analysis using Ward's method (Everitt, 1980). The advantage of a hierarchical classification is that it provides a natural way of choosing several sample sizes, so that different scenarios can be derived in an objective way.

In addition to cluster analysis, an attempt has been made to simplify the selection criteria by means of a dimension reduction technique (factor analysis with varimax rotation – Krzanowski, 1988). This provides some corroboration of the clustering and, at the same time, gives a simpler picture of what the cluster groups actually represent. The factor analysis was performed on all 69 cases together.

The cluster analysis was carried out separately for each sub-region and the results subjected to cross-checking of "balance" with respect to habitat type and the values of the factor scores resulting from the factor analysis. In a few cases slight adjustments were made to the selections to correct for imbalance.

Site selection was performed on site ID codes, without reference to site identifications. The idea of this was to avoid any unconscious subjective bias in selection. The ID codes for all sites are listed in Annex II. The entire selection procedure was determined only by the statistical methods outlined above. The method is objective, transparent and repeatable.

Asian Sites

The methodological approach for the Asia sites was basically identical to that adopted for the Africa sites. There were a few minor differences, however, and these are listed here:

(1) Since there were just 30 sites presented for inclusion, there was little point in splitting them into sub-regions for separate analysis, as was done for Africa. A pooled analysis was done for all 30 together.

(2) None of the Asian range states registered under CITES 10.2, so this variable was excluded from the analysis.

(3) Whereas the question on government co-operation was excluded for Africa (because virtually all of the responses were the same), it has been included for Asia.

(4) While habitat type (forest/ savannah) was a factor to consider with the African elephant, it is not an really issue in Asia (although the question was asked and it has been reported).

(5) Less information was available on elephant population sizes in Asia. Population size has been classified as simply low or high for each site.

Aside from these minor points, the method of analysis was identical to that used for Africa.

3 RESULTS OF ANALYSIS

African sites

FACTOR ANALYSIS

Total Variance Explained

	Initial Eigenvalues			*Rotation Sums of Squared Loadings*		
Component	*Total*	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*
1	1.83	26.10	26.10	1.73	24.71	24.71
2	1.45	20.76	46.86	1.54	22.02	46.74
3	1.35	19.30	66.16	1.36	19.42	66.16
4	0.86	12.35	78.51			
5	0.53	7.59	86.10			
6	0.52	7.46	93.56			
7	0.45	6.44	100.00			

Extraction Method: Principal Component Analysis.

Rotated Component Matrix

	Component		
	1	*2*	*3*
Ivory trade	0.047	**0.857**	-0.058
CITES reg	-0.126	**0.716**	0.041
Enf't. cap.	-0.020	-0.380	**0.669**
Protection	0.130	0.167	**0.820**
Civil strife	**0.813**	0.153	0.219
Hunting	**0.829**	-0.119	0.017
Pop'n. size	-0.588	0.290	**0.431**

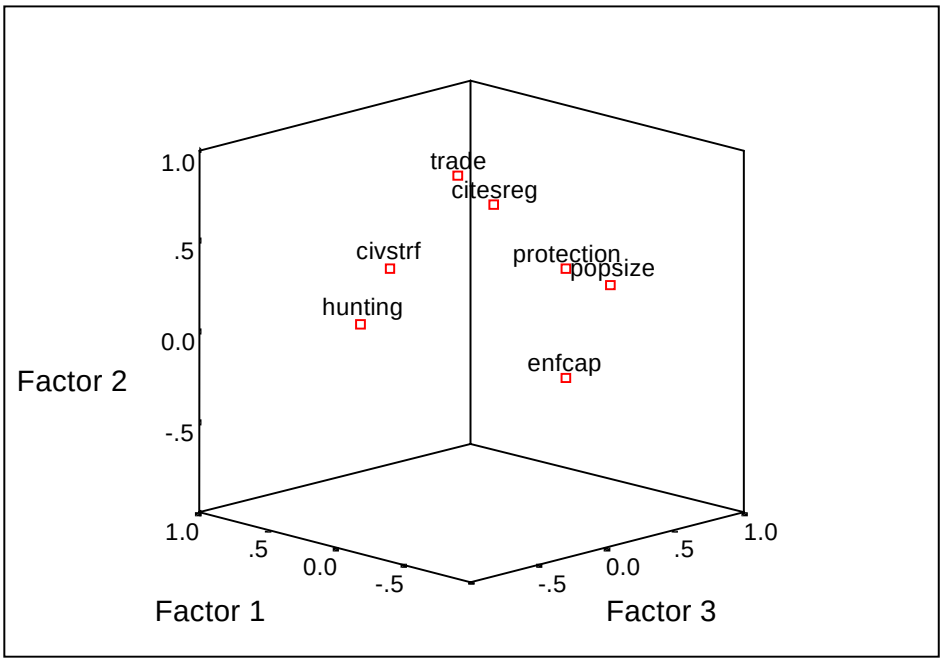
Rotation Method: Varimax with Kaiser Normalization.

Interpretation of rotated factors:

Factor	*Dominant contributions*
1	Hunting + civil strife
2	Ivory trade + CITES registration

3 Protection + enforcement capacity
(+ some contribution from population size)

Factor Plot in Rotated Space

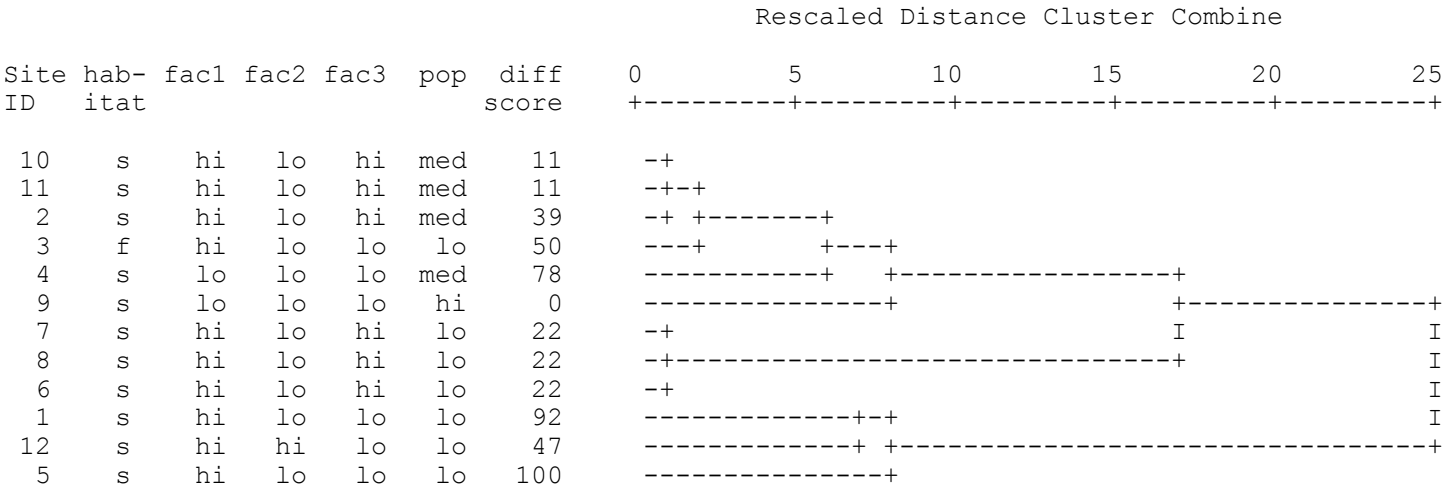


About two-thirds of the variation between sites can be explained by the above three factors. The analysis therefore results in a reasonable simplification.

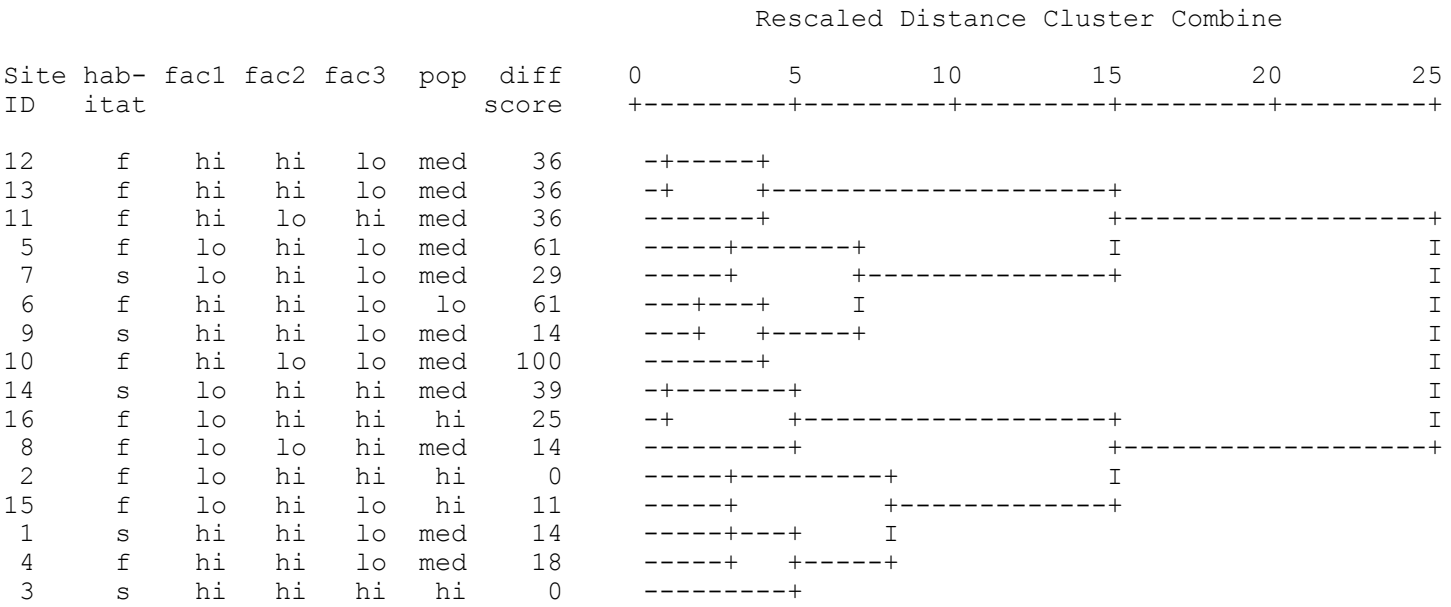
CLUSTER ANALYSIS

The main analysis from which the site selections were derived was the cluster analysis. The method used was Ward's method with squared eucidlean distances. This was applied to each sub-region separately. The dendrograms resulting from the analysis follow. For each site, the difficulty score is noted, together with the population level, the habitat type and the factor scores (lo or hi according to whether they are below or above their median values). Note that the factor scores correspond quite closely to the clustering - sites in the same group tend to have a similar pattern of factor scores, while different groups tend to have different scores.

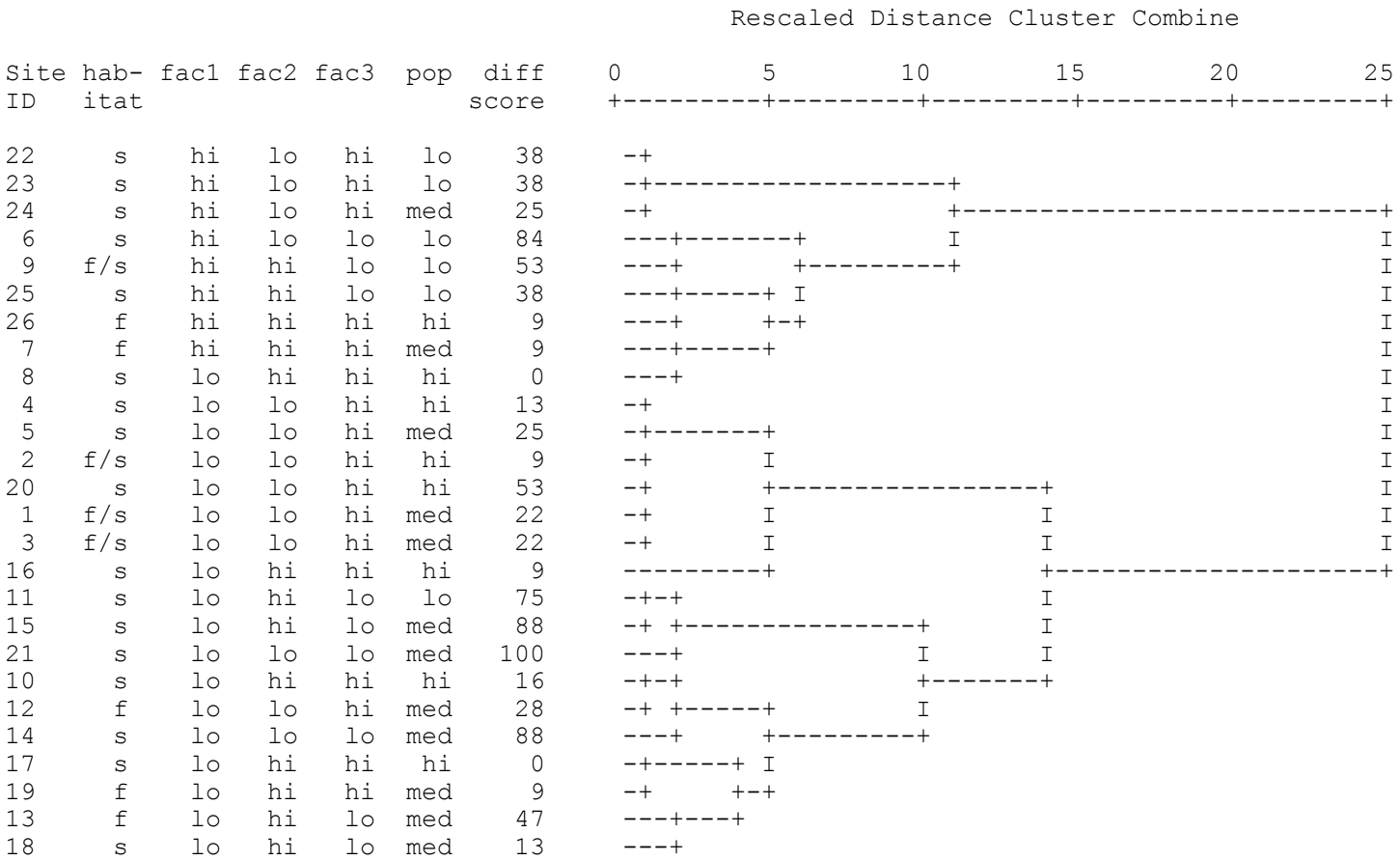
East Africa


Rescaled Distance Cluster Combine
Site ID
hab-itat
fac1
fac2
fac3
pop
diff score
0
5
10
15
20
25
10 s hi lo hi med 11
11 s hi lo hi med 11
2 s hi lo hi med 39
3 f hi lo lo lo 50
4 s lo lo lo med 78
9 s lo lo lo hi 0
7 s hi lo hi lo 22
8 s hi lo hi lo 22
6 s hi lo hi lo 22
1 s hi lo lo lo 92
12 s hi hi lo lo 47
5 s hi lo lo lo 100

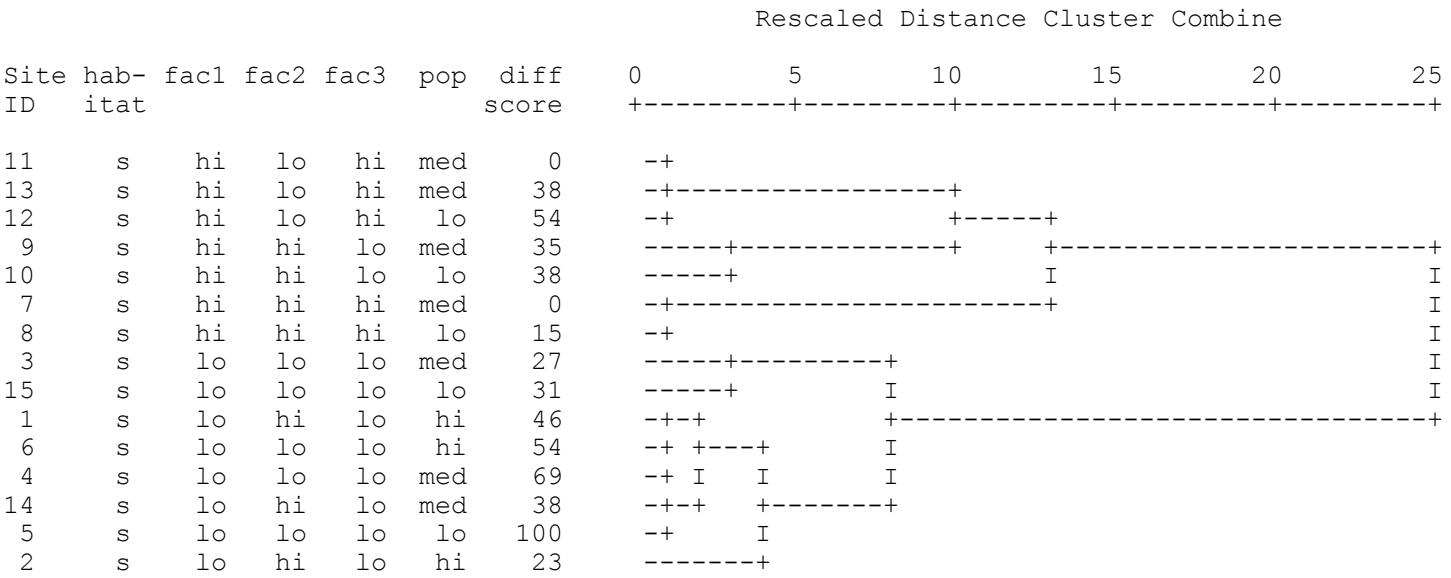
Central Africa



West Africa


Rescaled Distance Cluster Combine
Site ID
hab-itat
fac1
fac2
fac3
pop
diff score
0
5
10
15
20
25
22 s hi lo hi lo 38
23 s hi lo hi lo 38
24 s hi lo hi med 25
6 s hi lo lo lo 84
9 f/s hi hi lo lo 53
25 s hi hi lo lo 38
26 f hi hi hi hi 9
7 f hi hi hi med 9
8 s lo hi hi hi 0
4 s lo lo hi hi 13
5 s lo lo hi med 25
2 f/s lo lo hi hi 9
20 s lo lo hi hi 53
1 f/s lo lo hi med 22
3 f/s lo lo hi med 22
16 s lo hi hi hi 9
11 s lo hi lo lo 75
15 s lo hi lo med 88
21 s lo lo lo med 100
10 s lo hi hi hi 16
12 f lo lo hi med 28
14 s lo lo lo med 88
17 s lo hi hi hi 0
19 f lo hi hi med 9
13 f lo hi lo med 47
18 s lo hi lo med 13

Southern Africa



Asian Sites

FACTOR ANALYSIS

Total Variance Explained

	Initial Eigenvalues			*Rotation Sums of Squared Loadings*		
Component	*Total*	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*
1	2.219	36.988	36.988	2.219	36.988	36.988
2	1.484	24.740	61.728	1.484	24.740	61.728
3	0.871	14.513	76.241	0.871	14.513	76.241
4	0.675	11.254	87.495			
5	0.433	7.211	94.706			
6	0.318	5.294	100.00			

Extraction Method: Principal Component Analysis.

Rotated Component Matrix

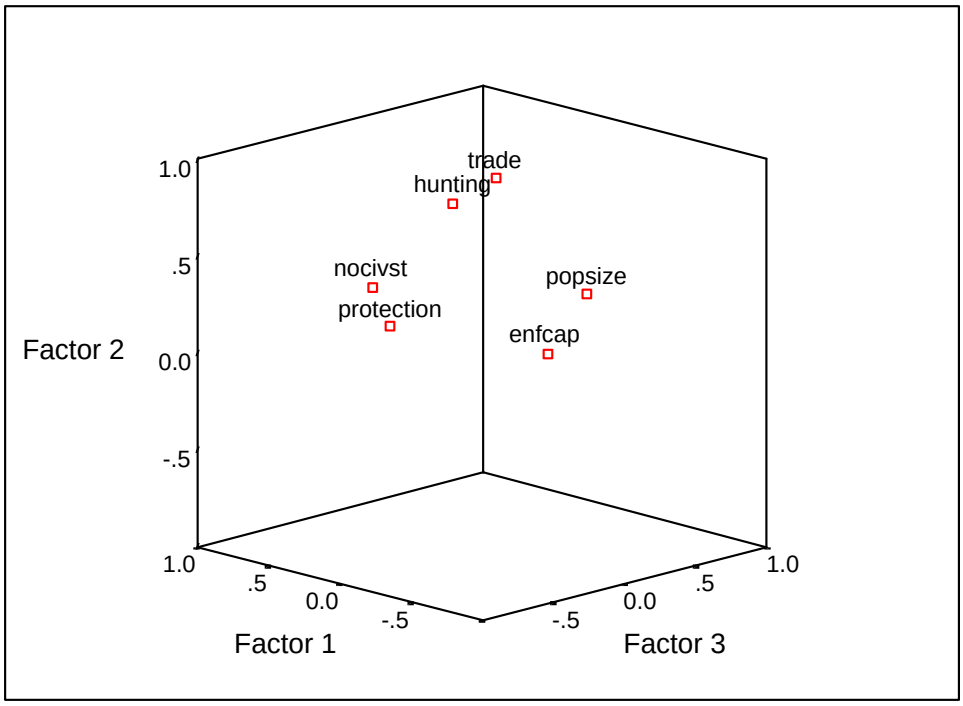
	Component		
	1	*2*	*3*
Ivory trade	0.199	**0.811**	0.293
Enf't. cap.	0.289	-0.198	**0.747**
Protection	**0.861**	-0.068	0.223
Hunting	-0.097	**0.850**	-0.301
Pop'n. size	0.081	0.132	**0.817**
No civil strife	**0.875**	0.153	0.108

Rotation Method: Varimax with Kaiser Normalization.

Interpretation of rotated factors:

Factor	*Dominant contributions*
1	No civil strife + protection
2	Hunting + ivory trade
3	Population size + enforcement capacity

Factor Plot in Rotated Space

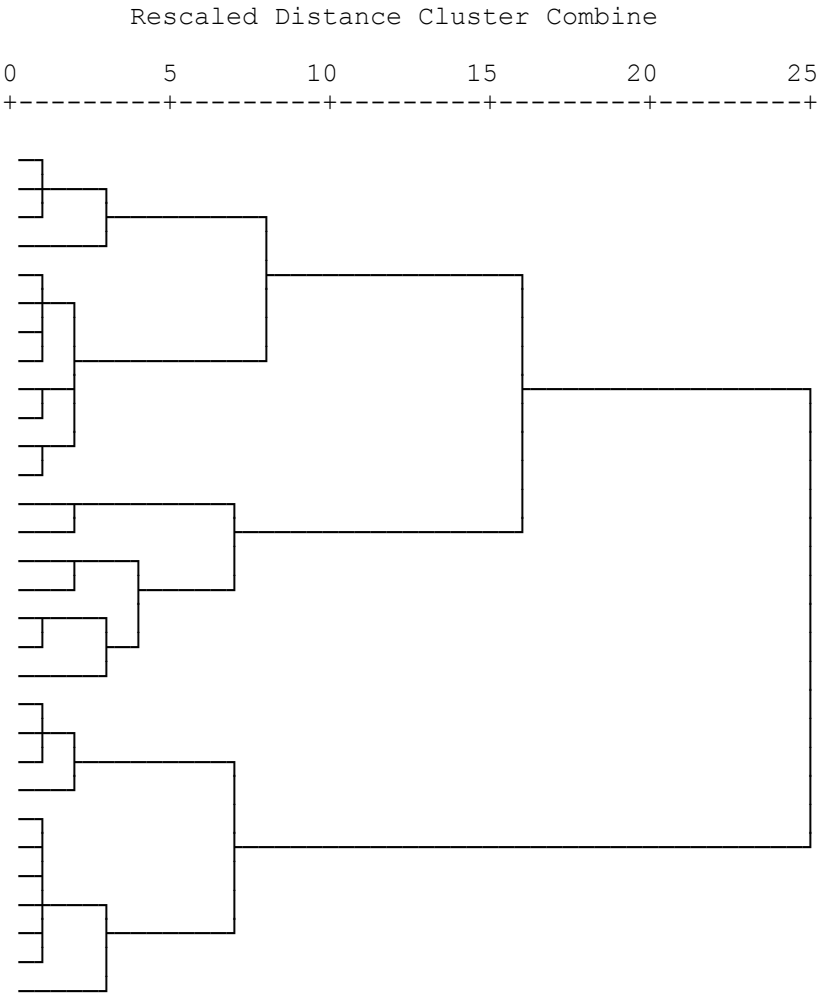


CLUSTER ANALYSIS

The same clustering method was used as was used for the Africa sites.

The resulting dendrogram is shown on the next page.

Site ID	hab-itat	fac1	fac2	fac3	pop	diff score
26	f	hi	lo	lo	lo	13
27	f	hi	lo	lo	lo	13
17	f	hi	lo	lo	lo	58
18	f	hi	lo	lo	lo	100
19	f	hi	hi	lo	hi	88
23	f	hi	hi	lo	hi	92
20	f	hi	hi	lo	hi	75
21	f	hi	hi	lo	hi	58
11	f	hi	hi	lo	hi	17
25	f	hi	hi	lo	hi	17
28	f	hi	lo	lo	hi	48
29	f	hi	lo	lo	hi	66
1	f	lo	lo	lo	lo	75
2	f	lo	lo	lo	lo	75
3	f	lo	hi	lo	lo	50
7	f	lo	hi	lo	lo	46
12	f	lo	hi	hi	hi	92
15	f	lo	hi	hi	hi	79
22	f	lo	lo	lo	hi	63
9	f	hi	lo	hi	hi	0
14	s	hi	lo	hi	hi	13
13	f	hi	lo	hi	hi	54
30	f	hi	lo	hi	hi	42
16	f	lo	hi	hi	hi	13
24	f	lo	hi	hi	hi	13
10	f	lo	hi	hi	hi	13
4	s	lo	hi	hi	hi	4
8	s	lo	hi	hi	hi	0
6	f	lo	hi	hi	hi	29
5	f/s	lo	lo	hi	hi	4



4 SITE SELECTIONS

African sites

Three sampling scenarios have been derived from the analysis. These correspond to approximate sampling fractions of 25%, 40% and 65% of all sites, respectively. Within sub-region sampling fractions have been held as close as possible to these overall percentages.

The method for obtaining a sample from the cluster analysis is to take a cut across the dendrogram at the point on the distance scale which gives the required number of sites for the sample. Note that there is not necessarily a solution for every possible sample size. The available sample sizes for each sub-region, corresponding to the results of the hierarchical clustering are as follows:

East Africa:	1, 2, 3, 5, 6, 7, 8, 12
Central Africa:	1, 2, 4, 5, 6, 8, 10, 13, 14, 16
West Africa:	1, 2, 3, 4, 5, 6, 9, 10, 16, 26
Southern Africa:	1, 2, 3, 4, 5, 6, 8, 9, 15

The selection method was first to sample at random from a selected group (unless there was only one site in the group). The final selection was reviewed for balance according to habitat types and to ensure that the difficulty scores were not too high. Changes (in all cases minor) were made to the selections to correct for any deficiencies in this regard. The overall distribution of habitat types for the 69 sites provided was:

Habitat	***No.***	***%***
Forest	17	24%
Savannah	48	70%
Both	4	6%

Wherever possible, up to two alternative sites have been proposed for each site given. These are chosen from the same group as the selected site. However, it should be noted that taking one of these alternative sites may disturb the overall balance of the sample.

Although it is possible to derive certain intermediate solutions by selecting additional sites from cluster groups, with total sample size between the three proposed, it is important to note that there would be no rational basis for doing this.

Scenario 1

Sub-region	*No. of sites*	*Site IDs*	*Alternative sites*
East Africa	3	**9**	2, 4
		7	6, 8
		12	1, 5
Central Africa	4	**13**	11, 12
		5	7, 9
		8	14, 16
		3	2, 15
West Africa	6	**24**	22, 23
		9	6
		2	-
		15	-
		17	-
		26	8, 7
Southern Africa	4	**11**	13, 12
		9	10
		7	8
		2	1, 6
Total	17 (approx. 25%)		

Overall sample distribution of habitat types:

Habitat	*No.*	*%*
Forest	4	24%
Savannah	11	65%
Both	2	12%

Scenario 2

Sub-region	*No. of sites*	*Site IDs*	*Alternative sites*
East Africa	5	**10**	11, 2
		9	-
		7	6, 8
		12	1
		5	-
Central Africa	8	**12**	13, 11
		5	7
		9	6
		16	14
		8	-
		2	15
		1	4
		3	-
West Africa	9	**24**	22, 23
		9	6
		26	25
		7	8
		2	4, 1
		16	-
		15	11
		10	12
		17	19, 18
Southern Africa	6	**11**	13, 12
		9	10
		7	8
		3	15
		1	6, 14
		2	-
Total	28 (approx. 40%)		

Overall sample distribution of habitat types:

Habitat	*No.*	*%*
Forest	7	25%
Savannah	19	68%
Both	2	7%

Scenario 3

Sub-region	*No. of sites*	*Site IDs*	*Alternative sites*
East Africa	8	**10**	11, 2
		3	-
		4	-
		9	-
		7	6, 8
		1	-
		12	-
		5	-
Central Africa	13	**12**	13
		11	-
		5	-
		7	-
		9	6
		10	-
		16	14
		8	-
		2	-
		15	-
		1	-
		4	-
		3	-
West Africa	16	**24**	22, 23
		6	-
		9	-
		25	-
		26	-
		7	-
		8	-
		2	4, 1
		16	-
		15	11
		21	-
		10	12
		14	-
		17	19
		13	-
		18	-

\ .. continued

Scenario 3
continued

Sub-region	*No. of sites*	*Site IDs*	*Alternative sites*
Southern Africa	8	**11**	13, 12
		9	-
		10	-
		7	8
		3	-
		15	-
		1	6, 14
		2	-
Total	45 (approx. 65%)		

Overall sample distribution of habitat types:

Habitat	*No.*	*%*
Forest	13	29%
Savannah	30	67%
Both	2	4%

Asian Sites

As with the Africa sites, three sampling scenarios have been derived. The choice of solutions is limited by the way the cluster analysis works out (i.e. the sample sizes that can be obtained by taking cuts across the dendrogram). The possible sample sizes are: 1, 2, 3, 4, 6, 7, 10, 15 and 30.

The three scenarios listed below consist of 6, 10 and 15 sites, respectively, corresponding to sampling rates of 20%, 33% and 50%.

Scenario	*No. of sites*	*Site IDs*	*Alternative sites*
1	6	**26**	27, 17
		11	25, 28
		1	2
		7	3, 22
		9	14, 30
		8	4, 10
2	10	**26**	27, 17
		18	-
		11	25, 28
		1	2
		7	3
		15	12
		22	-
		9	14, 30
		8	4, 10
		5	-
3	15	**26**	27, 17
		18	-
		21	20, 19
		11	25
		28	29
		1	-
		2	-
		3	-
		7	-
		15	12
		22	-
		9	14, 13
		30	-
		8	4, 10
		5	-

5 ESTIMATES OF SAMPLING ERROR AND PRECISION

To appreciate the potential sources of sampling error, it should be noted that the data obtained will be the result of a two-stage sampling procedure. The first level of sampling is the selection of sites, as above. The second level of sampling is the selection of sampling units (transects, quadrats, or whatever) within sites. Both of these sampling processes contribute to the overall error of the observed variable. Little information is available for this project which can be used to assess the within-site sampling error. However, it is generally true that in two-stage sampling, it is the between-site error which is dominant (Cochran 1977).

Statistical measures of sampling variation rest on the assumption of random sampling. In the present case, a sort of stratified sample design has been proposed (so as to take account of , or "balance", factors which are thought likely to affect illegal killing). With stratified samples, the selection of units (sites) within strata should be random. For reasons explained above, the element of randomness in the selection procedure has been inevitably rather less than ideal.

These two limitations make an accurate assessment of precision virtually impossible to achieve. However, very rough estimates can be made by making certain assumptions. First, we assume that a simple comparison between two successive observation periods (years, say) will be sufficient, thus eliminating the need to look at longer term time trends. (This assumption effectively ensures that the resulting estimates are conservative, in the sense that longer term trends provide more data and it is automatically easier to detect changes.) We can therefore reduce the problem to a simple paired t-test, assuming that the response variable is suitably transformed to approximate normality.

The next assumption is that carcass counts follow an over-dispersed Poisson distribution. This is very likely to be at least approximately correct (over-dispersal implying a spatial clustering of carcasses). Such data tend to follow Taylor's power law quite closely (Taylor 1961). The most common power law for such data is that the variance is proportional to the square of the mean. This fact allows the simplification of not having to obtain a prior estimate of variance; it also implies that a simple log-transformation will stabilise the variance (Green, 1994). With these assumptions it is easy to show that the fractional change detectable, δ, is related to sample size (n) by means of the formula

$$\delta \approx \left(t_{n-1}(\alpha) + t_{n-1}(\beta)\right) / \sqrt{n}$$

where α is the significance level of the test and β is the type II error rate, so that the power of the test is 1-β (the power of a test is the probability of detecting a difference when there really is one). $t_{n-1}(\alpha)$ is the percentage point of the t-distribution on n-1 degrees of freedom corresponding to a one-sided test (since we are estimating the precision of detecting an increase). This formula is an adaptation of that given by Green in the above reference.

Plots of % detectable change against power are given below for α = 0.05 and 0.10.

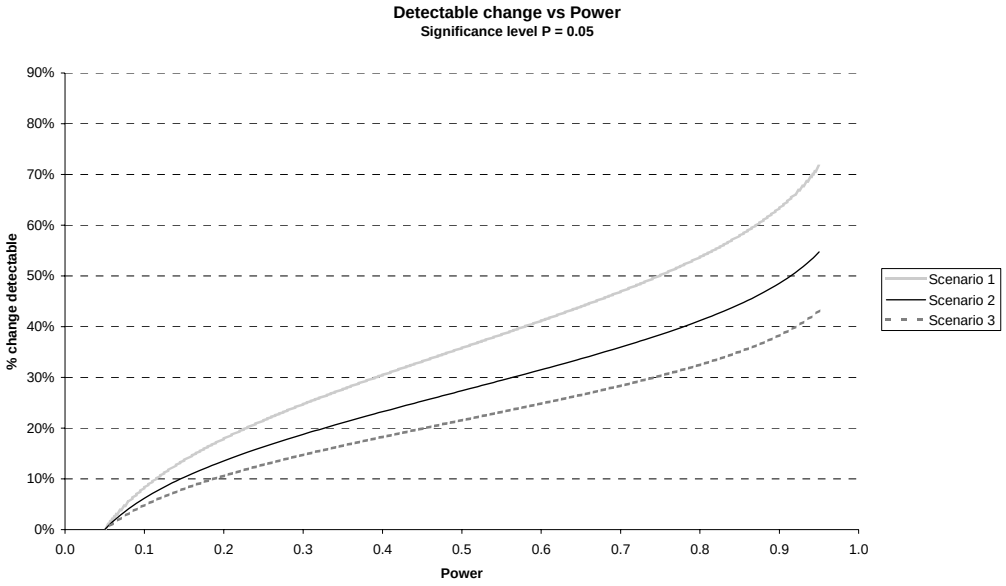
The interpretation of these plots is as follows: looking at Scenario 2 in the first graph, for example, the probability is 0.8 that a difference of 41% will be detected at a significance level of 0.05.

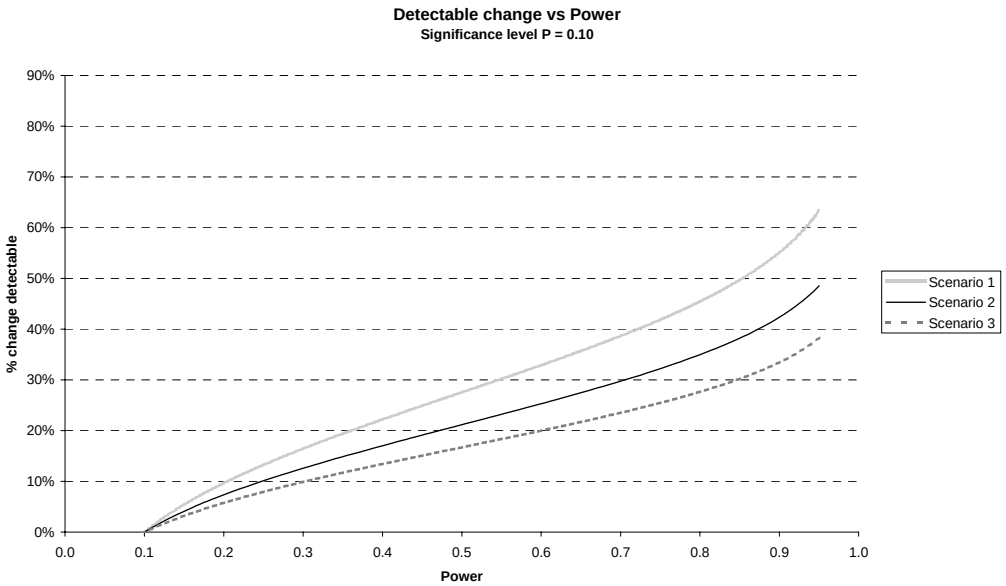
If these estimates seem disappointing, it should be noted that they are almost certainly very conservative due to the fact that the sample design has not been taken into account (in addition to the other reason concerning time trends, above). The effect of stratification in sample design is generally to reduce sampling errors, which in turn increases precision and power. But for reasons outlined above, there is insufficient information to attempt a rational quantification of this effect. Another mitigating factor is that we are only looking at the first

level of sampling in a two-stage sampling procedure. If more information were available on within-site sampling, then the above calculations could probably be applied to the second level, with an effective increase in sample size. Ideally, a multi-level modelling approach should be adopted. These refinements would undoubtedly lead to more encouraging estimates of precision. The above estimate can be regarded as worst-case upper bounds for the genuine precision.

Overall, global estimates of error and power have been derived by combining the results of Asia with those of Africa. This has been done by simply adding the sample sizes, so the overall numbers of sites for the three scenarios are 23, 38 and 60, respectively.

THE INTERPRETATION OF THIS ANALYSIS SHOULD BE APPRAOACHED WITH CAUTION:





Annex I. Factors Used to Assess Difficulty

The following scoring system resulted from consultations with IUCN/SSC. Note that one of the variables supplied with the data, namely the answer to the questions "Is the government co-operative with data collection at the site level and within the Wildlife Department?", was not used. The answer was "Yes" for all sites but one and the variable therefore has negligible discriminating power.

Variable	***Weight***
NGO capacity	10
Existing research	1
Pre-97 data	2
Post-97 data	1
Population size	4
Existence of limits	4
Homogeneity	6
Existence of key staff	1
Single agency	4

Annex II. Site ID Codes CONFIDENTIAL

REFERENCES

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Green, R.H. - Aspects of power analysis in environmental monitoring; in Fletcher D.J. & Manly B.F.J. (Ed.) - *Statistics in Ecology and Environmental Monitoring*, Univ. of Otago Press, Dunedin, N.Z., 1994.

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Said M.Y., Chunge R.N., Craig G.C. Thouless C.R., Barnes R.F.W., Dublin H.T. - *African Elephant Database 1995*, IUCN/SSC, 1995.

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Annex 5: Detailed budget breakdown

The following detailed cost analyses are attached:

5.1 Cost breakdown per survey year by heading

5.2 Population survey costs

5.3 Survey equipment
a) Costing of survey equipment - Africa
b) Costing of survey equipment - Asia

5.4 Costing for data collection and compilation

5.5 Costing of Technical Support and Data Processing Unit and Reporting

5.6 Costing of capacity building

5.7 Sub-regional cost breakdown

5.8 Costing of initial set-up costs

5.9 Estimated overall costs for Years 1-6

5.10 Example costing models

5.1 Cost breakdown per survey year by heading

Cost Headings			*Annex*	*USD*
Population surveys				
	survey costs	*total*	*6.2*	716,312
	survey equipment	*Africa*	*6.3a*	314,693
		Asia	*6.3b*	122,981
Data collection and compilation			*6.4*	713,909
Technical support and data unit and reporting			*6.5*	306,475
Capacity Building			*6.6*	179,228
			Total	**2,353,597**

5.2 Population survey costs (does not include equipment)

Scenario 3 **65% sampling** **60 total sites**

East Africa - Site ID's	*Method*	*Size sq.km*	*Transect Kms*	*Cost/km*	*Total*
1	AT	709	374	12	4,494
3	DuC	125	10	30	313
4	AT	7,485	3,953	12	47,441
5	asmpn	3,000	1,585	12	19,015
9	AS	43,626	4,839	12	58,067
7	AT	3,366	1,778	12	21,334
10	AS	10,401	1,154	12	13,844
12	AT	2,800	1,479	12	17,747

Central Africa - Site ID's					
1	AS	3,156	350	12	4,201
2	DuC	30,000	525	30	15,750
4	DuC	6,000	105	30	3,150
3	AS	15,125	1,678	12	20,132
5	DuC	1,322	23	30	694
7	AT	1,700	898	12	10,775
11	DuC	1,266	22	30	665
9	asmpn	3,000	1,585	12	19,015
8	TC	3,292	274	30	8,230
10	DuC	5,500	96	30	2,888
12	DuC	3,000	53	30	1,575
15	DuC	6,000	105	30	3,150
16	DuC	5,000	88	30	2,625

West Africa - Site ID's					
2	DuC	2,755	48	30	1,446
7	DuC	8,119	142	30	4,262
9	DuC	1,038	18	30	545
10	AS	4,840	537	12	6,442
15	asmpn	3,000	1,585	12	19,015
16	DuC	27,000	473	30	14,175
17	AT	2,244	1,185	12	14,223
24	AT	16.5	9	12	105
26	DuC	1,391	735	12	8,816
6	AS	2,368	263	12	3,152
8	AS	19,337	2,145	12	25,738
13	DuC	1,123	20	30	590
14	asmpn	3,000	1,585	12	19,015
18	AT	518	274	12	3,283
21	AT	352	186	12	2,231
25	AS	8,447	937	12	11,243

Southern Africa - Site ID's	*Method*	*Size sq.km*	*Transect Kms*	*Cost/km*	*Total*
1	AS	15,219	1,688	12	20,257
2	AT	3,390	1,791	12	21,486
3	AT	2,870	1,516	12	18,191
7	AS	19,485	2,161	12	25,935
9	AS	30,000	3,328	12	39,931
11	AS	9,050	1,004	12	12,046
10	asmpn	3,000	1,585	12	19,015
15	AS	8000	887	12	10,648

South Asia - Site ID's					
1	DuC	565	136	12	1,632
2	DuC	195	47	12	564
3	DuC	500	120	12	1,440
5	DiC	181	16	9	144
8	DiC	874	80	9	720
9	DiC	641	52	9	468
11	DiC	796	72	12	864
15	DiC	7,505	338	9	3,042
30	DiC	155	12	9	108

Southeast Asia - Site ID's					
7	DiC	2,000	180	9	1,620
18	DuC	2,167	520	12	6,240
21	DuC	3,445	827	12	9,924
22	DuC	575	138	12	1,656
26	asmpn	3,500	840	12	10,080
28	DuC	2,600	624	12	7,488

Sub-total		358,134.5	49,073.3		622,880.4
Administrative overhead (15%)					93,432
Total					**716,312**

Notes
1. asmpn = assumed size of site area
2. AT = Aerial Total count, DiC = Direct Ground Count, DuC = Dung Count, AS = Aerial Sample count
3. Cost/km was derived from costing models for both aerial and ground counts. **See 5.10**
4. Transect Kms were derived from costing models for both aerial and ground counts. **See 5.10**

5.3a Costing of survey equipment - Africa

EQUIPMENT	Q/ Team	Teams	Cost/ Item Per year	Total per year	Lifespan (yr)	6 Years Cost
Camera	1	29	833	24,167	4	36,250
Zoom lens 70mm - 200mm	1	29	500	14,500	4	21,750
Binoculars	1	45	100	4,500	4	6,750
Tape recorder	1	29	217	6,283	2	18,850
One pair parallel metal rods	1	29	33	967	1	5,800
Aerial calibration strip markers	1	29	33	957	1	5,742
GPS	1	45	1,200	54,000	2	162,000
StepSets 400 pedometer	1	16	1,200	19,200	2	57,600
Random number tables	1	45	10	450	1	2,700
Sighting poles	2	16	10	320	1	1,920
Matchetes and file	2	16	10	320	2	960
Surveyors chain/ Topofil	1	16	417	6,667	2	20,000
Backpacks	4	16	100	6,400	2	19,200
Peg markers	2	16	5	160	1	960
Calculators	1	45	40	1,800	2	5,400
Range finder	1	16	417	6,667	2	20,000
Starter tags and transect end tags	2	16	83	2,656	1	15,936
Dark clothing	8	16	80	10,240	0.5	122,880
Lightweight boots	8	16	60	7,680	0.5	92,160
Jerry cans	4	16	6	384	1	2,304
Tape measure	1	45	83	3,750	1	22,500
Hand held VHF radio	2	45	800	72,000	2	216,000
Tents	4	16	300	19,200	2	57,600
Day packs	4	16	10	640	2	1,920
Hip packs	4	16	10	640	2	1,920
Sleeping pads	4	16	10	640	2	1,920
Tarps	5	16	20	1,600	0.5	19,200
Personal compass	1	16	67	1,067	2	3,200
Sighting compass	1	16	200	3,200	2	9,600
Topofil line	1	16	100	1,600	0.5	19,200
Flagging tape	1	16	10	160	0.5	1,920
Pruning shears	1	16	10	160	2	480
Cooking pots	2	16	6	192	2	576
Cooking spoons	2	16	3	96	2	288
Plates	4	16	3	192	2	576
Cutlery	4	16	3	192	2	576
Sub-total				***273,646***		***976,638***
Administrative overhead (15%)				41,047		146,496
Total				**314,693**		**1,123,134**

Notes
1. Q/ Team indicates the number of items of a particular equipment required per survey team.
2. The number of teams is determined by the site survey type, 16 for forest sites and 29 for aerial surveys.
3. Equipment costs and lifespan was determined by supplier quotations, estimates and informed guesses.

5.3b Costing of survey equipment - Asia

EQUIPMENT	Q/ Team	Teams	Cost/ Item Per Year	Total Per Year	Lifespan (Years)	6 Years Cost
Camera	1	15	677	10,155	4	15,233
Zoom lens 70mm - 200mm	1	15	282	4,230	4	6,345
Film	1	15	190	2,850	4	4,275
Binoculars	4	15	279	16,740	4	25,110
Tape recorder	1	15	183	2,745	2	8,235
One pair parallel metal rods	1	15	33	500	1	3,000
GPS	1	15	340	5,100	2	15,300
StepSets 400 pedometer	1	15	70	1,050	2	3,150
Maps	1	15	63	945	2	2,835
Random number tables	1	15	15	225	1	1,350
Sighting poles	2	15	10	300	1	1,800
Matchetes and file	2	15	14	420	2	1,260
Surveyors chain/ Topofil	1	15	105	1,575	2	4,725
Backpacks	4	15	25	1,500	2	4,500
Peg markers	2	15	14	420	1	2,520
Calculators	1	15	35	525	2	1,575
Range finder	1	15	54	810	2	2,430
Starter tags and transect end tags	2	15	12	360	1	2,160
Dark clothing	8	15	41	4,920	0.5	59,040
Lightweight boots	8	15	35	4,200	0.5	50,400
Jerry cans	4	15	12	720	1	4,320
Tape measure	1	15	17	255	1	1,530
Hand held VHF radio	2	15	466	13,980	2	41,940
Tents/mosquito nets	4	15	284	17,040	2	51,120
Day packs	4	15	23	1,380	2	4,140
Hip packs	4	15	23	1,380	2	4,140
Sleeping pads	4	15	38	2,280	2	6,840
Tarps	5	15	32	2,400	0.5	28,800
Personal compass	1	15	92	1,380	2	4,140
Sighting compass	1	15	90	1,350	2	4,050
Topofil line	1	15	100	1,500	0.5	18,000
Flagging tape	1	15	61	915	0.5	10,980
Pruning shears	1	15	14	210	2	630
Field camp furniture	1	15	125	1,875	2	5,625
Cooking utensils	1	15	47	705	2	2,115
Sub-total				***106,940***		***403,613***
Administrative overhead (15%)				16,041		60,542
Total				**122,981**		**464,154**

Notes
1. Q/ Team indicates the number of items of a particular equipment required per survey team.
2. Equipment costs and lifespan was determined by supplier quotations, estimates and informed guesses.

5.4 Costing of data collection and compilation

CO ORDINATION	Q/ Team	Teams	Cost/ Item Per Year	Total
Sub-regional, National and Field				
Africa				
STAFFING				
Sub-regional compilers	1	4	7,031	28,125
National compilers	1	15	7,031	105,465
Site data collection officers	1	45	3,750	168,750
Guard/ Cook	1	45	600	27,000
RECURRENT COSTS				-
Travel and meetings	1	4	18,750	75,000
Telephone, fax and e mail	1	4	2,250	9,000
Africa sub-total				413,340
Asia				
STAFFING				
Sub-regional compilers	1	2	14,000	28,000
National compilers	1	2	3,600	7,200
Site data collection officers	1	15	3,350	50,250
Guard/ Cook	1	15	600	9,000
RECURRENT COSTS				-
Travel and meetings	1	4	18,750	75,000
Telephone, fax and e mail	1	19	2,000	38,000
Asia sub-total				207,450
Sub-total				***620,790***
Administrative overhead (15%)				93,119
Total				**713,909**

Notes for Africa costings
1. The staffing costs were on best estimates adjusted for the current trends.
2. Sub regional compilers were taken at 25% of their time.
3. Data collection officers were taken at 50% of their time.

Notes for Asia costings
1. The staffing costs based on average of estimates from each of the Range States
2. All staff estimated as full time positions.

5.5 Costing of Technical Support and Data Processing Unit and Reporting

CO ORDINATION	Q/ Team	Teams	Cost/ Item	Total
			Per Year	
Central Support Unit				
STAFFING				
Head of unit	1	1	75,000	75,000
Information technologist	1	1	52,500	52,500
Secretarial support person	1	1	26,250	26,250
Statistical consultancy	1	1	20,000	20,000
RECURRENT COSTS				
Travel and meetings	1	1	18,750	18,750
Nairobi telephone, fax and e mail	1	1	12,000	12,000
Reporting	1	1	50,000	50,000
Office rent	1	1	12,000	12,000
Sub-total				***266,500***
Administrative overhead (15%)				39,975
Total				**306,475**

Notes

1. Staffing costs represent cost of employment and were based on IUCN grade structures and adjusted for current trends.
2. Head of Unit likely to be expatriate with Phd qualifications, Grade 11
3. Information Technologist likely to be Grade 10
4. Secretarial support person required to be bilingual, Grade 5

5.6 Costing of capacity building

	Africa	Asia
Number of sub-regional sessions	4	2
Participants per session	15	15
Estimated cost per session	14,500	14,500
Sub-regional sub-total	*58,000*	*29,000*
Number of national sessions	15	2
Participants per session	6	10
Estimated cost per session	4,050	4,050
National/site based sub-total	*60,750*	*10,000*
Total estimated costs	118,750	37,100
Administrative overhead (15%)	17,813	5,565
Sub-Total	***136,563***	***42,665***
TOTAL		**179,228**

1. Costs include

6 sub regional workshops per year employing a specialist consultant for upto a month

	US$	
Fees	*6000*	
Travel and accomodation	*7000*	
Equipment	*500*	
Communication	*1000*	
	14500	*per workshop*

20 national or site based workshops per year

Travel and accomodation	*3000*	
Materials	*50*	
Communications	*1000*	
	4050	*per workshop*

5.7 Sub regional cost breakdown (in a survey year)

	AFRICA				ASIA		TOTAL
	East	**Central**	**West**	**South**	**South**	**Southeast**	
Population Surveys							
Survey costs	*209,592*	*106,775*	*154,423*	*192,634*	*10,329*	*42,559*	*716,313*
Survey equipment	*47,412*	*111,176*	*113,333*	*42,771*	*73,789*	*49,192*	*437,673*
(apportioned directly as incurred)							
Sub total	257,005	217,951	267,756	235,405	84,118	91,752	1,153,986
Data collection and compilation	95,188	154,680	190,376	95,188	107,086	71,391	713,909
(apportioned on basis of no. of sites)							
Technical support and data processing unit and reporting	51,079	51,079	51,079	51,079	51,079	51,079	306,475
(apportioned equally)							
Capacity building	23,897	38,833	47,794	23,897	26,884	17,923	179,228
(apportioned on basis of no. of sites)							
Total	427,169	462,543	557,004	405,569	269,167	232,144	**2,353,597**

5.8 Costing of initial one-off set up costs (USD)

	AFRICA	ASIA
Central Support Unit		
Recruitment and passage of Technical Support and Data Processing Unit staff	115,217	
Telephone equipment	3,500	
Radio communication equipment	3,500	
Acquisition of Nairobi office premises	833	
Document imaging equipment	2,000	
Preliminary administration expenses	1,000	
Nairobi office furniture, fixtures and fittings	10,000	
Stationery corporate identity and initial printing	2,000	
Computers, software and printers	16,667	
Sub regional, National and Field Offices		
Computers and software for site co ordinators	125,000	45,000
Solar power supply units and backups for site co ordinators	90,000	30,000
Computers and printers for sub regional and national compilers	52,833	12,000
Solar power units and backups for sub regional and national compilers	38,000	8,000
Motorscooters for field survey teams		90,000
Sub-total	***460,550***	***185,000***
Administrative overhead (15%)	69,083	27,750
Continental Totals	**529,633**	**212,750**
GRAND TOTAL		**742,383**

Amounts were derived from supplier quotations, estimates and informed guesses

5.9 Estimated overall costs for Years 1- 6

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	*Total*
Set up							
Initial Set up costs	742,383	0	0	0	0	0	***742,383***
Survey Costs							
Survey Equipment	437,674	57,524	366,409	366,409	459,557	60,400	***1,747,972***
Survey costs	716,312		789,735		870,682		***2,376,729***
Refit Costs							
Computer Equipment	0	0	167,407	167,407	0	0	***334,814***
Capacity Building							
Annual training	179,228	188,189	197,598	207,478	217,852	228,745	***1,219,090***
Recurrent Costs							
Annual recurrent costs	1,020,384	1,071,403	1,124,973	1,181,221	1,240,283	1,302,297	***6,940,560***
Total	***3,095,980***	***1,317,115***	***2,646,121***	***1,922,515***	***2,788,374***	***1,591,441***	***13,361,547***

Six Year Total **13,361,547**

Notes

1. Initial set up costs are as illustrated in **5.8 Costing of initial fixed one off, set up costs**
2. Survey costs, see **5.2 Population survey costs**, are done every 2 years and at an increased cumulative cost of 5% pa.
3. The cost of survey equipment, see **5.3 Costing of survey equipment**, is based on lifespan.
4. Refit costs relate to the costs of replacing computer equipment and power sources in Years 3 and 4
5. Annual recurrent costs (data collection, compilation and central co-ordination) increases have been assumed at an average of 5% per annum

5.10 Example Costing Model

Example one

Aerial Sample	**Workings**		
Take the *Garamba* site in Congo Kinshasa with a total area of	15,125	*a*	Given
Determine the sample size at 21% sample intensity	3,176	*b*	21% of 15,125
Determine the number of blocks at ideal 1,100sq.km per block	3	*c*	b divided by 1,110
Determine the flight distance per block at block size/ flight corridor	1,588	*d*	(c times 1,100) divided by 2
Add the flight distance between flight corridors per block	90	*e*	(square root of 1,100) times c
Therefore total flight distance is equal to	1,678	*f*	d plus e
Time in hours	17	*g*	f divided by 100km/ hr
Adjust for dead(transit) time	25	*h*	g times 1.5
Time in days	8	*I*	g divided by three
Determination of cost per kilometre			
Cost of plane hire	6,291	*j*	250 US$ per hour times g
Cost of crew	11,743	*k*	1,400 US$ per day times I
Transport costs to and from base per day	839	*l*	100 US$ per day times *i*
Films and developing costs	336	*m*	20 US$ times survey hours *g*
SRF data analysis	839	*n*	time for analysis = *flight days*/2 , times 200 US$ per day
Total cost of survey	20,048	*o*	Sum *j, k, l, m* and *n*
Therefore cost per kilometre	12		l divided by f
Therefore cost per square kilometre	6		l divided by (c times 1,110)

Example two

Aerial Total Counts	**Workings**		
Take the Kruger National Park site in South Africa with a total area of	19,485	*a*	Given
Determine the number of blocks	18	*b*	a divided by 1,100sq.km
Determine the flight distance per block	9,743	*c*	(b times 1,100) divided by 2
Add the flight distance between corridors per block	549	*d*	(square root of 1,100) times b
Therefore total flight distance is equal to	10,292	*e*	c plud d
Time in hours	103	*f*	(e divided by 100km/hr) times 1.5 dead time
Adjust for dead(transit) time	154	*g*	f times 1.5
Time in days	51	*h*	g divided by 3
Determination of cost per kilometre			
Cost of plane hire	38,594	*I*	250 US$ per hour times f
Cost of crew	72,041	*j*	1,400 US$ per day times g

Transport costs to and from base per day	5,146	*k*	100 US$ per day times *h*
Film and developing costs	2,058	*l*	20 US$ times survey hours *f*
SRF data analysis	5,146	*m*	time for analysis = *flight days*/2, times 200 US$ per day
Total cost of survey	122,985	*n*	Sum *I, j, k, l, m* and *n*
Therefore cost per kilometre	12		k divided by e
Therefore cost per square kilometre is equal to	6		k divided by (1,100 times b)

Example Three

Dung Counts	**Workings**		
Take the *Parc Nat. Tai* site in Ivory Coast with a total area of	8,119	*a*	Given
Determine the sample size at 21% sample intensity	1,705	*b*	21% of *a*
Determine the length of transects at 1km for each 12sq.km	142	*c*	b divided by 12
Time in days at 5 kms a day	28	*d*	c divided by 5 kms a day
Reconnaissance/ preliminary survey	3	*e*	10% of total census time to determine dung transition
Determination of cost per kilometre			
Cost of survey team	4,126	*f*	(US$44 (KWS)per day times 3adjustment factor) times (d plus e)
Transport costs to and from site per survey	100	*g*	US$ 100 per survey
Stationery and other related costs	99	*h*	US$ 33 per survey times a factor of 3
Therefore cost per kilometre	30		(Sum f, g and h) divided by c
Therefore cost per square kilometre	3		(Sum f, g and h) divided by b

Example Four

Total Ground Count			
Take the Dzangha-Sangha site in CAR with a total area of	3,292	*a*	Given
Determine the total transect lengths	274	*b*	a divided by 12km.sq
Time in days	55	*c*	b divided by 5 kms a day
Reconnaissance/ preliminary survey	5	*d*	10% of total census time to determine dung transition
Determination of cost per kilometre			
Cost of survey team	7,967	*e*	(US$44 (KWS) per day times a factor of 3) times (c plus d)
Transport cost to and from site per survey	100	*f*	US$ 100 per survey
Stationery and other related costs per survey	99	*g*	US$ 33 per survey times a factor of 3
Therefore cost per kilometre	30		(Sum e, f and g)divided by b
Therefore cost per square kilometre is equal to	2		(Sum e, f and g) divided by a

b) this monitoring system shall be in accordance with the framework outlined in Annex 1 for monitoring of illegal trade in ivory and other elephant specimens and in Annex 2 for monitoring of illegal hunting in elephant range States.'

The Role of the Standing Committee

4. The Secretariat invites the Standing Committee to decide whether the proposal satisfies the requirements of Resolution Conf. 10.10, as described in paragraph 2 above, and whether it provides the basis for satisfying the requirements of Decision 10.1 and Decision 10.2 for monitoring illegal hunting.

5. In particular, the Standing Committee should consider the attached proposal (Annex 1) and decide on the practical or financial feasibility of the system proposed.

6. Resolution Conf. 10.10 points to the Secretariat as having overall responsibility for the systems for monitoring illegal killing, under the supervision and direction of the Standing Committee. If the Standing Committee agrees that the system proposed is acceptable, the responsibility for further developing and operating the system should be decided upon and the necessary resources provided for its implementation.