Feasibility report for the Re-introduction of African Elephants to Nyungwe National Park, Rwanda

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1. Executive summary

This report has been carried-out as a first step towards assessing the feasibility of re-introducing the African elephant to Nyungwe National Park, Rwanda. This report brings together a large amount of information and expert opinion that needs to be considered when re-introducing elephants to Nyungwe NP. It is stressed that elephant translocations are costly undertakings running into hundreds of thousands of dollars and are dangerous exercises for both the animals and staff involved. The translocations will have strong socio-political implications and these will be felt most by the rural communities living next to Nyungwe NP.

Therefore a decision to re-introduce elephants will have far-reaching consequences and will need to be based as firmly as possible on accurate and up-to-date information.

Next steps

Below are some of the key themes that need to be completed, and the final chapter of this report gives further recommendations that need to be followed.

- All available literature should be consulted. This report contains a large amount of information, but a literature review should be undertaken at the African elephant library which is housed in Nairobi, Kenya.
- A consultation with a team of experts (minimum of two people) possibly from Kenya Wildlife Service should be held. Elephant experts should provide details of possible source populations they feel could be acceptable following conditions laid out in this document.
- Following the selection of potential source populations by the Elephant experts, a budget can be put together based on the transportation methods and numbers of elephants involved.
- Following this, discussions should be held at the appropriate governmental levels between Rwanda and the host country with the source population of elephants, to try to negotiate a donation of the elephants to Rwanda.
- Experts should visit both the source and recipient sites. If the elephants are coming from outside Rwanda, a visit is needed to the source country as well.
- Re-introductions should only be undertaken if the outcomes of the re-introduction sufficiently meet pre-determined conservation objectives.

2. Contents

3. Abbreviations

WCS	Wildlife Conservation Society
HEC	Human-Elephant Conflict
ORTPN	Rwandan Office of Tourism and National Parks
NNP	Nyungwe National Park
VNP	Volcanoes National Park
PA	Protected Area
ANP	Akagera National Park
PAB	Protected Area Biodiversity Program
DNP	Destination Nyungwe Project
USAID	United States Agency for International Development
UNDP	United Nations Development Program
AfESG	African Elephant Specialist Group
IUCN	International Union for Conservation of Nature

4. Definitions

Boma: A fenced-in area where African elephants are kept for an acclimatization period before release into the wild.

Bottlenecked population: A population that has been reduced in size, effectively isolated from breeding opportunities with other populations, and whose remaining breeding individuals are unlikely to be representative of the original population as certain alleles and traits have been lost among the survivors, while others may be under or over represented.

Cow-calf group: A cohesive group of females and their calves led by the matriarch or another older female, which associate regularly and closely with one another over time. Individuals in these groups are believed to have a high degree of relatedness but this has not been established through known genetic identification techniques.

Conservation (of the African elephant): Ensuring the long-term survival of the species in viable populations, in their natural habitat throughout their historical range, while minimizing the loss of gene diversity.

Effective population size (N_e): The size of a hypothetical stable, randomly-mating population that would have the same rate of gene loss or increase in inbreeding as the real population (size N). N_e of a particular population is determined by several parameters describing deviations from "ideal" conditions such as sex ratio and the variance of family size. The effective population size is lower than the census population size (i.e. the population size measured as number of individuals). Typically N_e is 1/10 N or less, particularly if fewer males breed than females.

Enhancement: Addition of individual African elephants to an existing wild population of con-specifics; Also referred to as ***supplementation***.

Founder population: An African elephant population established for re-introduction purposes that is large enough to form the basis of a genetically viable population in the long-term. Long-term genetic viability should be achievable either by having a large population (thousands) with no genetic supplementation or a smaller population (hundreds) with genetic supplementation.

Genetic supplementation: Addition of individual elephants to an existing wild African elephant population in an effort to increase genetic heterozygosity and improve its long-term genetic viability.

Inbreeding depression: The loss of individual reproductive fitness, and thus population vigour and long-term viability, due to breeding between closely related individuals compared to less related individuals.

In situ: Within the historical range of the African elephant.

Intrinsic value: An ethic and philosophic property that an object has simply in itself, independent of attitudes to it or having a value as a means to something else.

Keystone species: A species that has a disproportionate effect on its environment relative to its abundance, and play a major role in determining which species exist in a particular community.

Notifiable disease: A disease that must be reported as specified under national or international law.

Pre-capture monitoring: A study of the elephants in the source population prior to the translocation, which has the objective of identifying the most suitable individuals for the proposed translocation and monitoring of these individuals prior to their removal.

Re-introduction: An attempt to establish a viable population of African elephants in an area of historical range where the species has been greatly reduced or extirpated.

Release site: The geographical point at which elephants are released after translocation within appropriate habitat and range selected to support a viable population of the species over the long-term.

Source population: The population from which the elephants targeted for translocation will be sourced.

Supplementation: see ***enhancement***.

Translocation: The deliberate movement of wild African elephants from one natural habitat to another for the purpose of their conservation and/or management at the source site, release site or both.

Viable African elephant population: A population of African elephants capable of persisting in the long-term (i.e. hundreds of years). Generally speaking, long-term genetic viability should be achievable either by having a large elephant population (thousands) with no genetic supplementation or a smaller population (hundreds) with genetic supplementation.

Wild African elephant population: Free-living elephants, in medium to large areas (>30km^2).

5. Summary

Why do we want to re-introduce African elephants to Nyungwe National Park?

- ✓ Ecological importance – African elephants can be key-stone species, being agents of seed dispersal and / or germination, maintain linkages in the food web, and diversify forest ecosystems.
- ✓ Support national African elephant conservation – we will strengthen the Rwandan African elephant population.
- ✓ Support international African elephant conservation – by returning them to their historical range, we will increase the population of continental African elephants.
- ✓ National pride – restoring an iconic species to its historical range for its intrinsic value and national cultural heritage.
- ✓ Publicity – increasing the profile of Nyungwe and Rwanda globally through publicity associated with the elephant re-introduction.
- ✓ Economic importance – African elephants will enhance the tourism product and will attract more visitors to Nyungwe.

- ✘ Human-Elephant Conflict (HEC) - elephants can destroy crops and / or property and pose a danger to human life in surrounding local communities; such occurrences would cause animosity towards conservation efforts and the National Parks in Rwanda.
- ✘ Insecurity – if the causes of the initial extirpation of the elephants in Nyungwe remain (i.e. poaching), their chances of survival will be compromised.
- ✘ Tourism – expectation management & risks: Nyungwe National Park is large and the chance of viewing an elephant in the next few generations would be unlikely. There is a risk associated with guiding tourists through dense elephant habitat.
- ✘ Ecological impacts - potential negative impacts on the habitat where they congregate.

6. Introduction

6.1 Objectives of this paper

This paper outlines the main themes and issues surrounding the re-introduction of African elephants and describes the protocol to follow in developing a proposal in line with recommendations as described in the IUCN publication:

Guidelines for the in situ translocation of the African elephant for conservation purposes. Dublin et al., 2003.

This paper puts forward the main themes to be considered when re-introducing African elephants to Nyungwe National Park (NNP) and the steps to be taken in writing and submitting a proposal for both approval from the IUCN African elephant specialist group (AfESG) and also to secure financial support from donors.

This paper will also allow managers and decision makers to understand the rationale and justification for a possible elephant re-introduction as well as the potential technical challenges. Past experiences have shown that the re-introduction of African elephants is an expensive, complex, difficult and possibly hazardous (both for the individual animal and staff involved) procedure.

Issues surrounding the re-introduction of African elephants to NNP are extensive and require consideration of a number of factors. The level of complexity increases with the number of elephants to be moved and if they are moved across international borders.

In the case that ORTPN decide that African elephants are to be re-introduced to NNP, this paper will be incorporated into a formal proposal to be submitted to the IUCN AfESG and also to potential donors in order to develop a strong proposal and avoid adverse consequences to both humans and elephants.

6.2 Elephant translocations to Nyungwe NP - Primary considerations

Before deciding to invest time and resources into writing a proposal to re-introduce African elephants into Nyungwe National Park, the reasons and objectives for the re-introduction need to be thought about carefully.

Decision-makers need to weigh the advantages and disadvantages of elephant re-introductions in light of other possible options. The decision can have far-reaching consequences and needs to be based as firmly as possible on sound information. This demonstrates the need to have as much accurate and up-to-date data as possible. Elephant translocations are costly undertakings running into hundreds of thousands of dollars. Although the exact costs vary tremendously from country to country and region to region, it is recommended to carefully consider the monetary costs of elephant translocations vis-a-vis the expected benefits before deciding whether such operations are the most appropriate way of using scarce conservation resources.

The re-introduction of elephants to Nyungwe NP should be appropriate with respect to the following:

- ✓ National biodiversity strategy.
- ✓ Existing conservation strategies (or management plans) in both the source, and release sites.
- ✓ The long-term conservation objectives for any other important elements of biodiversity in Nyungwe NP (plants, animals or habitats that may be adversely affected by the reintroduction).
- ✓ Existing national elephant conservation or management strategy.
- ✓ Biological, social and ecological requirements of the African elephant.
- ✓ Political considerations at local, national, regional and international levels.
- ✓ Social considerations of relevant stakeholders at both the source and release sites.
- ✓ Available capacity and resources to carry-out such an initiative.
- ✓ All potential post-release related management issues have been considered and budgeted for.
- ✓ All relevant governmental bodies have been informed and had the opportunity to participate in the decision process.
- ✓ Any other higher level conservation considerations have been taken into account.

The translocation and reintroduction of elephants should only be implemented once all the above conditions are adequately met.

Under certain conditions, IUCN AfESG will NOT recommend translocation and oppose the re-introductions of elephants. Circumstances in which this may be the case are summarised below:

- ✘ There is NOT a strong argument that the translocation will contribute to the higher-level conservation objectives in the source or release site.
- ✘ The translocation is in conflict with the higher-level conservation objectives in either the source or release sites.
- ✘ The reintroduction of elephants could lead to, or directly contribute to, the extinction of any species of flora or fauna in the release site.

- ✘ The proposed translocation is not technically feasible (e.g. the source site is a heavily forested area with steep terrain and inadequate access, rendering translocation an unrealistic option).
- ✘ The translocation is in violation of national or international disease control regulations *(office international des Epizootie)*.
- ✘ Tuberculosis (*Mycobacterium tuberculosis* or *M. Bovis*) is maintained in the wild population of the source site, but not in the release site.
- ✘ There is war or civil instability in areas adjacent to or impacting the release site.
- ✘ There are unsustainable current levels of illegal killing of elephants in the release site.
- ✘ The habitat in the release site is inadequate for translocated elephants.
- ✘ Removal of elephants would leave the source population unviable.
- ✘ The elephants targeted for translocation are comprised of lone females or calves and juveniles that have been intentionally removed from their natal cow-calf groups.
- ✘ The translocation involves the movement of known problem elephants into areas where these problems are likely to persist.
- ✘ The translocation means the movement of elephants to a release site where there is a likely risk that they will move back to the source site.
- ✘ Neighbouring communities at the source or release site oppose the translocation as planned.
- ✘ The translocation is in violation of international trade regulations allowed under the listing of the species in Appendix I or II of CITES.

Furthermore, based on the current knowledge of African elephant genetics and taxonomy, re-introduction or translocation should not take place:

- ✘ Between forest, savanna or hybrid populations.
- ✘ Between West African populations and any other forest, savanna or hybrid populations.
- ✘ If the source population is not sufficiently large.
- ✘ If all the founder animals are largely from a bottlenecked source population.

In addition, the translocation operation should be halted, delayed or cancelled even once embarked upon, if one or more of the above factors become apparent.

If none of the factors above apply, a proposal for re-introduction or translocation can be drafted. The proposal should include personnel to be involved, budget expectation, time frame, funding sources, the source elephant populations and results of social and ecological studies to support the proposal. The proposal should follow the outline of this document and be submitted to the IUCN AfESG. Authorizations from both source and release sites would need to be added as appendices in the proposal.

On receiving a successful proposal, the IUCN AfESG will issue a statement if re-introduction guidelines have been followed and the re-introduction conforms to IUCN accepted standards.

6.3 Context of African elephant re-introductions in modern day conservation

Modern day conservation is concerned with finding solutions to meet the growing needs of the planet's human population that do not sacrifice the natural world. The human population has doubled over the past 50 years and is set to climb towards 10 billion during the next half a century. This is coupled to a world economy that is projected to double or triple over a similar time frame. These elements place enormous pressure onto the world's remaining natural resources and the global conscience is awakening to this fact. The environment is now among the top agendas in global politics and pressure is mounting to reverse the ecological crisis that man is affecting on the planet. It has been estimated that we are losing between US$ 2 to 5 trillion worth of natural capital in ecosystem services each year and the 2008 IUCN red list states that at least a quarter of the world's mammal species (1,141 out of a total of 5,487) are now at risk of extinction.

With the burgeoning pressures on the natural world, it is encouraging to hear that the world's largest living terrestrial mammal, the African elephant has not only survived, but due to widespread conservation successes, its overall population size is now increasing. Although African elephant populations continue to decline in parts of their range (central and west Africa especially), recent conservation successes with better protection and controlling the poaching of these animals in Eastern and Southern Africa, has led to a general increase in the number of elephants (Blanc *et al*., 2007). The African elephant is one of the few animals in the 2008 IUCN red list whose risk status has actually been lowered from *Vulnerable to extinction* status to *Near threatened* (IUCN, 2008).

The African elephant holds an iconic status in man's psyche of the natural world, and has huge economic, cultural and ecological values. Their two elongated incisors composed of ivory have been coveted by humans for hundreds of thousands of years, and ivory has played a significant role in the art and culture of many people (Ross, 1993).

The main threats to African elephants across the continent today are:

- Habitat loss and fragmentation
- Human-elephant conflict
- Poaching for meat and ivory
- Negative localized impacts of elephants on their environment.

The relative importance of these issues varies considerably across countries and regions, but finding solutions to these problems are the most pressing issues in elephant conservation today.

6.4 The African elephant - a brief overview

The African elephant currently occurs in 37 countries in sub-Saharan Africa (IUCN, 2008). Its range is diverse, and individuals can move between a variety of habitats (Lausen *et al*., 1978). It is found in dense forest, open and closed savanna, grassland and the arid deserts. It is also found over wide altitudinal and latitudinal ranges – from mountain slopes to oceanic beaches, and from the northern tropics to the southern temperate zone. Although large tracts of continuous elephant range remain in parts of Central, Eastern and Southern Africa, elephant distribution is becoming increasingly fragmented across the continent. The quality of knowledge available on elephant distribution varies considerably across the species' range. While distribution patterns are well understood in most of eastern, southern and west Africa, there is little reliable information on elephant distribution for much of central Africa. Elephants are known to have become nationally extinct in The Gambia, Mauritania, Burundi and Swaziland. They were later re-introduced to Swaziland in the 1980s and 1990s.

A note on African elephant taxonomy...

There is currently no consensus in the scientific community as to the number of extant elephant species in Africa (Debruyne, 2005). It is suggested that over the past ½ million years 35 elephant species have become extinct in Africa, leaving only the one species today (*Loxodonta africana*).

The radiation in elephant evolution has been attributed to the manner by which elephants adapt to particular ecological conditions. Long-maintained family traditions in different habitats lead to the evolution of elephant sub-populations. These populations can show consistent characteristics in size, ear shape, limb proportions, skull and tusk shape, number of nails, skin texture and colour. Modern taxonomy suggests that the sub-species of the savanna elephant *Loxodonta africana africana*, and the forest elephant *Loxodonta africana cyclotis*, may in fact constitute two separate species, namely *Loxodonta africana* and *Loxodonta cyclotis*. In addition there may be a third species in west Africa inhabiting both savanna and forest habitats (Eggert *et al*., 2002; Roca *et al*., 2001; Roca *et al*., 2007).

Recent studies have suggested that the demographic history of African elephants is complex, due to multiple refugial lineages and recurrent hybridization among them so as to render a simple forest / savannah elephant split ineffective in modern African elephant populations.

Due to the on-going nature in this field of work and as of yet no clear consensus, the IUCN AfESG currently treats African elephants as a single species. Following this precedent, this report will also adopt this current nomenclature.

Elephant numbers have been decimated over the past few hundred years, due to the commercialisation of hunting for ivory and degradation of their habitat by an increasing human population. Current total African elephant numbers are thought to be around 500,000 individuals and although there are no credible estimates for a continental population prior to the late 1970s (estimated at 1.3 million), it has been modelled that there may have been a crude pre-colonial population estimate of approximately 27 million African elephants based on carrying-capacities (Milner-Gulland et al., 1993). The greatest threat to the African elephant is continued habitat destruction and degradation, although regional populations particularly in central Africa suffer from illegal hunting.

A note on the Ivory trade debate...

An issue of contention is the legalization of the international trade in ivory. The ban was issued by CITES (The Convention on International Trade in Endangered Species) in 1989 to deal with years of unprecedented elephant poaching. During the 1980's elephant populations were decimated from 1.3 million to 600,000 individuals, with countries such as Kenya losing 85% of their elephant populations. In 1997, the African elephant was moved from CITES appendix I to appendix II, allowing some trade of the animal or its products but still under strict regulation. This was followed in 1999 by the first legal sale of ivory in a decade, in which Botswana, Namibia and Zimbabwe sold 50 tonnes of ivory to Japan, the only country which met requirements for import at the time. Ivory stockpiles sold were obtained from culling, problem animal control, or from animals that died of natural causes. The sale raised an estimated US$5 million. No more sales were permitted for another 10 years.

In October 2008, a second one-off sale occurred between the same countries with the addition of South Africa also selling their ivory stocks and China joined Japan as the sole buyers. Zambia applied for permission from CITES to sell its ivory stock piles, but was refused, as it showed insufficient control over illegal elephant killing. In total Namibia sold 7.2 tonnes, Botswana 44 tonnes, Namibia 9 tonnes, South Africa 51 tonnes and Zimbabwe 4 tonnes. The sale price averaged US$142 / kg and a total of US$15 million was raised. There is now a 9 year moratorium on the commercial sale of ivory.

Concerns with the legalization of the international trade in ivory include arguments covering economics, ethics, animal welfare, ecology and market forces. Opponents to the trade are generally based within the eastern and central African block and argue that any legal ivory market will encourage elephant poaching and make it easier for illegal tusks to be sold. Based within countries with high levels of elephant poaching, and a low capacity of trade controls, conservationists in these areas see any trade as sending a message to poachers and traffickers, who will think the trade is opening up. Secondly, any legal trade could act as a cover for the illegal trafficking of ivory. This illegal trafficking is in fact larger than any one-off sales and research has suggested that in one year between 2005 to 2006, illegal trafficking of ivory out of Africa accounted for an estimated 250 tonnes of ivory, from 38,000 illegally killed elephants (Blanc *et al*., 2007).

Proponents for a limited trade generally stem from southern Africa, where conservationists argue that their elephant populations are healthy and well managed, with any funds raised through these sales further supporting elephant conservation projects. Furthermore the majority of elephant populations live outside protected areas, and therefore come into direct conflict for land with an expanding human population. Elephants are a natural resource to be used by poor rural communities who can benefit financially by managing their local populations through sustainable harvesting and the sale of elephant products.

Therefore both arguments have justification, and the future will depend on adaptive policies, and strong enforced legislation to benefit the African elephant population across the entirety of its range.

6.4.1 Social structure and behaviour

African elephants live in a fluid and dynamic social system in which males and females live in separate, but overlapping spheres (Douglas-Hamilton, 1972; Martin, 1978; Moss, 1977, 1981; Moss *et al*., 1983; Hall-Martin, 1987; Poole, 1994). Neither sex is territorial, although both utilise specific home ranges during particular times of the year (Moss *et al*., 1983; Hall-Martin, 1987). Related females and their immature offspring live in tightly knit matriarchal family units (Buss *et al.*, 1976), while males live a more solitary independent existence with few social bonds (Martin, 1978; Moss et al., 1983). In forests systems, such families may include no more than one or two offspring, whereas in savanna systems these family units may be up to 30 individuals. Female elephants are not able to conceive until 8 years old (20 at latest), but once they become mothers they quickly become unit leaders or 'matriarchs'. Dominance is not a large feature in female groups, but age, size and health determine the matriarch in large family groups. Very aged or permanently disabled females are often forced to drop out of their groups. Closely related matriarchal groups in the same vicinity maintain frequent and friendly meetings for many years and these associations have been called 'bond-groups' or 'clans'.

Males are driven out of the matriarchal family units at about 10-14 years of age. Thereafter they may join up with other males, but tend to choose partners that are substantially younger or older than themselves to give an informal linear hierarchy. Adult males exhibit a period of heightened sexual and aggressive activity known as musth (Poole et al., 1981; Poole, 1987; Hall-Martin, 1987). During musth periods males leave their bull areas in search of oestrus females. During this time they are likely to be found alone or in association with groups of females (Poole, 1987). The musth periods of older males can last several months and occur at a predictable time each year. By contrast, the musth periods of younger males are short and sporadic, lasting a few days to a few weeks (Poole, 1989).

Most elephant populations do not exhibit a pronounced breeding season although the occurrence of oestrus and conception is often sensitive to rainfall and resource availability. The degree of this seasonality varies from population to population, and the seasonality of male musth periods reflects that of the females (Poole, 1987; Hall-Martin, 1987).

Elephants are born after a gestation period of 21.5 months and the sex ratio at birth is 50:50. Mean calving interval varies between populations from 2.9 to 9.1 years, with high density populations or otherwise nutritionally stressed populations exhibiting longer intervals (Laws et al., 1968, 1975; Eltringham, 1977). Females between the ages of 14 to 45 experience the highest fecundity. Calf mortality is highest in the first 12 months of life, and is generally low after this age (Lee et al., 1986). The calves of younger and older females experience higher mortality rates than middle-aged females. Experience of the mother, her rank within the family and her general physical condition all affect calf survival (Shrader *et al*., 2006).

Elephants communicate with one another using numerous sounds (Berg, 1983; Poole *et al.,* 1988; Poole, 1994) and scents (Buss *et al,*. 1976; Adams *et al.,* 1978; Rasmussen *et al.,* 1982; Poole et al., 1989) as well as numerous ear, trunk and body postures. Elephants communicate vocally using a wide variety of sounds, from the higher frequency screams, trumpets, snorts and bellows to the lower frequency rumbles which contain components below the level of human hearing. The ability of elephants to produce these very low frequency sounds means that they are, theoretically able to communicate with one another over distances of 5-10km, even in thick forest (Poole *et al.,* 1988).

Females use some 22 different vocalisations while males use only seven; only three of these calls are made by both sexes. It appears that most of the female vocalisations are related to family/group dynamics, cohesion and protection, while the few male vocalisations are primarily related to male - male dominance or reproduction (Poole, 1994).

6.4.2 Elephant ecology

Elephants have a major influence on most vegetation communities they inhabit. They are bulk feeders, consuming about 5% of their body weight (i.e. up to 300 kg) in 24 hours but digesting only 40% of what they consume. They can cause local disappearance, or the selective survival and dispersal of particular plants and plant communities. Generally they eat both grass and browse, taking them in different and changing proportions by season. Trees may be felled to obtain out-of-reach fruits, leaves, pith or branches, but also social behaviours also account for tree-felling in young males. Due to this capacity to modify their surroundings, elephants can be considered architects of the habitat and can be considered as key-stone species.

Environmental factors affect elephant population dynamics, home range, migration patterns, diet, group size and composition, all of which can vary tremendously, in turn influencing the dynamics of elephants and their habitats. An elephant's diet may include grass, herbs, bark, fruit and tree foliage. In savanna habitats grass may make up 70% of the elephants' diet in the wet season, with larger proportions of browse contributing to their diet as the dry season progresses. In tropical forest, the diet may include as many as 230 species with leaves, twigs, bark and fruit constituting over 90% of all items eaten (White *et al.,* 1993). Trees represent up to three quarters of the species fed upon and in contrast to savanna elephants, fruit is an important component of a forest elephant's diet (White *et al.,* 1993; Alexandre, 1977). Studies have also shown the ecological importance of elephants as agents of seed dispersal (Alexandre, 1977) increasing habitat mosaic in forests (Kortlandt, 1984) and diversifying forest and mammalian communities (Western, 1989). As a keystone species, elephants play a crucial role in maintaining linkages in the food web, and their extermination from some habitats may cause a cascade of change or extinctions in ecosystems.

In situations where African elephant natural movement is restricted such as by human expansion, elephants alter traditional migration patterns and concentrate in protected areas (Western, 1989; Tchamba et al., 1992; Poole *et al.,* 1992). At high densities, particularly where they have been compressed into fenced protected areas, elephants can equally reduce biological diversity (Western, 1989).

6.4.3 Home range and Migration

Elephant home ranges vary from between populations and habitat types. Individual home ranges can vary from 15 to 3,700km^2 (Douglas-Hamilton, 1972; Leuthold, 1977; Thouless, 1995). In most areas where they have been studied, females live in predictable wet season home ranges, but migrate over large areas during the dry season (Leuthold *et al.*, 1973; Leuthold, 1977; Western *et al.*, 1984). Moving singly or in groups of up to several thousand, elephants may travel as far as 75km in a few days (Leuthold, 1977). They may live at densities as low as 0.024 per km^2 (Poche, 1974) or as high as 5 per km^2 (Douglas-Hamilton, 1972). Historically, elephants migrated over long distances throughout their range but increasing human pressure for land has restricted elephants to smaller and smaller protected areas. With no allowance for seasonal migration elephant population management is often required to limit accelerated habitat destruction and an overall loss of biodiversity in protected areas.

6.5 A short history of African elephant translocations

IUCN states that translocation is a powerful tool in the management of the natural environment and when properly used offers great benefits to natural biological systems and to man, but if misused has the potential to cause enormous damage (IUCN, 1987).

The practice of moving African elephants for management and reintroduction purposes was first carried out in South Africa in the 1970s. Kruger NP has witnessed an elephant population increase from approximately one hundred individuals in 1898 to approximately 6500 individuals in 1967 (Pienaar, 1963, 1967). The elephant population has now increased to over 13,000 individuals. Due to this increasing elephant population, in the 1970's a management decision was taken to begin managing the elephant population by culling. Alongside the culling programme seven orphaned juvenile elephants (a young animal whose mother was either destroyed or who was not translocated) were translocated from Kruger NP to Londolozi NP in 1976 (Fairall, 1979). Heavy lifting machinery to move adult elephants was not yet introduced until many years later. In 1997, South African National Parks (SANP) made a policy decision not to carry out anymore translocations of juvenile elephant groups, and the practice of breaking-up family groups is now considered inhumane by SANP (Whyte *et al*., 1999). Since 1976 culling and translocation programmes have been practiced throughout southern African parks in an attempt to control the elephant population, and currently more than 2000 elephants have been moved out of Kruger NP (Kruger National Park Database, 1996).

The domestic demand for translocated elephants in South Africa has now been mostly satiated, and park authorities have been looking at opportunities to translocate elephants to neighbouring countries. In 2001, 16 African elephants comprising of cow-calf groups were transported by air to Angola, and in 2008 160 elephants were donated by the South African Government to Lusenga Plains National Park in Zambia.

In East Africa several elephant translocations have occurred in Kenya, and one in Uganda. Kenya has seen elephant movements between many PAs, with translocations between Mwea NR to Tsavo East NP, Lewa Downs Conservancy to Kora NP, from Mwaluganje Forest Elephant Sanctuary to Tsavo East NP and from Shimba Hills NR to Tsavo West NP. In 2005 the largest single translocation of 400 elephants was carried out from Shimba hills NR to Tsavo East NP (Njumbi *et al*. 1996; Litoroh *et al*., 2001; Omondi *et al*., 2002).

In 2001 four elephants were moved in Uganda from the Luweero Valley where they were living amidst human settlements to the Murchison Falls NP. The operation was carried out by UWA with technical assistance provided by KWS. Finance for this operation was provided by IFAW who donated US$97,000.

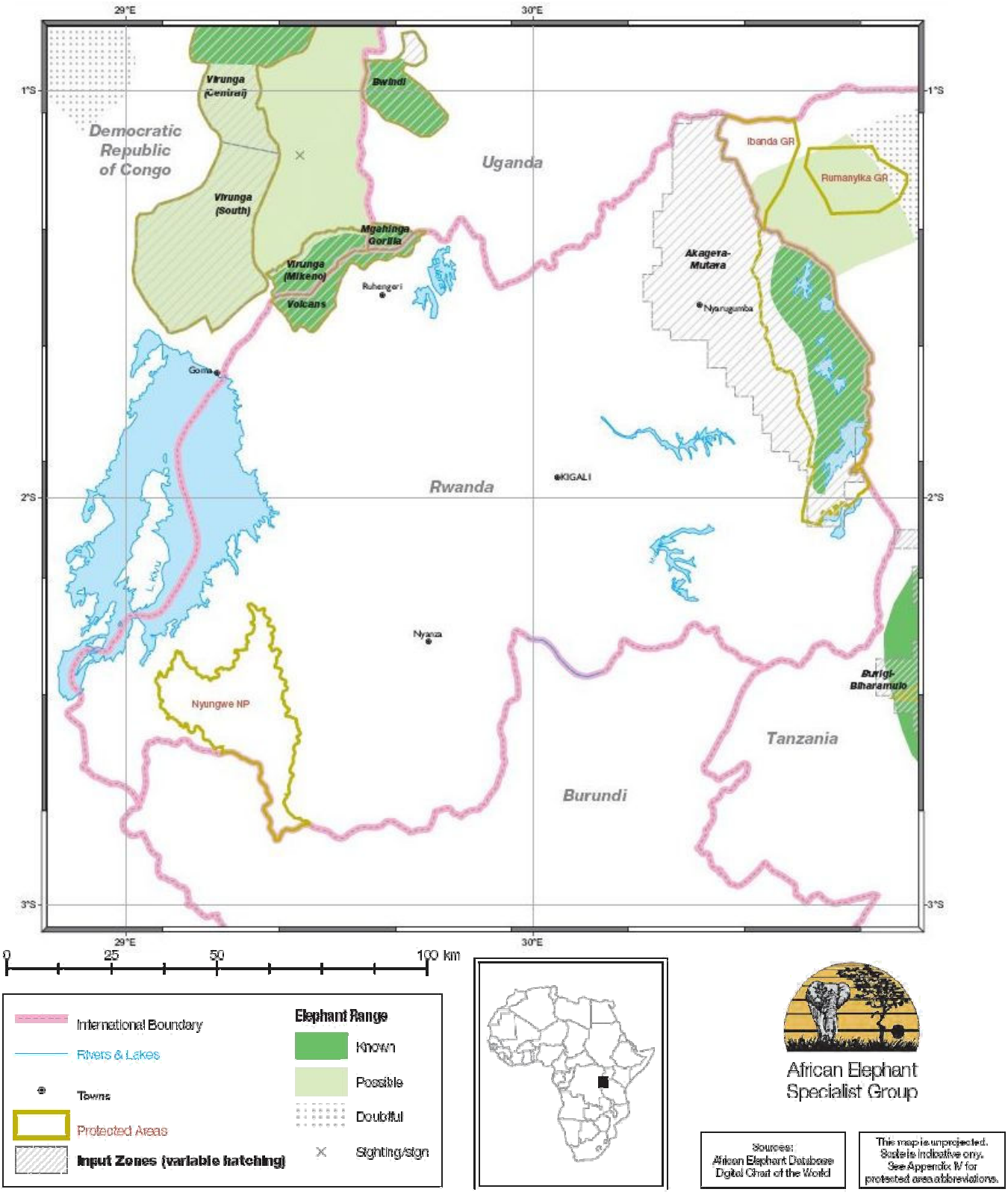
{{ …The IUCN/SSC African Elephant Specialist Group (AfESG) holds the view that the primary objective of any and all re-introduction and supplementation of African elephants through translocation should be to promote viable, free-living populations in the wild, i.e. to contribute to the conservation of the species in the long-term…}}

The practice of elephant translocations is now so well managed in some countries that in 2008 a group of tourists paid US$9000 each to participate in the capture and translocation of 40 elephants in Malawi. However despite following best practices some mortalities as a result of translocation still occur, and information collected from over 1000 translocated elephants in eastern and southern Africa show a mortality rate of 3% on average.

6.6 Rwanda's elephant population

Rwanda's elephant population is small and fragmented while its human population is dense and widely distributed. Rwanda is one of Africa's smallest nations (26,340 km^2), but one of the continent's most densely populated with a population of 9.7 million people. Rwanda has 9% of its surface area in designated PAs and the range area of elephants is currently at 1,014km^2 (4%) of the surface area. The possible range of elephants inside the PAs is 100%.

Map of Rwanda showing elephant populations (from Blanc et al., 2007)



Historically, elephants occurred at low densities throughout Rwanda albeit in small fragmented patches. In 1950 the territory of Ruanda-Urundi (the Rwanda and Burundi of today) was estimated to have some 800 elephants (Blanc *et al.,* 2002). By 1973 there may have been roughly 300 elephants remaining (Blanc *et al.,* 2002), half of which were found in un-forested areas. As human populations grew, human-elephant conflict (HEC) reached such a high level that, in 1975 the Rwandese Government commissioned professional hunters and trappers to eliminate all adult elephants and un-weaned calves in high profile conflict areas and to translocate as many of the remaining juveniles as possible to the southern sector of Akagera National Park (ANP). A total of 126 animals were shot and 30 captured. Of the latter, 26 were translocated to ANP (Haigh *et al.,* 1979; Blanc *et al.,* 2002).

Today there are three IUCN category II protected areas in Rwanda: Nyungwe NP (1013 km^2), Akagera NP (1085 km^2) and Volcanos NP (167 Km^2). Volcanos NP is situated in the north western corner of Rwanda and forms part of a trans-boundary park with Virungas NP in DRC and Mgahinga Gorilla NP in Uganda. Akagera NP is located in the east of Rwanda and borders Tanzania. Nyungwe NP lies in the south-west of Rwanda and forms a trans-boundary park with Kabira NP in Burundi.

There are elephant populations in two of the protected areas, ANP and VNP. In VNP a point transect dung survey conducted in 2003 returned an estimate of 89 elephants for the entire Virunga-volcans range. Elephants in the VNP are part of a single trans-boundary population that includes the Mgahinga Gorilla NP in Uganda and the Mikeno sector of Virunga NP in the DRC (Owiunji *et al*., 2004). The estimate of 89 could in theory be split between the three parks in proportion to area, to giving a figure of 37 elephants for the Volcanos NP (Blanc *et al*., 2007). This figure is categorized as an *informed guess* following Blanc *et al*., 2007.

ANP is part of a wider Akagera – Mutara landscape and the best estimate for this NP is of 34 individuals categorized as an informed guess (Lamprey, 2002; Karidozo *et al*., 2008). The ranger based monitoring programme has suggested there are more than 100 individuals split into two groups, but the accuracy of this estimate is unknown (Kukiye per. Comm., 2008). Elephants used to move between ANP and Ibanda, Burigi and Biharamulo in Tanzania, but their passage is now restricted by high levels of settlements on the Tanzanian side.

The Rwandan elephant population is currently small and fragmented and found in PAs that are surrounded by dense and widely-spread human settlements. HEC is prevalent in the surrounding areas of ANP and farmers in this area are calling for the enactment of laws to address the problem of crop raiding (Blanc *et al*., 2007).

6.7 Nyungwe National Park

6.7.1 History of its protection

NNP (2°15' – 2°55' S, 29°00'– 29°30' E) was first gazetted as a forest reserve in 1933. However, this status did not prevent people from utilizing the forest with gold miners beginning extraction in 1935. Following the introduction of alluvial mining techniques by the Belgian colonial administration, there were an estimated 3,000 Rwandan miners working in the Nyungwe watershed in the 1950's (Fimbel *et al.,* 1994). Alongside the gold miners, the forest was used for a wide range of activities including honey collection, wood cutting, hunting of animals, and small scale agriculture. These human activities and encroachment by farmers reduced the size of the park from 1141 km^2 to 971 km^2 (Weber, 1989). In 1967 the Swiss technical assistance program focused on the forestry sector in Rwanda and initiated a pilot project along the northern edge of Nyungwe Reserve. They established buffer plantations of pine trees and constructed sawmills and also placed an emphasis on protecting the remaining natural forest. In 1984, the Rwandan Ministry of Agriculture, with funds from the Swiss government, completed a management plan with the emphasis to ensure the conservation of the forest by subdividing it into zones of different utilisation. Pine plantations were planted on the edges of the forest to mark the boundaries of the forest reserve and to act as buffers between local communities and the interior of the forest.

In 1985, the New York Zoological Society (now the Wildlife Conservation Society, WCS) began working at Nyungwe. WCS carried out surveys and initiated research on the fauna and flora in the forest. The initial assessment phase noted that Nyungwe's terrestrial mammal fauna had been depleted by hunting, but that primates were still abundant and that the primate community was exceptionally species rich with at least 13 species existing in the reserve (Vedder, 1988). Over the following years, WCS staff installed an extensive trail system and built modest tourist facilities within the park and commenced an education program for the local communities.

Unfortunately, the violence that engulfed Rwanda in early 1994 resulted in the destruction of many of the infrastructures developed and put an end to tourism at Nyungwe for the remainder of the decade. In 2005 Nyungwe was gazetted as a National Park and came under management of the Rwandan Office of Tourism and National Parks (ORTPN). Currently there is substantial investment in tourism infrastructures and development in NNP, to increase the profile of the park, and to attract international tourists. There are currently four investors building tourist accommodation around NNP, as well as a canopy walkway, interpretation centre and birding platforms under construction.

6.7.2 Biological richness

NNP is one of the most biologically important montane rainforests in central Africa (1600-2950m ASL). In conjunction with the contiguous forest in Kibira National Park in Burundi, NNP forms one of the largest blocks of lower montane forest in Africa (Plumptre *et al*., 2002; Weber, 1989; Vedder *et al.*, 1992). Because it is so large and located at these altitudes, NNP represents a key area for rainforest conservation in central Africa.

NNP forms part of the Albertine rift, the western branch of the Great Rift Valley. The Albertine rift stretches from the northern end of Lake Albert down to the southern end of Lake Tanganyika and encompasses the forests, savannahs, wetlands and mountains to be found in the rift and on the adjacent escarpment in Uganda, Rwanda, Burundi, Tanzania and Democratic Republic of Congo. This area of Africa contains 40% of all bird species and 25% of all

mammal species on the African continent. Many species are endemic to this part of the world and it has been identified as being of global conservation importance by several global priority setting exercises including being classified as an endemic bird area, eco-region and hotspot (Butynski *et al*., 1997; McNeilage *et al*., 1998; Omari *et al*., 1999).

NNP supports more than 260 species of trees and shrubs (Dowsett, 1990), including at least 24 that are believed to be endemic to the Albertine Rift. It is also one of the most important sites for bird conservation in Africa with a total of 260 bird species, 25 of which are endemic to the Albertine Rift. Thirteen species of primates are known to inhabit the forest, including chimpanzees (*Pan troglodytes schweinfurthii*), owl-faced guenons (*Cercopithecus hamlyni*) and Angolan black and white Colobus monkeys (*Colobus angolensis ruwenzorii*), the latter living in groups of more than 300 individuals (Plumptre *et al*., 2002).

The forest at Nyungwe is interrupted by two large swamps, Kamiranzovu and Uwasenkoko. Kamiranzovu swamp covers approximately 13 km^2 and is one of the largest peat bodies in Africa (Hamilton, 1982). Temperatures at Nyungwe are generally cool with an average minimum temperature of 10.9° C and an average maximum temperature of 19.6° C (Sun *et al*., 1996). The mean annual rainfall of 1,744 mm (Sun *et al*., 1996) is typical for an African rainforest. A major dry season occurs between July and August and a minor dry season takes place between December and January. A recent analysis of the phenological patterns at Nyungwe over a two-year period found that fruit production peaks between March and May, leaf flush peaks in July and August, and flower production peaks in December and January (Sun *et al*., 1996).

6.7.3 Elephants in Nyungwe NP

Elephant data for Nyungwe NP is poor due to the low elephant population since the 1970's onwards and the eventual extirpation of elephants in the late 1990's. Dr. Jean Pierre Vande Weghe, a medical doctor who worked in Kigali and a keen natural historian provided the following detailed commentaries made during 300 hours of personal observations made in Nyungwe forest between 1970 and 1985:

{{ .... These elephants (in Nyungwe) were savanna elephants, and in the 1950's they used to migrate between the Rusizi plain in Burundi and the Nyungwe-Kibira forests (according to Francis Verhulst who was an official gold prospector in the area just after World War II)....They were cut-off from the Rusizi plain somewhere around the independence of Rwanda (1962).

They were seen around Kamiranzovu, but much more on mount Bigugu (up to the summit at 2950 m), in the Tangaro and Nyungwe valleys, in the area around Gisakura, in a swamp and grassland east of mount Bigugu, and in the bambou-Podocarpus forests south of Rwasenkoko, down to the Burundi border..... Probably they could be found over a large part of the forest.

At that time the forest was considered very dangerous, just because of the elephants, and many people never ventured into it. I saw groups of up to 40-50 animals. They spent a lot of time in Ficalhoa-Faurea ridge forest where they had wide trails bordered with countless fallen trees. They were also using Cyperus swamps, open mountain grasslands, bracken and heath, open Macaranga forest, swamp forest....In fact they used a great diversity of habitats....}}

This idea of the Nyungwe elephants being widespread and also dangerous is re-iterated in a study undertaken in 1992 by the Projet Conservation de Foret de Nyungwe (PCFN) and the African Ele-fund. Interviews were carried out by Rowena Lloyd with four local community members (Jean Nyagasimba, Cornel Uworoheje, Froduald Barahinyura,

and Paul Bitorwa). These informants had knowledge specific to the elephants in Nyungwe and direct experience of hunting the elephants (PCFN, 1992):

{{.....Up until 1976, elephants inhabited almost every part of the forest. They followed set routes via Gasere, Mubaga, Kugashyi, Kibugazi, Shave, Giberoa, Kinyange, Kanyirabusani, Bigugu and Kamiranzovu. Every where they foraged large clearings were left. They moved a great deal in search of food and springs.....and were important in forming the present landscape of the forest....

....The oldest informant remembered seeing groups of 30 -50 animals at any one time. The males had long tusks (1.5m visible), whereas the females had tusks of 1m. The bulls were usually in groups of 4 or 5, being about 3m in height. The ears were rounded, and conformed to the shape and size of the Loxodonta cyclotis.....

...When elephants existed in large numbers they were highly aggressive, charged and attacked frequently on sight of people...the relic Kamiranzovu population was timid and afraid of people, having withdrawn to the marsh to shelter from human aggressors...}}

The Hunters interviewed in 1992 also provided detailed descriptions of their hunting practices:

{{ ....Hunters used spears, dogs and traps. Traps were made by digging trenches 3m deep and approximately 2.5m square. Twa used spears (without poison) which would often cause the elephants to retreat without dying. The Hutu did not use the hide and most of the carcass was left to decay, carrying as much meat as possible.

Initially it seems that poachers hunted elephants only for the King (Mwami) up until the 1960's. They gave the meat to the Twa as tribal lore prevented the Hutu eating the meat believing it was bad for the health. By the 1950's they began to realise the fallacy of this (the Twa surviving!) and also began to eat the meat.

The Hutu were under obligation to bring the king the tusks. The men state that the economical importance of ivory was unknown to them at this time. By killing an elephant, you won the favour of the king and won bullocks as payment. The king used them as decorations. It was believed that the elephant was the king of the forest and thus the obligation was to bring the tusks to the "king of the men". He also collected trophies such as leopard skin. Although the men did not know what the ivory was used for, tribal lore stated that the ivory gave power or maybe medicine.....}}

The Hunters interviewed in 1992 also provided detailed descriptions of local communities towards elephants:

{{ ....It seemed that elephants did not pose any real disadvantages to the villagers....They crop-raided, but rarely. Loxodonta came into the village at night, damaging maize and bananas but by 3am had begun to travel back quickly. The villagers state that the animals are "intelligent" because they never came far out of the forest and always made their way back quickly and before dawn. The villagers took no precautions against this as it occurred maybe only once a year....}}

On the subject of the illegal hunting of elephants, and their eventual extirpation from NNP, Dr. Jean Pierre Vande Weghe noted:

{...Many elephants were killed in the late 1960's and early 1970's... In the early 1970's there were an estimated 150-200 elephants in the Nyungwe forest. Thirty elephants were killed in the Bushoro area (south of the Nyungwe valley), and at least ten were shot near Gisakura when the Gisakura tea estate was planted. Around 1974-1975, the elephants were massively hunted for ivory, apparently by hunters coming from Burundi. By 1976 only 4-5 animals remained, hiding in Kamiranzovu swamp..... }}

He goes on to add for the forest buffaloes and giant forest hogs, both of which have been hunted to probable extirpation from Nyungwe:

{{ ....In 1971, I found foot prints of a lone forest buffalo in a small river of the Bururi valley not far from the research station. A Belgian man living in Cyangugu hunted some buffaloes in the western part of the Nyungwe forest around 1968-1970, and according to Francis Verhulst, buffaloes, elephants and giant forest hogs were quite common in the southern parts of the Nyungwe forest and in the northern parts of the Kibira forest in Burundi. These animals used to concentrate around open highland swamps and wet grasslands, which functioned a bit like bais (natural forest clearings in the Congo-basin lowland forest).... }}

The hunters interviewed gave further insight into the demise of the population:

{{ .... (Historically) The Hutu maintain that they killed very few elephants per year under obligation to Watutsi and even with the Twa killing for meat, the numbers did not drop significantly. In the colonial period (1890 – 1957), the poaching definitely occurred in Nyungwe, there were two butcheries set up for the Belgian colonists in Karamba and Nyungwe (within the forest) and exporting of ivory was occurring almost certainly to Europe....

In 1973 the forest was full of elephants with an estimate of more than 2,000. Around 1969 the decline in the population began, it was in 1973 that the economical importance of ivory became known and groups of poachers came in from eh north, the east, Burundi and Zaire. From Rwanda they came from the villages of Kirambo, Kagano, Nshili, and Bweyeye. They ripped out the tusks taking enough meat to act as provisions for their outward journey, leaving the rest to decay. The major influx occurred in 1974-75 until in 1976 the villagers could not help noticing the dramatic decline in numbers. The power of money had quickly taken hold of Nyungwe and the villagers were hunting for ivory to sell to the outside....They were paid 30 Frw per day and maybe 200 Frw for a decent amount of tusks...Each small group of poachers were killing 8-10 elephants per day. There were only 5-8 elephants left in 1976. It took just 3 years for over 1500 elephants to be slaughtered.....

The final words from the hunters come across almost remorseful, reflecting on the consequence of people's actions:

{{ ....The elephants were a rich product of Rwanda, but it was lost to Tanzania, Burundi and other countries in East Africa....The power of money slaughtered the elephant. Now there are as good as none. We would never let it happen again.....}}

Since these interviews were carried out in 1992, the few remaining elephants have also been killed.

7. Pre-translocation Stage

7.1 Overall objective of the re-introduction of African elephants to Nyungwe National Park:

{{ The re-introduction of a viable African elephant population to Nyungwe National Park following the local extirpation of African elephants by poaching through the 1960's to the 1990's. }}

Both benefits and costs of this re-introduction will be realised at different levels:

Local level

- ✓ *Ecological restoration:* Elephants historically have been part of the Nyungwe forest ecosystem. They may provide ecological functions such as seed dispersal, open up areas for regeneration, and act as forest architects by impacting the forest structure (so–called *bulldozer* species). They can be seen as a key-stone species, having large impacts throughout the community. This natural system has been disrupted by modern man as he exterminated the African elephant from the forest due to poaching. Therefore, in order to return NNP to a natural ecological state, this management intervention is necessary.

- ✓ *Social pride:* The local community should be proud to see elephants return to NNP and have the forest return to its natural ecological state.

- ✓ *Conservation value:* Re-introduction of elephants will increase the conservation value of NNP.

- ✓ *Economic value:* Elephants may increase tourism revenue to the park, as their re-introduction may directly attract tourists who might be more inclined to visit NNP knowing there are elephants in the forest. Indirectly, the publicity that re-introducing elephants will generate may also promote public awareness and interest about NNP both nationally and internationally. However, one tourism expert with experience of visiting elephants in forest habitat, stressed that forest elephant viewing is very hard, unless at a "salt lick" type experience (e.g. Treetops/ Ark/ Mountain lodge in Kenya), or a natural forest clearing (Langoué Bai, Gabon). He added that "*...the reality is even a few yards away you would not see them (the elephants) and no matter the level of experience of the guide, tracking elephants on foot in a forest environment will result in a flat guest or a dead elephant sooner rather than later*. A further proposition he made, if tourism is to be an important influencing factor, was a combined release program with an associated elephant interaction and riding operation. This currently occurs and is highly succesful at Abu's camp in the Okavango Delta, Botswana.

- ✘ *Tourism:* Advertising elephants in NNP as a means of promoting tourism would need expectations to be managed and would involve a certain level of risk. NNP is large and the chance of viewing an elephant in the next few generations would be unlikely. Additionally, the forest habitat makes elephant viewing difficult and potentially dangerous, and hence even if tourists are near elephants they are unlikely to have the opportunity to actually observe them. One high-end private Tourism expert suggested a potential pilot study would be to look at observation rates of elephants in VNP where there are elephants in a similar habitat at low density, as well as carrying out a survey to assess whether more tourists are attracted to the park due to the presence of elephants.

✘ *Human-Elephant Conflict (HEC)*: Elephants can destroy crops and / or property and pose a real danger to human life in surrounding local communities; such occurrences can cause animosity towards conservation efforts of NNP impacting overall conservation success and support for NNP and all other National Parks in Rwanda. This aspect has been raised by several experts and biologists with experience in the area, and a number of social issues may prove insurmountable to the successful re-introduction of elephants.

✘ *Ecological impacts:* Potential negative impacts on the habitat and community where they congregate in large numbers.

✘ *Insecurity:* If the causes of the initial extirpation of the elephants in Nyungwe remain (there is no documentation explaining the decline of elephants, but was most likely due to unsustainable hunting practices), then their chances of survival will be compromised. Also reprisals from local communities if elephants venture out of the forest into plantations will increase insecurities for the elephants.

✘ *Elephants returning to their source site:* when translocated elephants are released, they often walk away from the release site, and their ranging patterns can be erratic for the first few weeks. During this period they may also try to return to the source site and this can mean moving out of the PA and into surrounding communities.

National level

✓ *National biodiversity strategy:* The exercise will strengthen conservation efforts to protect Rwanda's African elephant population. The re-introduction will double the current range for African elephants in Rwanda, and could potentially triple the national elephant population.

✓ *Economic objective:* The re-introduction of a charismatic and popular animal to NNP will add conservation and touristic value to the park potentially increasing donor funds, visitor numbers and park revenue.

✓ *Education and publicity:* Added benefits of the re-introduction will be increased publicity and public awareness of NNP.

✓ *National pride:* Restoring an iconic species to its historical range for its intrinsic value and national cultural heritage.

✘ *Economic cost:* Re-introducing elephants is a hugely expensive operation, and this money could be used for other conservation objectives where it could go further. Alongside this the initial cost of introducing elephants, there are also ongoing costs associated with monitoring the elephant population as well as management issues such as conflict with local communities which may require certain intervention measures such as the removal of problem animals, or the implementation of compensation schemes.

International level

- ✓ *African elephant conservation:* The African elephant will re-populate areas of its historic range, therefore expanding its continental population and range and build upon the current successes in elephant conservation in Africa.

- ✓ *Publicity:* The reintroduction exercise will provide some international publicity for Rwanda and the National Parks of Rwanda, which are diversifying away from the focus of mountain gorilla viewing.

- ✓ *Source site management:* If African elephants can be sourced from over-populated PAs, this re-introduction will relieve ecological problems created through high elephant densities elsewhere in their range.

- ✓ *Nyungwe-Kibira Landscape:* The re-introduction of elephants to NNP means that they may move out of NNP and into Kibira NP in Burundi. This could improve transboundary relations, and encourage better conservation efforts in both Pas.

- ✘ *Trans-boundary insecurity:* The re-introduction of elephants to NNP may provide increased incentive for poachers from Burundi to come into NNP for poaching and the chances of the elephants' survival will be compromised.
- ✘ *Lack of support from Burundi:* As a trans-boundary park, this operation would need support and political will also from the Burundian government to be successful. A lack of political will or insecurities impacting NNP from the Burundian border could compromise the long-term survival the elephants. This aspect must therefore be well studied and appropriate liaison and information sharing to ensure good levels of cross-border cooperation.
- ✘ *Human-Elephant Conflict (HEC)*: Elephants may destroy the crops and / or property of communities in Burundi. Elephants could walk over the border into Kibira NP and then into the Burundian countryside. This would cause animosity towards conservation efforts in NNP, Kabira NP and possibly diplomatic issues.

Recommendation:

Workshop held with all relevant stakeholders including wildlife and park authorities from Burundi, to discuss the feasibility of carrying-out elephant re-introduction to NNP, with specific objectives of the re-introduction and costs involved. Relevant experts from IUCN AfESG in game capture / elephant population ecology should also be present to give their technical advice.

7.2 Budgeting

Budgeting for the translocation operation should cover all costs of the operation and have a sufficient provision for contingencies or unforeseen expenses. Issues specific to the budget of the translocation relate to:

- The number of elephants to be moved in a single shipment and the age structure and composition of the group. This will influence the number of people, the days required and the type of equipment required.
- The distance between the source population and release site, and the distances to be travelled within the two areas. This will impact the amount of fuel, and flying hours of helicopter and / or fixed-wing aircraft. Estimated helicopter hovering and search time should be included.
- The cost of radio collars, receivers, immobilisation drugs, and aerial support, vehicle and personnel costs for pre-capture and post-release monitoring can be substantial.
- Consultancy costs for members of the interdisciplinary team.
- As unexpected events during translocation events are common a reasonable contingency budget to cater for such should be included.

The costs can be split into four main categories which are summarised below:

Planning	Pre-capture	Implementation	Post-release
- Preparation of capture and release sites (road repairs / construction of bomas) - Purchasing costs - Fundraising costs - Costs of publicity and awareness raising at release site - Personnel costs	- Equipment, material and supplies (radio-collars, receivers, computer hardware). - Capture costs (drugs, staff, helicopters, fixed wing aircraft) - Vehicle and equipment operating costs (fuel, repairs). - Personnel costs	- Equipment material and supplies. - Vehicle and equipment operating costs. - Cost of elephant transportation. - Transport and accommodation costs for staff. - Coordination and communication costs. - Personnel costs.	- Equipment materials and supplies. - Vehicle and equipment operating costs. - Coordination and communication costs. - Personnel costs. - Monitoring and management costs.

Recommendation:

Experts in game capture should be contacted for an estimate of the costs involved, once a source population and number of individuals to be introduced have been identified.

7.3 Logistical coordination and Planning

African elephant translocations are very complex, capital and labour-intensive, and time-consuming undertakings, which require specialized and multidisciplinary input. Planning and coordination are two key themes which ensure success of the operation.

A coordination committee should be set-up, which may not be directly involved in the capture and translocation operation but are responsible for ensuring that:

- Planning for all the aspects of the operation and broad-based consultation with all the stakeholders has taken place;
- Funding is secured;
- All legal documents / paper work is obtained;
- Pre-capture monitoring is carried out well in advance of the translocation date;
- Availability of transport for animal and personnel delivery is guaranteed;
- Sufficient drugs are in supply and available;
- Contingency plan is in place - the operation may be altered or terminated in the event of serious unexpected developments (injury or death of animals or staff);
- Media coverage of the operation at the capture and release sites is properly managed;
- Designing and implementing a post-release strategy to ensure the stated objectives of the operation are achieved.

The coordination committee should have representatives from the following:

- Qualified elephant expert;
- Veterinary team;
- Capture team;
- Air support team;
- Area managers for source and release sites;
- Communications and public relations;
- Financial and administrative management for the funds;
- Legal officer;
- Logistics officer;
- Security team.

When translocations take place across international borders two coordination teams (one for the source and one for the release sites) may be appointed with activities closely coordinated and their responsibilities carefully outlined in a MOU.

Timing of elephant translocations:

Local knowledge of the climate and vegetation at the source and release sites will be used to establish the ideal time of year for translocation. Usually the capture is planned early in the dry season, as elephants will be in good condition and the ground will be drier to allow better access for vehicles. Temperature should not exceed 25^{o}C to minimise chances of either hyperthermia.

Planning for procurement and logistics:

Procurement and importation of required drugs, darting equipment and equipment such as radio collars / receivers may take considerable time, and should be carried out well in advance of the target date of the operation. Various licences are required for both source and release sites and these should be required well before the date of operation (e.g. CITES permits). Many capture teams and pilots have busy schedules and should be contacted well in advance.

Recommendations:

Expert game capture team contacted for the feasibility of releasing into the mountainous and heavily forested area of Nyungwe. Elephants have been released into wooded savanna and so it should be possible. An initial release into bomas in a forest clearing along an access road would probably be the safest system.

A coordination committee should be created and capture teams contacted, logistics considered and the procurement of materials. A timeframe should be developed.

7.4 Staffing and expertise

The success of an elephant translocation depends largely of the personnel involved. Once a decision is made to carry out the operation, the process should be handed over to a dedicated translocation team with its own management structure for the physical capture and movement of animals.

The exact composition and number of personnel needed depends on the number of animals to be translocated but a team should always consist of at least the following:

- Experienced wildlife veterinarians, veterinary technicians and capture personnel;
- Logistics personnel;
- Elephant researchers (pre and post- translocation monitoring);
- Experienced game capture pilots (helicopter and fixed-wing);
- Security / safety officer;
- Medical staff;
- Media liaison personnel;
- Financial / administration staff;
- Drivers;
- Mechanics and welders;
- Aircraft attendants;
- Labourers.

Building local capacity for elephant translocation

If the elephant translocations are likely to become a regular activity in Rwanda then the development of relevant expertise should become a priority for ORTPN. In this case, ORTPN should establish a national team to carry out the physical translocation and external experts could be hired to apply the guidelines and to advise on specific

aspects of the operation where national capacity is lacking. If the country is not expecting to carry-out regular elephant translocations the costs of training and maintaining an elephant translocation team may be high and in such cases it may be better to rely on external experts for technical advice.

Recommendations:

Personnel identified and appointed positions for the capture / release period. The development of national staff should be considered priority if elephant translocations are to become a regular occurrence.

7.5 Pre-capture monitoring

The pre-capture monitoring period may take up to a year, and requires the identification of a source population followed by the monitoring of that population to identify the best individuals / groups to translocate. Only healthy elephants able to withstand the stresses of translocation, and those not carrying infectious or contagious diseases should be selected for translocation. This monitoring period should also provide detailed information on the source population size, age and sex structure.

For this translocation whole cow-calf groups would need to be translocated and therefore monitoring should focus on selecting animals which show regular patterns of affiliation or association. Translocation is stressful and traumatic for the elephants involved, and this can be limited by ensuring that intact entire cow-calf groups with the matriarch are targeted for translocation. The will help to ensure that cow-calf groups are not broken up during translocation and will encourage group cohesion after release in NNP.

The use of radio-collars may facilitate the location of the target elephant or family of elephants both during the pre-capture monitoring and on the day of capture. In cow-calf groups the collar should be fitted to an adult female, whereas for bull elephants, which are normally solitary, each target animal would have to be fitted with a collar.

Recommendations:

Following the selection of a source site, personnel should be appointed as monitoring staff and a monitoring project implemented to identify and follow the individuals and / or families to be translocated.

7.6 Habitat considerations

It is important to ensure habitats into which the elephants are released are suitable and are available in sufficient quantities. African elephants are capable of extensive habitat modification, thus prior to any release the implications of this modification for the African elephant population must be carefully considered and evaluated.

Elephants translocated are likely to experience less stress adjusting to their new environments when the habitat and seasonality characteristics at the two sites are similar. Knowledge of the habitat at both source and release sites is therefore important. Prior to any translocation, it is important to determine whether the habitats of the proposed release site are suitable and adequate for the establishment of elephants in the long term. Careful consideration should also be given to factors that can influence the movement of elephants in the release site. These may include seasonality, accessibility to water sources and historical travel routes.

Recommendations:

Given source populations should come from areas with similar environmental factors as the release site, regional elephant experts should be contacted to obtain this information. Possible regional populations living in similar environments may include: Mt. Kenya NP, Kilimanjaro NP, Aberdare NP, Mahale Mountains NP.

A desk-based study should firstly be carried-out on elephant populations to identify all possible populations in the region and contact made with the protected area managers in order to determine which population could be a suitable source population.

7.7 Environmental and Ecological Impact

The ecological roles of savanna African elephants have been well documented and they are capable of extensive habitat modification (Caughley, 1976; Tchamba *et al*., 1992; Prins *et al*., 1993). In tropical forests, studies on the forest elephant sub-species have found that diets include as many as 230 plant species including leaves, twigs, bark and fruit constituting over 90% of all items (White *et al.,* 1993). There are very few studies on the diet of the savanna sub-species living in forest systems, but it is likely to follow the forest elephant in its tendency to rely on trees and fruit as a large component of its food intake. African elephants also act as dispersal and / or germination agents for the seeds of many plant species and they may play an important role in this respect in NNP (White et al., 1993; Lieberman et al., 1987; Sheil et al., 2004).

Source site considerations:

It should be taken in account that the removal of elephants from any source site may result in habitat changes that are adverse to the stated objectives of the local ecology. The proportion of the elephant population that is removed must be carefully considered and evaluated against clear objectives. To minimize any negative impacts on habitat and ecology of the source site by the removal of elephants the spatial distribution of the target groups should be spread rather than concentrated. This will disperse any possible impacts of elephant removal. If the removal operation is designed primarily to address a problem of local over-population or other similar management issue then the removal of elephants can target certain areas in order to address the issue.

Release site considerations:

It is difficult to predict potential impacts of elephants on the ecology of NNP. Mega-fauna such as elephants and buffalo have been absent in a functional ecological perspective from NNP for several decades, and thus the forest today is likely different from the conditions when elephants were present (Fimbel *pers. comm.*). In NNP elephants may historically have played a role in seed germination, and dispersion, but questions such as *Are there adequate food sources to support them? Will their habitat selection and impacts mirror historic use patterns? Will their re-introduction push the forest in some new, unforeseen direction?* are difficult to answer. Insights might be gleaned by comparing the vegetation composition and distribution of NNP to other PAs (e.g. Kahuzi-Biega NP) in which elephants are present to determine a list of species which may be favoured by elephants, and if there are species of plant that require large herbivores for the germination or dissemination of their seeds (Babaasa, 2000; Babaasa et al., 2004).

A study by PCFN carried out in 1992 interviewed elephant hunters around NNP and found that the elephants were eating a large variety of species, but with some preferences. These included Umugeti (*Hagenia abyssinica)*; Umkipfu (*Sericostachys scandens)*; Umugote (*Syzigium parvafolium);* Intonvu (*Lobelia giberroa)*; Umugano (*Arudinaria alpina)*; Itsi (*Salacia erecta)* (1992, PCFN). Hunters also believed elephants were eating three species also used by people for medicinal purposes: Umushwati (*Carapa grandiflora);* Umwishogwe (*Schefflera spp.)* with the elephants eating the bark and the leaves, and the bark is used to treat diarrhoea in human babies; Umukaragata (*Embelia schimperi).* It was also thought that the elephants aided the dispersal of the following species: *Macaranga neomildbraediana, Syzigium parvifolium*, *Hippocratea goetzi* and *Carapa grandiflora* (PCFN, 1992).

There is has been some speculation that elephants may have played a role in helping to suppress *Sericostachys scandens*, via physical trampling and possible consumption. It is thought that in Bwindi NP elephants do feed on the climber (Babaasa, *pers comm.*), and a thorough search of the literature today may point towards elephants actually serving in this role. It was considered to be a preferred elephant food by hunters in NNP, interviewed by the PCFN in 1992 (PCFN, 1992). However, following a *Sericostachys scandens* workshop held in Kigali in September 2009, a consensus among experts was that even if elephants do consume *Sericostachys scandens*, it is highly improbable that they would in any way suppress the liana. Elephants have significant impacts on young trees, and decades of Sericostachys scandens impacting forest regeneration in NNP may lead to elephants having a disproportionally high level of impact on the few cohorts of young trees that have managed to escape the climber's suppressing effects (Sheil et al., 2004; Fimbel, *pers comm*.). In summary, it is unlikely that elephants would have a controlling effect on *Sericostachys scandens.*

Due to initial population size, an elephant re-introduction will have very little ecological impact on vegetation of NNP in the first few generations and with future increases in the elephant population, there could be eventual negative impacts on the forest. At higher densities elephants may become "agents of change", significantly modifying or altering the composition, structure and/or the diversity of plant and other species within their habitats (Laws *et al.*,

1970; Caughley, 1976; Leuthold, 1977). Therefore suitable monitoring of vegetation and mammals in the areas used by elephants should be in place following re-introduction. Localised vegetation change is likely to be seen in the beginning time period of re-introduction and localised monitoring will highlight interactions of elephants with other elements of biodiversity.

Recommendations:

The exact environmental impacts of the re-introduction of elephants to NNP cannot be accurately predicted but a number of aspects should be considered.

A research study should be undertaken to compile a list of all key elephant food species that are found in NNP, based on the literature of elephant diets in similar habitats. This should include tree foliage, tree bark, fruits, and herbaceous plants, including looking for evidence that *Sericostachys scandens* is a key food item. If elephants act as key seed germinators or dispersers (*Carapa* species may be a possibility), this also should be identified.

A follow up workshop similar to PCFN 1992 study should be held with previous elephant hunters and forest users from across the NNP landscape to gain local information on areas used by elephants prior to their clumping around Kamiranzovu, and any plants that were eaten by elephants.

7.8 Demographic and population considerations

The manipulation of elephant populations can have positive or negative impacts both at the source and release sites. All potential implications for both source and release populations need to be carefully assessed before any elephant translocations are begun.

Source site considerations:

The source population needs to be well understood before the removal of individuals. The long-term viability of the source population should not be compromised, and therefore the status and size of source population must be known. Factors including age and sex biases, current elephant management practices, movement patterns and any other relevant information collected during pre-capture monitoring need to be considered. Without this data, a population should not be considered as a source for elephant translocations because it will not be possible to determine what impact the removal of elephants may have on the population.

A source population should be relatively large in the sub-regional and national context and not declining or under threat. Translocations should not reduce the numbers to less than an effective population size of fifty (i.e. an actual population size of several hundred elephants (Franklin, 1980)).

Release site considerations:

Knowledge of the historical elephant population in NNP should be acquired and used to guide the release in to NNP. Factors such as carrying-capacity, seasonal range and movement, and the causes of the initial extirpation of the elephants should be understood to avoid releasing elephants into situations where their survival is compromised.

African elephant populations can increase at close to 7% per year (Whyte, 2001), meaning a doubling in numbers every 10 years. This means that elephants can very quickly achieve population densities which may negatively impact on other species. There are examples of this occurring in South Africa. African elephants should only be introduced at densities which allow for healthy population growth and well below levels that could place habitats in the release site under pressure.

As there are no resident elephants in NNP the introduced elephants should have a normal age and sex distribution and be in sufficient number and origin to at least address genetic considerations. The re-introduction could be carried –out over several years with future population supplementations in order to increase viability and reduce homozygosity in the founder population.

Recommendations:

As part of the pre-translocation monitoring, the source population demographics and size should be established, with information collected on ranging patterns, sex ratios, and population demographics.

At the release site, a workshop should be held with the local communities who used NNP and hunted elephants, alongside any other personnel who can provide information useful to determine elephant ranges and population movements in NNP prior to their decline.

Population estimates of what the NNP could hold should be based on other elephant populations living in similar environments to NNP.

7.9 Genetic considerations

Translocation of breeding groups of African elephants can now occur over large distances, with elephants being air-freighted in specialised containers. This has highlighted the importance of genetic aspects of moving African elephants. There are two aspects to be considered:

1) Genetic mixing;

2) Long-term genetic viability.

Genetic mixing

With respect to genetic mixing, there is growing genetic evidence that forest, savanna and west African elephants are distinct species (Roca *et al*., 2001). Therefore in order to avoid any potentially negative conservation consequences of genetic mixing, in which genetically discreet populations may be lost, AfESG has drawn up some regulations:

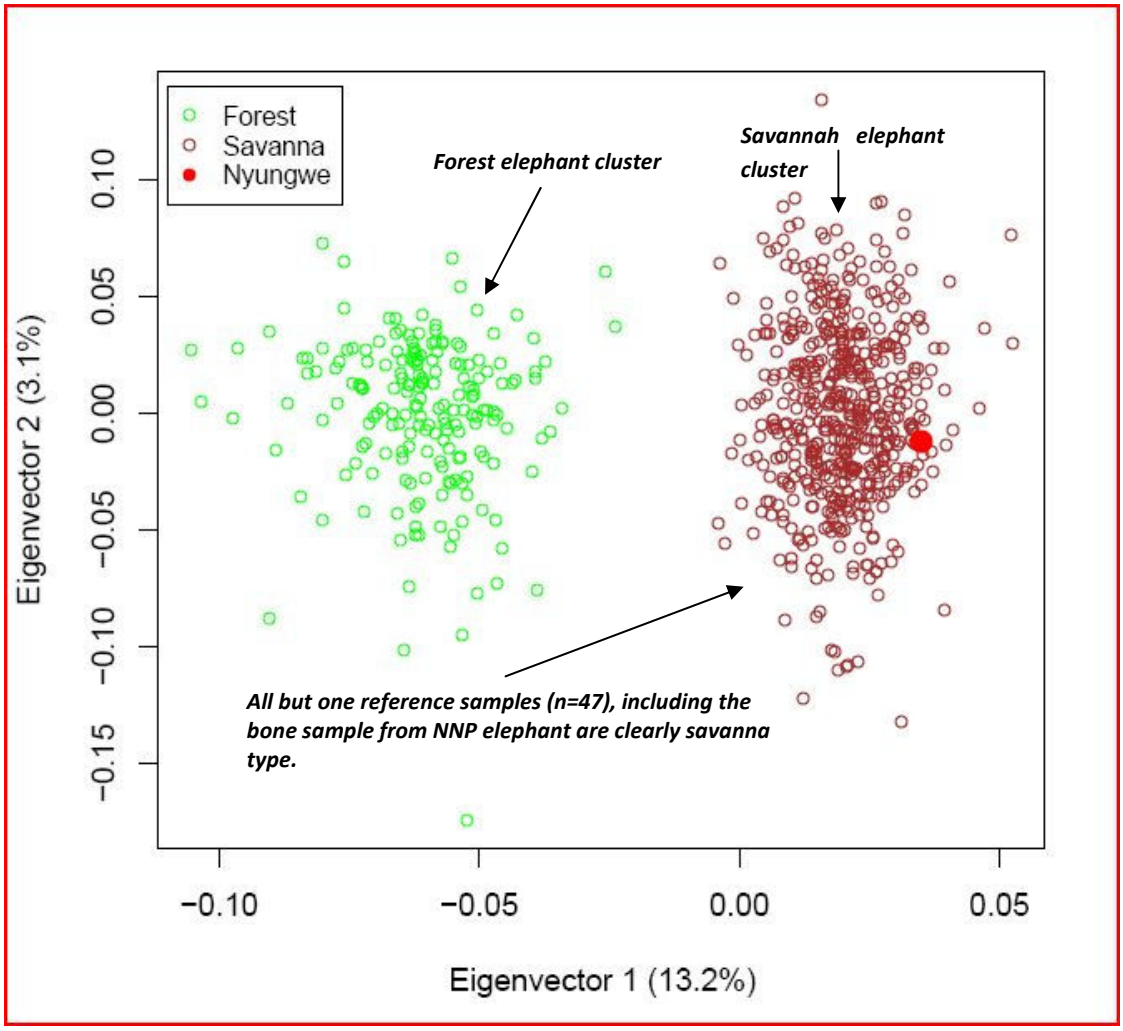
- There should be no translocations between central African forest elephant populations and savanna or potentially hybrid populations.

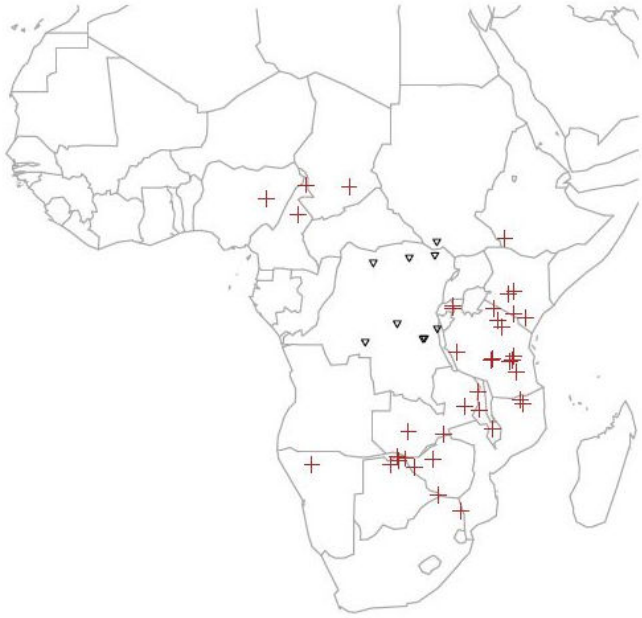
- Individuals selected for translocation from central African forest elephant populations should always be chosen from populations that are geographically as close to the release site as possible

- There should be no translocations of African elephants between west Africa and any other savanna or forest elephant populations.

It has recently been established through genetic analysis of a bone sample taken from the last living elephant in NNP, that this animal was indeed a savanna elephant (based on hybrid assignment runs of SCAT) (S. Wasser, *pers comm.*). To have a better understanding of the genetics of the NNP elephant population, more than one individual elephant should have been sampled and genetic analysis run on a whole population of animals. Given that this is no longer possible, we must base our assumptions on this one sample.

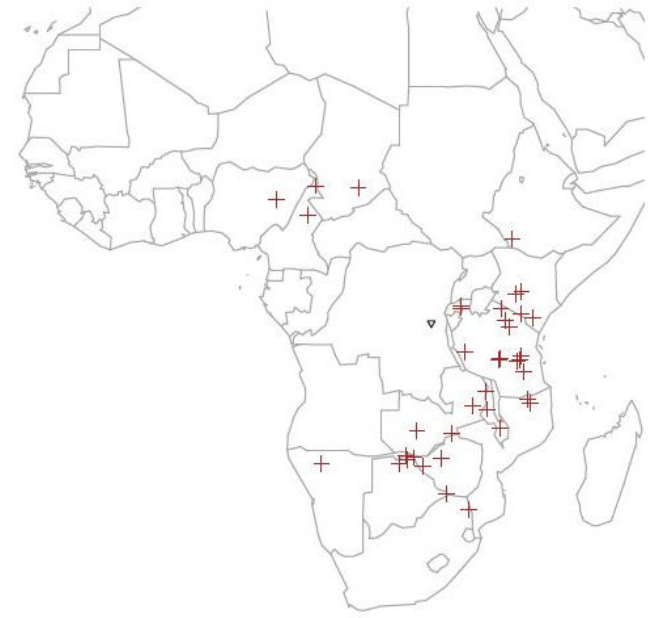
Principal components analysis (PCA) of elephant DNA samples showing clear clustering of savannah elephants, and forest elephants, all the Rwanda samples except one were clustered within the savannah elephants (Wasser, S. University of Washington)





Map showing nine median assignments (triangles) for the Nyungwe Bone sample (Wasser, S. University of Washington)

The map to the left shows nine triangles, which illustrate the 9 different attempts (the medians) of the nine independent runs of SCAT 2 to show the origin of the Nyungwe bone sample. The crosses signify the savanna reference samples used to assign the origins of the Nyungwe bone sample. There is a lot of scatter across southern and northern DRC, probably because there are no savanna reference samples west of Rwanda. Reference samples from these areas should therefore be collected to refine this spread.



Map showing the overall mean assignment (triangle) for the Nyungwe Bone sample (Wasser, S. University of Washington)

The map to the left shows the overall mean of all the medians from the above figure.

From these analyses, we can assume that the Nyungwe bone sample is savanna, with affinities to northern savanna elephants and/or to savanna elephants in southern DRC. However, the wide spread across DRC is in part due to the fact that the locations are based upon only a single bone sample, and we do not have multiple samples of other individuals from the same locale to use as a cross-check. Secondly, there were no reference samples used in this analysis from southern DRC, Sudan or Uganda. The analysis therefore tried to approximate what their gene frequencies look like in these areas, given the reference samples that were available. Hence, the analysis had difficulty definitively placing the Nyungwe sample.

It should also be noted that these analyses do not target genes that reflect adaptation to particular habitat types, but focus upon neutral genes whose distributions reflect more isolation over space and time than phenological traits. However, these neutral genes may well be associated to functional genes with phenological expression, but how tight association is remains unknown for the moment.

Following these results, it is probably prudent to say that the elephant sample from NNP is probably closer to elephant populations in Eastern DRC, S.W. Uganda, Kenya or Tanzania and very different from savanna elephants in for example southern Africa. It should be understood that is very difficult to locate where the best population to use as a source is. One sample does not provide enough data to make any decisions of great biological significance, and therefore we must use caution and expert opinion when considering areas of source population. It has been suggested to consider using elephants whose range includes forest/savanna interface and are spatially close to NNP (S. Wasser, *pers. comm*.). However, most of these populations are probably too depleted to be used for re-introduction.

One suggestion would be to begin analysing genetic samples from elephants in SW Uganda. There is a strongly held belief that a lot of elephants fled to Uganda from eastern DRC to escape poaching in their home country (S. Wasser *pers. comm*.). These elephants could in theory be ideal candidates for translocation, and Uganda could be willing to offer them, as they are immigrant individuals. This approach would need to be handled at the appropriate governmental levels of the two countries. Even if they are forest elephants and not savannah species (future analysis may provide this information), they have proved themselves able to thrive in un-forested habitat. They therefore seem to have the potential and flexibility to switch between environments and thus they have endured the test of time, regardless of what their genetics reveal.

In conclusion, in order to increase our confidence about answering which population is most suitable from a genetic perspective, reference samples should be collected from southern DRC. Reference samples from southern Uganda, are still being processed and these will also help refine the assignments.

Long-term genetic viability

Current understanding of conservation genetics, particularly for a species as complex and long-lived as the African elephant, makes it difficult to quantify exact numbers for founder populations and minimum viable population sizes. However, in general terms, the Founder populations should never be comprised exclusively or mainly form historically bottlenecked populations and the release site must be able to accommodate a population that will eventually number in the thousands.

This point will be an obvious problem, if targeting Akagera NP as a potential source population. The population of elephants here is both small and bottlenecked. The elephants in the ANP disappeared altogether in the early 1960s, probably as a result of human activities, and they were last sighted in 1961. In 1975, the government of Rwanda translocated 22 young elephants to the ANP from Bugesera in the south east of Rwanda. This population grew, and the most recent figures suggest an estimated population size of 34 (Blanc et al., 2007,), or 28 (CL: 17-45) (Parker, 2006; Karidozo et al., 2008). However this may be closer to 60-70 animals (following Parker, *pers. comm.)* or up to 100 animals (following Kukiye, *pers. comm*.).

Generally speaking, long-term genetic viability can be achieved in two ways, either by having a large initial population (numbering in the 1000's) with no genetic supplementation or having a smaller population (100's) with genetic supplementation, to prevent the negative effects of inbreeding depression.

Re-introduction without genetic supplementation:

This would be a massive and expensive undertaking, and have to be balanced against possible HEC and social considerations. Fencing all or part of NNP may have to be under-taken and management structures put in place to deal with problem animals and compensation claims. The founder population would ideally be made up of hundreds with an effective population size of approximately 50 (Franklin, 1980). In Kenya, such large elephant translocations have occurred from Shimba hills forest reserve into Tsavo East NP. The animals moved would have to include unrelated cow-calf groups and unrelated males from one or more appropriate source populations. This scenario should ensure sufficient genetic diversity to mitigate any inbreeding depression.

Re-introduction with genetic supplementation:

If the effective founder population of 50 is not achievable, then there will be a need for genetic supplementation in the future. In establishing or managing such a population, social and genetic considerations must be carefully balanced, as ideally the founder animals (cow-calf groups and males) should be unrelated. With genetic supplementation, viable populations in the hundreds (as opposed to the thousands) may be achievable in the long-term. Every few years a supplementation of elephants could be carried out in conjunction with management objectives of NNP, to reach a viable population given genetic and ecological measures.

Recommendations:

Genetic mixing –

The population of elephants in NNP were savanna elephants, and although the genetic differences among savanna elephants are not as distinct as for central African forest elephants, source animals should be chosen from populations that are geographically as close to the release site as possible.

PAs with strong elephant populations in the region should be prioritised as possible source populations. A good choice would be close-by savanna elephant populations that have historically lived in or near the forest edge. The biggest problem with this will be finding elephant populations that meet these criteria and are also in sufficient abundance to warrant their translocation. Areas such as SW Uganda, Kenya, and Tanzania should be prioritised, with contact made through IUCN AfESG and managers of specific PAs of interest. Populations from southern Africa are not recommended as source populations at this time.

Genetic analysis of samples from elephant populations in SW Uganda, and Eastern DRC should provide further insights in to the best source populations to target.

Long-term genetic viability –

As there are no elephants currently left in NNP, it would be necessary to select groups of genetically unrelated elephants to establish a genetically viable founder population.

The elephants selected should therefore compose of:

- One or many related whole cow-calf groups;
- Unrelated bachelor herds of males of different ages to give a linear hierarchy.

These males should be unrelated to the females and could come from separate population altogether. The linear hierarchy in the male groups should provide some social and behavioural direction to younger males, who otherwise are more likely to become problem animals (see social considerations in 6.10).

7.10 Social considerations

African elephants are highly social animals that live in a matriarchal society with two distinct social organisations (males and cow-calf groups) with separate habitat requirements and behavioural traits. These social structures and their attributes must be taken into account before any translocation can be considered, specifically the strong bonds between females and close relatives. Therefore close pre-capture monitoring of the source population is required to understand relationships between individuals as well as between individual cow-calf groups.

Some key social aspects to consider include:

- The matriarch plays a vital role in African elephant societies and must be translocated together with the group.
- Lone females or juveniles or groups comprised only of juvenile elephants must not be translocated.
- Groups with very small calves (i.e. less than a few weeks old) should not be translocated.
- A normal population age structure should be maintained within the cow-calf groups and bulls targeted for translocation.
- Elephants that have been moved before and elephants from previously all-juvenile groups should not be translocated. (This would be an issue when targeting animals from Akagera NP).
- The source population should be as large as possible to minimize social impacts of translocation.

The introduction of functional elephant family units and adult bulls appears to provide the best social conditions for translocated elephants. There have been cases in a number of newly established smaller reserves (e.g. Pilanesberg, Umfolozi/Hluhluwe, Madikwe) in South Africa where only juvenile elephants were stocked. After a number of years, social aberrant behaviour was noticed in a number of the reserves including killing rhinos in Pilanesberg (Slotow *et al*., 2000). To rectify these behavioural problems, PA managers introduced a number of adult bull elephants, and these seemed to provide the hierarchical social conditions needed to control this unusual behaviour.

Recommendations:

For social reasons structurally complete matriarchal family groups should be translocated.

Bachelor groups containing a young bull, and older males should also be introduced, providing a loose linear hierarchy. A mature bull would provide some discipline and cohesion to the groups.

In order to select the best individual groups, close pre-capture monitoring of the source population is required to understand relationships between individuals as well as between individual cow-calf groups.

7.11 Behavioural considerations

When selecting elephants for translocation the general behaviour of the target individuals should be observed during pre-capture monitoring. This may provide important clues on how the animals might react to translocation, how they settle in their new environment and may help to identify and address potential problems in advance.

It is however, very difficult to predict the nature of behavioural responses and so it is crucial to ensure adequate post-release monitoring of target individuals.

Source site considerations:

- Translocation of elephants that regularly undertake long-range movements in the source site should be avoided.
- Habitual problem animals with a history of crop-raiding, damaging property or aggression towards humans or livestock must be avoided.
- Adult bulls will be less likely to cause problems if moved in groups (minimum of 2). Single bulls are more likely to break out of reserve boundaries in search of social partners (male or female).
- Young adult bulls (20-25 yrs old) are more suitable for translocation than older bulls, which can cause considerable problems, as they are not easy to contain.
- A bull that is in musth is more likely to show aggression or attempt to break out of the release site and should therefore not be translocated.

Release site considerations:

The release site should be inspected prior to the translocation in order to identify any factors that might impede the success of the translocation or impede the elephants from settling into their new environment.

Factors may include:

- High degree of human disturbance;
- Construction;
- Logging;
- Hunting.
- There should be sufficient space to allow the translocated group to establish an independent home range. This will depend largely on the availability and spatial distribution of suitable habitat.
- Proximity of the release site in relation to the source site is an important factor to be considered. Elephants have returned to the source site and this has occurred with both bull and cow groups. Elephants can probably communicate over a maximum of 30 km (O'Connell-Rodwell *et al*., 2000), and this should not be an issue in NNP, given the source site will be at a much greater distance.
- Human disturbance should be strictly limited at the release site to minimize stress on the introduced animals until the elephants have had a chance to settle into their new environment. Panic caused by human disturbance has led to mortalities among young calves.

Recommendations:

As part of close pre-capture monitoring, identification of problem animals should be made and those animals whose behaviour is most suitable for translocation selected.

At the release site, human disturbance should be minimized and ranger patrols should guarantee human impacts are minimised when the elephants are re-introduced.

7.12 Veterinary considerations

From a veterinary perspective a translocation can be seen as a movement of a whole package of organisms alongside the elephant, including bacteria, fungi, viruses, internal and external parasites, all or any of which could be potentially harmful to other species in the release site. Likewise, the release site may contain agents to which the arriving animals have never been exposed.

It is therefore a pre-condition of the translocation that the animals are healthy and not carrying any infectious or contagious diseases. Healthy animals are also more likely to survive the translocation and more able to adapt to their new environment. For these reasons, appropriately trained veterinarians are involved in all stages of the operation.

A disease database should be set-up and monitored for both the source and release sites. Prior to translocation, the health and prevalence of infectious diseases in the source population and release site must be established. This can be by way of veterinary records, or an independent study before capture. Before the translocation, observation of general body condition a few weeks before capture, and immediately before capture and collection of data during immobilization at capture stage will also provide information regarding the health of the animal.

There are several diseases of concern and the major biological agents in African elephants include the following:

- Mycobacterium tuberculosis;
- Mycobacterium bovis;
- Bacillus anthracis;
- Picorna virus;
- Endotheliotropic herpes virus.

There are statutory veterinary requirements for any animal transportation, and an authorized veterinarian must confirm in writing to the appropriate government veterinary authority that the animals to be translocated are in good health and suitable for transportation and free from infectious or contagious disease.

Recommendations:

Appropriately trained veterinarians should be involved in all stages of the operation. Source populations should be identified which are free from possible sources of disease that could be transported into NNP. If elephant translocations are to occur across international borders, veterinarians from both countries should be involved in order ensure correct paper work and export permits are in order.

7.13 Socio-political considerations

Re-introductions of elephants are complex operations requiring long-term social and political support. Whilst elephants maybe seen as an asset when viewed for conservation and ecological functions, this needs to be balanced against the potential cost to property and lives that they may bring. Generally, elephant translocations have socio-political impacts at local, national, and international levels. For the translocation to succeed the operation needs to be fully understood, accepted and supported at all levels. This may require targeted actions, at all levels both at the source and release sites. The primary justification needs to be as part of a conservation plan for the elephants and their habitats, but the re-introduction must also be acceptable in a current socio-political context.

Issues common to both source and release sites:

Local level

- Concerted and targeted consultation with local communities and other relevant players in the immediate area. Issues and concerns must be given real consideration in the planning process a participative approach is preferred but a minimum of consultative approach is required.
- It is critical to evaluate the benefits and costs that local people associate with elephants in the local areas.
- Unexpected events can happen, and although the chances will be minimised, local people must be briefed on the major undertaking and potential dangers involved. Local people must be briefed on what to expect both during and after the translocation exercise.
- The status of the adjacent land-use as well as trends in human population growth and land-use patterns need to be established to assist with the assessment of the potential for human-elephant conflict (HEC).

  AfESG stress that no translocation should be conducted if it is likely to result in increased levels of HEC which cannot be substantially mitigated.

National Level

- Before translocation is attempted there should be a proactive attempt to inform decision-makers as well as the general public. Political support is central to the success of the proposal.
- Accurate and well-targeted publicity may inform the general public and secure their interest and support. Public relations campaign through television, radio and newspapers, using common language to outline the costs and benefits of such an exercise.
- If the source or release sites do or could hold elephants whose seasonal movements span other districts / provinces or states, adequate consultation needs to be conducted with all those concerned.
- Legislation pertaining to various aspects of elephant release should be in place in both the source and recipient countries, and relevant authorities fully briefed.

International Level

- Re-introductions involving the movement of elephants across international borders require the full permission and involvement of all relevant government agencies in both source and recipient countries.
- If the source site is a trans-boundary population, adequate consultation must take place with invested range-states.

- In NNP there is potential that the elephants could move into Kabira National Park, Burundi. Therefore relevant Burundian authorities need to be consulted. Formal Memoranda of Understanding or agreements should be signed at the highest possible political levels to ensure common understandings and commitment from the involved governments.
- As African elephants remain high-profile species in the eyes of the international conservation community, and the world at large, there is additional pressure to ensure that the re-introduction is properly planned and executed.

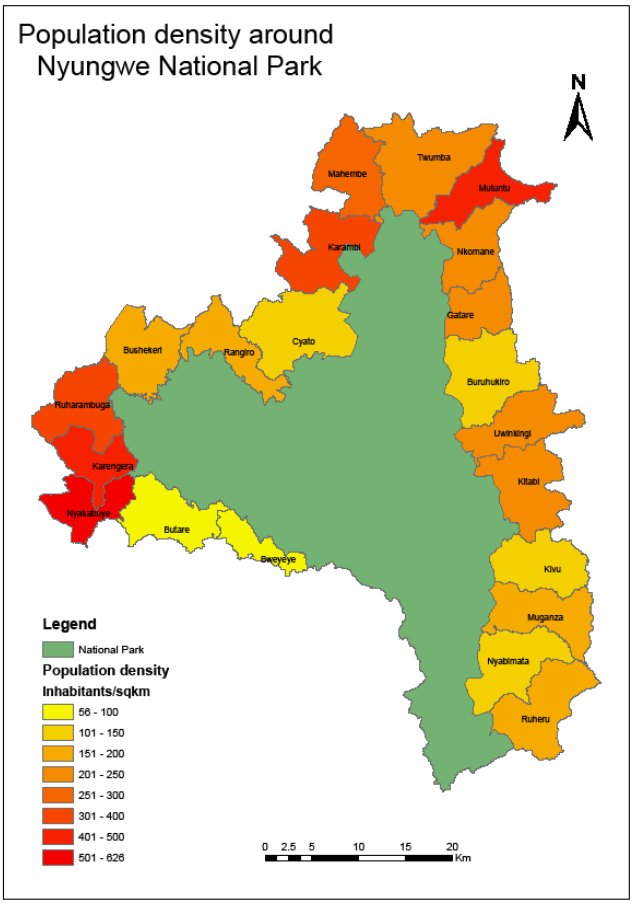
Source site considerations:

There may be a perceived loss of benefits to communities local to the elephant population to be translocated, and this may be due to a sense of ownership among local populations. Advance consultation with communities local to the elephant population is very important. This is important as elephant removal could be a large dis-incentive for conservation of elephants, if they are removed with no consultation at the local level.

If compensation is required, a transparent mediated process should be drawn-up to compensate either directly or indirectly the affected stakeholders.

Release site considerations:

These issues will be associated with the potential risks and subsequent costs associated with release of translocated elephants into NNP. The land-dependence of a large dispersed human population surrounding NNP could lead to many conflicts (both real and perceived) between people and the re-introduced elephants. These conflicts will erode relationships between conservation mangers and communities surrounding the PA. For example in Uganda the Government is not seen as a good 'neighbour' by the local communities of one PA. This feeling is a manifestation of the feeling that the government 'owns' all the wildlife (the Government is seen to own wildlife because it legislates as to what people can and cannot do in relation to wildlife) yet does not behave like a responsible owner, either by 'controlling' the actions of its wildlife (i.e. preventing wildlife from entering farming areas) or paying compensation for crop damage caused by that wildlife (Hill *et al*., 2002).



It has been found that people may often complain about losing crops to wildlife, yet it is not so much crop damage that is the issue as their fear of the particular species they claim is causing the damage. Elephants are complained about more frequently and more strongly than other species, yet they are sometimes not the species that causes most damage to a crop (Naughton-Treves, 1996). People complain about them so vehemently because they fear them more than other animals. Therefore a good understanding of the actual problem is needed.

Communities in the immediate vicinity of NNP must be consulted and kept informed of plans. A thorough assessment of local attitudes is necessary to ensure long-term security of the translocated animals. This is especially important as the original loss of elephants in NNP was due to human activities.

Potential risks to life and property should be minimized and adequate provision made by the local authorities for compensation / mitigation measures if and where necessary. Linkages, roles and responsibilities of the various authorities involved at the local level, should be clearly laid out and covered by the appropriate legislation, to ensure responsibility is taken for the care and security of both people and elephants. In 2006, five principal threats were identified an elephant management workshop based upon the elephant population in Akagera NP:

- A lack of national legislation concerning elephant management;
- A lack of institutional capacity within ORTPN;
- A lack of information on ANP's elephant population;
- Human disturbance within elephant habitats;
- Conflict with communities outside the ANP (Karidozo *et al.*., 2008).

These issues would need to be addressed before elephants were to be re-introduced to NNP.

Recommendations:

At the source site

Following the identification of a source population, an in-depth social study and information dissemination phase should be initiated. This should be carried out well before the proposed date of translocation.

At the release site

An assessment of local attitudes and perceptions at NNP need to be carried-out. This should be carried-out in a series of workshops with local community members. Local authorities should also be included to ensure roles and responsibilities are laid out, and adequate provision is made for compensation / mitigation measures.

Appropriate research and information systems need to be put in place to allow managers to assess possible conflict situations.

All possible options with respect to intervention and trying to reduce human-wildlife conflict should be laid-out. Factors that render the farmers vulnerable to crop damage by wildlife should be drawn-up, and a range of possible deterrence methods, and their effectiveness and suitability in different situations developed.

7.14 Security Considerations

Although many elephant population extinctions are being driven by habitat loss, and fragmentation, the main cause of decline in the 20th century has been due to local killing of elephants (ITRG, 1989). Whilst the absolute number of elephants being killed for ivory may have declined, there is still a demand for ivory as the recent sales of ivory in October 2008 to China and Japan demonstrate. The decline of elephants in NNP has been catastrophic with the population being devastated between the 1960's to the 1990's. The cost of the security of an asset such as elephants can be large with studies suggesting this cost can be as great as US$1,500/km^2 per annum (Currie, 1998; Dublin *et al.,* 1998).

Before any re-introduction to NNP can be implemented, the security of the re-introduced elephants needs to be guaranteed and an appropriate budget made available to support the required levels of protection. From the security perspective, NNP is a suitable size being small enough to increase the security levels but not too large (less than 3000 km^2) which would increase the security costs very high.

As a general rule, release sites where the immediate and long-term security of the re-introduced elephants will be challenged should not be considered to be viable options. With NNP forming an international border, additional security concerns and challenges arise. Under some security circumstances elephant re-introduction is not seen as appropriate:

- Areas where major development activities are occurring. There are clear indications that such areas present high security challenges due to increase human activities, and the transient nature of settlements which form around such activities (UN Panel of Experts, 2001)
- Areas of civil instability or war or immediate threat of such in the area. Civil disturbance and the accompanying flow of arms or planting of land mines presents a risk to elephant populations (Douglas-Hamilton, 1983; Mubalama *et al.,* 2001).
- Areas where there has been a high influence of HEC.
- Areas where large-scale subsistence, or commercial bush meat industry is occurring. Elephants are renowned targets for the bush meat trade. Where humans are living in high densities with shortages of food and protein, elephants often become an important target species (Eves and Ruggiero, 2000; Stein and BCTF, 2002).
- Areas where there is a high military presence. Such areas where the military are heavily armed, and often operating with limited supplies and food rations, have been known to present high security risks for elephants (Douglas-Hamilton, 1983).

Recommendations:

In NNP the following security factors should be in place prior to re-introduction of elephants:

- Close cooperation and coordination with law enforcement agencies between Rwanda and Burundi need to be developed.
- Adequate levels of appropriately trained and equipped law enforcement staff. A ratio of 75-88 km^2 per man has been demonstrated to be an effective staffing level for the protection of elephants (Jachmann, 1998). In larger areas (>200km^2) ground surveillance should be supplemented by a mobile specialist that can help in an emergency and can act as an internal check on other field ranger patrols (Emslie *et al.,* 1999).
- Adequate annual operational budgets to support the field force. Modest capital investment for vehicles, equipment and construction.
- A dedicated law enforcement strategy, planned establishment of a functioning intelligence network. Engagement of local communities to support the network's operations. Close collaboration with national police / military, especially in NNP where there is a high military presence.
- A standardized system for monitoring law enforcement effort. This should be based on the protocols developed by CITES system for the Monitoring of the Illegal Killing of Elephants (MIKE). In NNP the MIST and ranger-based monitoring should be harmonized with the MIKE system.

7.15 Legal considerations

The legal status of the animals to be translocated and the legal status of the land in the source and release sites must be considered during the planning stage. It is important to adhere to all local, national and international laws regarding the status of the African elephant as well as the land and adjoining areas (dispersal areas) at the source and release sites.

The main types of legislation to consider are briefly laid-out below:

- National laws regarding the movements of wild and / or protected animals with special protection status.
- Specific laws or veterinary regulations between provinces in relation to movements of animals and disease.
- If translocation occurs across international borders, regulations concerning the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) must be adhered to and relevant import and export permits obtained.

Recommendations:

If there are any areas in which a specialist is required, a lawyer should be appointed whose role it should to ensure that all permits and legal documents are properly followed.

8. Implementation of the Translocation

The details of the implementation of the translocation would depend on the location of the actual source population and the number of elephants involved. Some key aspects however which should be adhered to in any translocation are considered below:

8.1 Capture and transportation aspects:

- The capture team should include some people from the release site;
- A communication system must be in place;
- In order to minimize delays in capture and loading and to reduce stress, the elephants should be herded into suitable terrain for capture;
- Mothers and small calves must not be separated during herding and must be crated together;
- Members of cow-calf groups should all be darted together;
- Transportation routes should be carefully selected in advance and use the shortest journey time possible;
- Rough road surfaces increase physical stress on elephants and should be avoided as much as possible;
- Vehicle failures are one of the most common problems contributing to unsuccessful elephant translocations; Mechanics should accompany the transport vehicles to attend to any unexpected malfunctions of machinery;
- Acceptable temperature range in the crate is between 15-25^{o}C. The journey length must not exceed 14 hours.

8.2 Release aspects:

- There should be minimal disturbance to the animals during the acclimatization period and all unnecessary spectators should be barred from the site until animals have been fully acclimatized;
- Special security procedures must be in place to prevent injury or death of people or animals during the release process.
- In NNP elephants should be released into a large and secure enclosure or boma (minimum 1-2 hectares). This would allow the veterinarian to monitor the animals for any transport injuries or any other health-related issues and gives the elephants a chance to recover from the drugs and to get acclimatized to their surroundings. This is important in NNP as once they move into the forest, visibility will be poor and direct observations may not be possible.
- The boma should be built in a shady area, have an off-loading ramp and should be strongly built to prevent elephants from breaking out;
- The boma must have sufficient water and browse for the entire period of the confinement of the animals;
- The boma should have a wide sliding gate operated by remote-control;
- The Boma should have easy access, including turning space for trucks;
- Cow-calf groups that are translocated together should also be released into the boma together but this will depend on the number of animals to be moved. If a large number of animals are translocated (50 or more), then individual cow-calf groups must be released one after the other, without two groups in the same boma together;
- Elephants should be kept in the boma for 1 – 2 days to allow for full acclimatization.
- The boma must be well constructed and “break-out proof” by being securely fenced with cables and have a good and functional electrification system in place.

9. Post-Release Monitoring

The success of any translocation will be measured against the achievement of the original objectives of the exercise and the subsequent health and proper acclimatization of the translocated animals. The translocation operation will put significant stress on the animals. Post-release monitoring is carried-out to ensure that normal behaviour returns and the translocated animals remain healthy. A minimum of one year of monitoring should be established to determine extent of their movements in all seasons.

Experienced post-release monitoring personnel must be selected prior to the operation, and they must have necessary equipment, such as vehicles, radio collars, radio receivers, GPS, radios, access to aircraft. The new generation GPS/ Satellite collars should be used as these provide detailed daily movements. Standard VHF collars can also be fitted to other members in the group to ensure group cohesion.

Key aspects to monitor include:

- Post-release habitat utilization (water points, feeding areas, and habitat types).
- Bulls in particular should be monitored for problematic behaviour (e.g. crop-raiding, undue aggression to other animals or humans) and should be radio-collared.
- Because security of the elephants must be guaranteed, monitoring of the security situation must also form part of the overall post-release monitoring programme.
- The cause of death of any translocated elephants during post-release monitoring should be established.
- The human safety element must always be considered, which may mean that certain breakout elephants will have to be destroyed. This must be done by experience personnel and as humanely possible for the elephant.

Veterinary considerations for the post-release period:

After release, a programme to monitor the health of the introduced elephants should be put in place to ensure problems are identified and dealt with early on. On the first and fourth day after translocation veterinarians should make remote assessments of the animals with respect to wounds, clinical symptoms of ill-health, or diseases such as nervous, locomotive or digestive disturbance.

There should be long-term monitoring of the health of the released population as part of the overall post-release monitoring programme to look for chronic problems such as failure to reproduce or persistent weight loss. This monitoring should occur on the fourth and twelfth week and again twelve months after the translocation.

10.Lessons learned from past translocations

From looking at past translocations it is possible to learn from mistakes to minimise risks of problems.

- It has been found that many elephants show erratic post-release movements, and may cover long distances, especially if there are human disturbances in the area. This has led to exhaustion or even death of young calves, trying to keep up with the herd. Human disturbances should be minimized during this period.
- Elephants tend to wander from the release site and frequently attempt to return to their old home range. In areas that are not fenced, they may cause considerable problem through crop-raiding and other HEC conflict in attempts to return to their former home range.
- There is potential for problems to develop such as adverse behaviours such as crop-raiding or chasing vehicles.
- Utilization of the environment by elephants is never spatially uniform and their bunching behaviour often becomes exaggerated when they are moved to new sites. Elephants like to congregate in certain areas (e.g. along watercourses, in favoured habitats or in secure refuges).
- Elephant stressed by translocation will be more aggressive in human-elephant encounters, but generally this level of aggression will decrease once the animals settle down.
- Large (older) adult males tend to be more problematic after release than young adults; problems may be reduced if there is a resident cow-calf group already established at the release site.
- There have been cases of juvenile bulls developing behavioural aberrancies when translocated as juveniles to areas without adult bulls (attacking and killing rhinos for example). These cases have involved the translocation of juvenile cull orphans that grew up under abnormal social circumstances without an established cow-calf group structure or male hierarchy.
- Cow-calf groups originating from the same source area or possible related individuals will usually join up to form a single herd at the release site. On the other hand, groups sourced from different areas or comprised of unrelated individuals will tend to avoid each other, which results in a wider dispersal of elephants.

11.Recommendations

Theme	Issue	Reccomendation
International African elephant conservation	Does the re-introduction support international African elephant conservation?	IUCN AfESG is part of the decision-making process.
	Where is / are the source site(s) and is the translocation in conflict with the higher-level conservation objectives in the source site(s)?	Source site(s) identified using DNA results, expert opinion (AfESG / IUCN / KWS) and a literature review (AfESG library, Nairobi).
	Is the source site population sufficiently large to allow removal of the animals?	Conservation strategies (management plans) for the source sites are followed, plus local expert opinion and liason with government departments.
National African elephant conservation	Will the re-introduction strengthen the Rwandan African elephant population?	AfESG is part of the decision-making process. National biodiversity regulations followed.
	Will the translocation contribute to the higher-level conservation objectives in NNP?	ORTPN follow NNP management plans and a full literature review and expert opinion followed by workshop with relevant stakeholders.
	Is the re-introduction in line with a National biodiversity strategy, and management plans for NNP?	
The ecological importance of elephants in NNP	Is the elephant a key-stone species in NNP, maintaining linkages in the food web, and diversifying forest ecosystems?	Full literature reviews (using AfESG library in Nairobi) and also expert opinion gathered. Reserach projects suggested for students to carry-out in this area.
	What role does it play in seed dispersal?	
	What role does it play in seed germination?	
	What are the potential negative impacts on the habitat where elephants may congregate?	
	Are the long-term conservation objectives for any other important elements of biodiversity in NNP afected? (Plants, animals or habitats that may be adversely affected by the reintroduction).	
	Will the reintroduction of elephants lead to, or directly contribute to, the extinction of any species of flora or fauna in NNP?	
Socio-political context	What political considerations need to be met at local, national, regional and international levels?	Relevant governmental bodies at different levels are informed and have had the opportunity to participate in the decision-making process. This should include Burundi as NNP is a trans-frontier park.
	Have social aspects of relevant stakeholders at both the source site and NNP been considered?	Research and and workshop held at local level with stakeholders at both source and release sites.
	Is there war or civil instability in areas adjacent to or impacting NNP?	Relevant governmental bodies contacted to advice on instabilities in the area.
	Have Human - Elephant Conflict (HEC) issues been addressed? Elephants can destroy crops and / or property and pose a danger to human life in surrounding local communities (in Rwanda and Burundi); such occurrences would cause animosity towards conservation efforts and the National Parks in Rwanda.	Survey of attitudes of local communities towards the re-introduction of elephants. Workshops held at local level with relevant stakeholders. Lessons learnt form Akagera NP, and clear responsibilities laid out for implementation (or not) of a compensation scheme and rewards for damages caused by elephants.
Publicity / awareness raising	Can the re-introduction increase the profile of African elephants, NNP, or Rwanda at national and international levels through strong publicity?	ORTPN marketing department are involved and are workshop held for awareness raising campaign.
	Is there a sense of National pride? The restoration of an iconic species to its historical range for its intrinsic value and national cultural heritage.	National surveys of attitudes towards increasing the elephant population in Rwanda
Tourism	What are the risks associated with guiding tourists on foot through dense forest containing elephants?	Expert opinion from guides who have experience guiding on foot in elephant habitat. ORTPN will be involved in the process and could develop training modules for guides on procedures in elephant confrontations.
	Economic income - will the re-introduction of elephants add value to the NNP product (i.e. Are more tourists likely to visit)?	Expert opinion sought from Tour Operators of the impact of re-introducing elephants on tourism numbers
Insecurity	Are the causes of the initial extirpation of the elephants in NNP remaining (i.e. poaching)? If so, their chances of survival will be compromised.	NNP authority to provide detailed reports of the state of illegal hunting and other threats in NNP.
	What is the level of trans-boundary insecurities? The re-introduction of elephants to NNP may provide increased incentive for poachers from Burundi to come into NNP for poaching and the chances of the elephants' survival will be compromised.	
	Are there likely to be illegal killing of elephants in NNP?	
Veterinary considerations	Is Tuberculosis (*Mycobacterium tuberculosis* or *M. Bovis*) maintained in the wild population of the source site, but not in NNP?	Once source populations are identifed, correct veterinary procedures are carried-out.
	Is the translocation in violation of national or international disease control regulations *(office international des Epizootie)?*	
Logistics & finance	Is the proposed translocation technically feasible? (E.g. the source site is a heavily forested area with steep terrain and inadequate access, rendering translocation an unrealistic option).	Expert opinion from elephant translocation expert (KWS).
	Are there available capacity and resources to carry-out such an initiative?	Following identidfication of source population a budget is drawn-up using expert opinion and previous similar oparations.
		List of personnel to be involved and a coordination commitee created.
		A timeframe is developed.

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