BEFORE THE SECRETARY OF THE INTERIOR

Photo by Tara Easter

PETITION TO RECLASSIFY AND UPLIST AFRICAN ELEPHANTS FROM THREATENED TO ENDANGERED UNDER THE ENDANGERED SPECIES ACT AS TWO SEPARATE SPECIES: FOREST ELEPHANTS (*Loxodonta cyclotis*) AND SAVANNAH ELEPHANTS (*Loxodonta africana*)

JUNE 10, 2015

CENTER FOR BIOLOGICAL DIVERSITY

NOTICE OF PETITION

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The Center for Biological Diversity (Center) is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center is supported by more than 900,000 members and activists throughout the United States. The Center and its members are concerned with the conservation of endangered species and the effective implementation of the Endangered Species Act.

CENTER for BIOLOGICAL DIVERSITY Because life is good.

Submitted this 10th day of June, 2015

Pursuant to Section 4(b) of the Endangered Species Act (ESA), 16 U.S.C. § 1533(b); section 553(e) of the Administrative Procedure Act (APA), 5 U.S.C. § 553(e); and 50 C.F.R. § 424.14(a), the Center for Biological Diversity hereby petitions the Secretary of the Interior, through the U.S. Fish and Wildlife Service (FWS or Service), to reclassify and uplist African elephants from Threatened to Endangered as two separate species: forest elephants, (*Loxodonta cyclotis*) and savannah elephants (*Loxodonta africana*).

FWS has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on FWS. Specifically, the Service must issue an initial finding as to whether the petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C. § 1533(b)(3)(A). FWS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." *Id.*

Respectfully Submitted,

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EXECUTIVE SUMMARY

Elephants in Africa are currently classified as a single species, the African elephant (*Loxodonta africana*), and listed as Threatened under the U.S. Endangered Species Act (ESA). Given recent, rapid and continuing declines of elephants throughout Africa, if viewed as a single species elephants in Africa would clearly qualify for uplisting to Endangered. However, the best available science demonstrates that elephants in Africa are in fact comprised of two separate species, each of which is individually even more imperiled than the currently recognized continent-wide "species". Consequently, through this petition, the Center for Biological Diversity requests that elephants in Africa be recognized as two separate species, the forest elephant (*Loxodonta cyclotis*) and savannah elephant (*Loxodonta africana*), with both species uplisted to Endangered. Such listing would afford legal protection of elephants in Africa in line with current science and ensure that each species receives the specific conservation attention that it needs to survive.

The existence of two species of elephants in Africa is supported by geographical, ecological, morphological and genetic evidence, including recent genetic studies demonstrating that the two species diverged from each other as long ago as Asian elephants diverged from mammoths. Forest elephants and savannah elephants, as their names suggest, evolved in and generally occupy different ecosystems, with forest elephants concentrated in the forests of Central and West Africa, and savannah elephants generally occurring in more open terrain throughout sub-Saharan Africa. Forest elephants are smaller, and have thinner and straighter tusks, more rounded ears and differently shaped skulls than savannah elephants.

Both savannah and forest elephants are highly imperiled and suffering steep population declines, primarily as a result of direct persecution by poachers for the use of their tusks in the global ivory trade. Thirty-five years ago, the continent-wide population of elephants was likely over a million animals. Today it is less than half that. Fewer than 400,000 savannah elephants likely remain, with populations in West, Central and Eastern Africa suffering rapid and severe declines, while previously secure populations in Southern Africa are being increasingly targeted. For the forest elephant the situation is even more dire, with an over 60 percent decline documented in less than a decade, fewer than 100,000 remaining, and extinction possible within a decade. As detailed in this petition, both species clearly meet the criteria for listing as Endangered and should promptly be classified as such.

Status and Distribution

For both forest and savannah elephants, precise population estimates are currently unavailable, but all available information indicates massive population declines in recent decades, with such declines greatly accelerating over the past decade.

Most (95 percent) forest elephants occur in Central Africa in the countries of Cameroon, Democratic Republic of Congo, Republic of Congo, Gabon, and Central African Republic. There, forest elephant populations have declined by 62 percent in just nine years from 2002-2011. In West Africa, where forest elephants were once widespread throughout the Guinean Forest, populations have been under relentless habitat and poaching pressures for the last

century. They now occur in very small, fragmented populations in Sierra Leone, Liberia, Guinea, Côte d'Ivoire, Ghana, and Nigeria with most containing less than 100 individuals. In total, fewer than 100,000 forest elephants likely remain, and the actual number could be lower than 50,000.

Savannah elephants also occupy parts of West and Central Africa and those populations have been equally as decimated as those of the forest elephant. Savannah elephants had a wide distribution through the Sudano-Sahelian range, which covers Senegal, Mauritania, Mali, Guinea, Burkina Faso, Ghana, Togo, Benin, Niger, Nigeria, Cameroon, Chad, Central African Republic, and Sudan, but those populations have declined by 33 percent in West Africa and 76 percent in Central Africa over the past three decades. Most remaining populations are small and fragmented.

Larger populations of savannah elephants occur in Eastern and Southern Africa. Eastern Africa, which includes Sudan, South Sudan, Ethiopia, Somalia, Uganda, Kenya, Burundi, and Tanzania, has lost about 20 percent of its elephants since 2008, with 130,000 remaining. Tanzania holds the majority of the region's elephants with over 109,000 individuals in 2009, but those populations have declined by 60 percent in just five years, with only about 43,000 remaining in 2015. One of the largest and most monitored populations in the country occurs in the Selous ecosystem of Tanzania. That population declined by 62 percent from 2006 to 2013, dropping from over 70,000 to about 13,000.

Southern Africa holds about 64 percent (~250,000) of remaining savannah elephants, which includes Angola, Namibia, Botswana, Zimbabwe, Mozambique, Zambia, and South Africa. As a whole, this region's elephant populations have been relatively stable until about 2010 when they started declining. Some important populations have lost a significant number of elephants such as in Mozambique, which lost half of its elephants in just five years, and Zambia's Luangwa Valley elephant population which was also halved from 2009 to 2012.

Across their range, it is likely that fewer than 400,000 savannah elephants remain, with actual numbers potentially being significantly lower than this estimate.

Endangered Species Act Listing Criteria

The ESA defines an "endangered species" as "any species which is in danger of extinction throughout all or a significant portion of its range". 16 U.S.C. § 1532(6). A "threatened species" is "any species which is likely to become an endangered species throughout all or a significant portion of its range". 16 U.S.C. § 1532(20). Elephants in Africa are currently treated as a single species and classified as Threatened under the ESA.

The ESA dictates that a species shall be determined to be Endangered or Threatened based on any one of five factors (16 U.S.C. § 1533 (a)(1)): 1) the present or threatened destruction, modification, or curtailment of its habitat or range; 2) overutilization for commercial, recreational, scientific, or educational purposes; 3) disease or predation; 4) the inadequacy of existing regulatory mechanisms; and 5) other natural or manmade factors affecting its continued existence. An assessment of the conservation status of, and threats facing the forest and

savannah elephants, in light of the ESA listing factors, demonstrates that each species warrants uplisting to Endangered.

Factor One: Modification or Curtailment of Habitat or Range

Habitat for both forest and savannah elephants has been drastically reduced and degraded throughout their ranges, and such impacts are ongoing and increasing. UNEP, CITES, IUCN's African Elephant Species Survival Group, and TRAFFIC state that habitat degradation and loss presents the most significant threat to the long-term survival of elephants in Africa. Almost 30 percent of the currently estimated elephant range is considered heavily impacted by human development. Over the next 40 years, the heavily-impacted area is predicted to rise to over 60 percent. UNEP et al. predicts this rise will first eradicate elephant populations in Central and West Africa and severely reduce their range in Eastern and Southern Africa.

Given the forest elephant is limited to Central and West Africa, even absent the ivory trade, habitat loss alone could drive this species extinct in just 40 years. Such habitat loss would also cause extirpation of the significant populations of savannah elephants in West and Central Africa.

Habitat loss for both forest and savannah elephants is occurring as a result of land-use changes, including expanding settlements and agriculture, livestock grazing, natural resource development, construction of fences, roads and other barriers, and deforestation, as well as from desertification and climate change. Such changes are being driven by population growth, economic development, and in some places, political instability. The resulting encroachments into elephant habitat not only directly reduce the amount of available space to these animals, but also open previously remote areas to hunting and resource extraction. This is especially problematic in West and Central Africa where a rise in industrial scale logging is creating a network of roads that increase forest elephants' vulnerability to poachers. Additionally, human settlement creates a barrier for elephant movement, as both species are known to generally avoid people and roads. Fencing is also a prevalent problem for their movement, which is best illustrated in Southern Africa where expansive veterinary fences block elephant movement and unnaturally concentrate the animals, which itself can lead to habitat degredation.

Human-elephant conflict also results from these habitat encroachments. During the dry season or other times in which food may be limited within elephant habitats, elephants may raid nearby farms, in some cases, destroying entire fields of crops. This can result in both direct retaliation against elephants and a loss of local support for elephant conservation efforts. Additionally, climate change is predicted to increase water stress throughout the continent leading to further conflict between people and elephants for space and resources, as well as habitat loss and degradation, and therefore poses severe threats to the survival of forest and savannah elephants.

In sum, habitat degradation and loss is an ongoing and immediate threat to both forest and savannah elephants. Absent any other threat, such impacts alone would be sufficient justification to uplist each species to Endangered. Unfortunately, as discussed below, elephants face even more immediate and pressing threats from poaching for ivory.

Factor Two: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The overutilization of forest and savannah elephants, mainly for their ivory to sell in the black market, is driving both species to extinction. Poaching elephants for their ivory has risen to levels which are unsustainable across the continent. Over 100,000 elephants were killed in just three years from 2010 to 2012, and CITES's program for Monitoring the Illegal Killing of Elephants (MIKE) has shown that poaching rates have now exceeded the birth rate of elephants in all four regions comprising their current range. Preliminary results from 2014 indicate that poaching rates remain high and have not diminished. Similarly, results from the Elephant Trade Information System (ETIS) show no sign of a decrease in the demand for ivory.

Forest elephants and the savannah elephant populations of Central and West Africa are most severely impacted, with their regional poaching rates well above the threshold at which CITES considers unsustainable. Those populations never recovered from the first wave of poaching in the 1970s and 1980s, and pressures remain high to this day. Historically, countries in this region have been the most active traders in illicit ivory, and some of the world's largest domestic ivory markets still exist there. Cameroon serves as an exit point for ivory which mostly comes from Central Africa and the Democratic Republic of Congo, but as those sources of ivory have become depleted and more difficult to access, there has been a shift in illegal trade to Eastern Africa.

Eastern Africa's poaching rates are similar to the continental average and are considered a key factor in the 20 percent decline of savannah elephant populations there. Uganda, Kenya and Tanzania have recently assumed major roles in the illicit ivory trade. Nearly half of all illegal ivory seizures from 2009 to 2011 came from the seaports of Mombasa, Dar es Salaam, and Zanzibar, with most ivory originating from Eastern Africa. Elephants in this region are, therefore, also highly vulnerable to poaching and the illegal trade in ivory. As one example among many, the rapid decimation of Selous Game Reserve's elephants from over 70,000 to 13,000 in less than a decade demonstrates that previously stable and robust populations are no less susceptible than others to the this crisis.

Predictably, as Central and West African ivory stocks are depleted and trade increases in Eastern Africa, the poaching crisis has begun to spread south. In 2010, overall poaching rates for the Southern Africa region exceeded the birth rate, indicating that populations in the region are now, as a whole, declining. Zambia and Mozambique have had particularly high poaching rates in recent years. Illegal trade routes are also emerging in Southern Africa, with South Africa increasingly implicated in large-scale ivory movements. Ivory markets, and hence poaching, are common in Angola as well, where recent post civil war recovery of elephants is now threatened.

Poaching is largely driven by the high demand for ivory and the rise in its value. The majority of this demand comes from China and Thailand. Ivory markets, both legal and illegal, are widespread in both countries, and neither government has made any substantial progress towards cracking down on their illegal markets or reducing the demand for ivory among their citizens. The price for ivory continues to rise, and as a result poachers still have high incentive to kill elephants.

Overutilization for commercial purposes – the ivory trade – is the most urgent and immediate threat to both forest and savannah elephants. Given the drastic and ongoing declines in both species' populations as a result of this threat, this factor alone is sufficient to warrant uplisting each species to Endangered.

Factor Three: Disease or Predation

Disease and predation are not considered threats to forest or savannah elephant populations at this time.

Factor Four: Inadequacy of Existing Regulatory Mechanisms

The fact that existing regulatory mechanisms are inadequate to protect the forest and savannah elephants is self-evident given both species are undergoing rapid, severe and accelerating declines. Numerous domestic and international laws and agreements have been put into place to safeguard elephants, yet populations continue to decline.

The most important regulatory mechanism regarding elephants is the Convention on International Trade in Endangered Species of Flora and Fauna (CITES). African elephants are listed under Appendix I of CITES except populations in Namibia, Botswana, South Africa, and Zimbabwe, which are listed under Appendix II. Consequently all forest elephants are Appendix I listed, while savannah elephants are split between the Appendix I and Appendix II. The Appendix II listing of Southern African elephants creates enforcement complications and opens avenues for the laundering of ivory taken from Appendix I populations. Additionally, CITES only regulates the international trade in species; it does not regulate the killing of elephants or the in-country trade of ivory within elephant range states. Lastly, even if all African elephants were Appendix I listed, there is little indication that market-demand for ivory would decline or that illegal trade would be curtailed.

In the United States, African elephants are listed as Threatened under the ESA with a special rule allowing for certain exemptions for the import and export of elephant parts. The African Elephant Conservation Act was written to regulate the trade in ivory after the first poaching crisis in the late eighties, and the Lacey Act provides backbone to these laws by having general provisions on wildlife trade. The Obama Administration's Executive Order to Combat Wildlife Trafficking also strengthened ivory regulations in the United States. Nevertheless, the United States has one of the largest domestic ivory markets in the world, and there are no national mechanisms that ensure that ivory sold does not come from illegal sources. A 2015 study in California in fact found that most ivory for sale was likely illegally imported.

Conservation of elephants in Africa is also impaired by the fact that almost all national and international conservation regimes and their associated regulatory mechanisms fail to recognize and differentiate between forest and savannah elephants. Failure to recognize and regulate based on the existence of two separate species raises the substantial risk that one species (most likely the critically-imperiled forest elephant) could suffer irreparable declines that would be overlooked if elephants are viewed as a single, continent-wide species.

Factor Five: Other Factors

War, civil unrest, and other political conflicts have a direct impact on elephant populations and have already caused the decline of numerous populations of forest and savannah elephants in West and Central Africa, as well as in Angola and Mozambique in Southern Africa and have the potential to do so in Eastern Africa. On local, national and regional scales, widespread poverty increases the likelihood of people turning to wildlife as a source of meat or income. Given the unfortunate lack of stability and high levels of corruption in many elephant range states, these factors present significant threats to forest and savannah elephant populations.

Conclusion

The ESA plays a powerful role in safeguarding species from extinction. The best available scientific information indicates that forest and savannah elephant populations are at risk of extinction and therefore clearly warrant uplisting to Endangered status due to severe population declines and ongoing threats to their survival. Recognizing and reclassifying forest and savannah elephants as separate species and uplisting then to Endangered would create stronger regulations of the import and trade in elephant parts, provide additional funding for recovery efforts, and bring national and international attention to the current elephant crisis. Additionally, rightfully reclassifying African elephants as two species under the ESA will encourage both range-state and international organizations and institutions to do the same, and therefore better provide species-specific conservation measures that can help save both species from extinction.

I. INTRODUCTION

Elephants are iconic species that play crucial roles in their environment and attract millions of visitors to Africa from around the world to witness their impressive stature. It is impossible to imagine the African landscape without them, yet that is exactly what may happen in the near future unless immediate and effective action is taken to reverse their decline.

For the second time in the last century, elephants in Africa are being slaughtered for their ivory at rates which are causing severe population declines across the continent. The illicit trade in ivory continues to rise due to flaws in trade regulations and lack of enforcement ability, while anti-poaching efforts are inadequate, as well as largely dependent on the huge influx of international funding that could be interrupted at any time. In fact, more funding is needed in many African countries to cap the current poaching crisis. On top of this, loss of habitat, human-elephant conflict, and political instability provide significant long-term challenges to their survival.

Importantly, despite compelling genetic research concluding that two species of African elephants exist – forest elephants (*Loxodonta cyclotis*) and savannah elephants (*Loxodonta africana*) – they are still being managed as one. Forest and savannah elephants occupy different ecological niches and face different threats and should be managed in accordance with these differences. When population data is analyzed under the two species model, it is clear that forest elephants have experienced dramatic population declines throughout their range and are susceptible to significantly higher poaching pressures than their savannah counterparts. Under the one species model, declines are less apparent with some elephant populations in Southern Africa not yet suffering the consequences of the rampant ivory trade. Therefore, we are passively watching the extermination of one entire species by not managing them as two.

The United States plays a crucial role in elephant conservation. The Fish and Wildlife Service (FWS) took a strong stand against elephant poaching when it issued the Director's Order to combat wildlife trafficking in February 2014, and again when it subsequently crushed six tons of confiscated ivory. These acts caught the attention of countries around the world. Listing forest and savannah elephants as endangered species under the Endangered Species Act (ESA) would not only have a direct impact on illicit trade by strengthening current ivory regulations, but it would build upon previously established momentum and focus national and international attention to the plight of elephants. Moreover, reclassifying African elephants as two species under the ESA would set an important precedent that could result in the Convention on International Trade in Endangered Species of Flora and Fauna (CITES) and the International Union for the Conservation of Nature (IUCN) to do the same, thereby increasing protections and improving management plans for both African elephant species.

II. TAXONOMY

African elephants belong to the genus *Loxodonta* (order Proboscidea, family Elephantidae). The Elephantidae family originated in the Miocene and includes African and Asian elephants as well as the extinct woolly mammoth (*Mammuthus primigenius*) and the American mastodon (*Mammut americanum*). The extinction of mammoths and other Proboscidea species has made

the determination of phylogenetic relationships among living elephants historically difficult (Rohland et al. 2010, p. 1-2).

Forest Elephants and Savannah Elephants Should be Classified as Two Distinct Species (*Loxodonta cyclotis* and *Loxodonta africana*, respectively)

Traditionally, forest elephants and savannah elephants have been classified as two subspecies of *Loxodonta africana*. However, numerous genetic, morphological, and ecological studies have shown that they are in fact two separate species: savannah elephants, *Loxodonta africana* (Blumenbach 1797) and forest elephants, *Loxodonta cyclotis* (Matschie 1990) (Roca et al. 2001, p. 1476; Grubb et al. 2000, in Soshani et al. 2001, p. 676; Comstock et al. 2002, p. 2489; Roca et al. 2005, p. 96; Roca et al. 2007, p. 12; Rohland et al. 2010, p. 2; Ishida et al. 2011, p. 2; Maisels et al. 2013, p. 2). Discrepancies over the degree of separation between forest and savannah elephants, shared haplotypes, and hybrid zones have been resolved, and there is no longer significant disagreement among scientists that they should be classified as two species (Roca et al. 2015, p. 159).

Morphological distinctions between forest and savannah elephants have been well documented (Grubb et al. 2000, in Maisels et al. 2013, p. 2). Forest elephants are smaller, have thinner and straighter tusks, more rounded ears, and differently shaped skulls (Maisels et al. 2013, p. 2; Roca et al. 2001, p. 1473). Grubb et al. (2000, abstract) examined 295 elephant skulls from locations throughout the African continent and found appreciable morphological and ecological distinctions, concluding that they deserve to be ranked as two separate species.

Roca et al. (2001) found genetic evidence for species level classification by examining four nuclear genes in elephants across the continent (p. 1473). The authors identified a phylogenetic clade containing three populations of forest elephants (Dzanga-Sangha, Lope, and Odzala) and another clade containing 15 populations of savannah elephants (p. 1474). Ninety-four percent of the genetic variation between groups was due to the differences between forest and savannah elephants, and the evolutionary distance between them was estimated to be greater than three million years (Roca et al. 2007, p. 2). Reproductive isolation was evident (p. 1475), and no difference was observed within forest and savannah groups, despite vast geographical distances (p. 1474). Comstock et al. (2002) expanded upon Rota et al.'s findings and further supported the species level classification (p. 2496). Their allelic variation comparisons between species, broad geographical regions, and specific geographic locales to discover the degree of genetic subdivision between African elephants (p. 2490) revealed that forest and savannah elephants are almost as genetically distant as Asian and African elephant genera (p. 2496).

In 2005, Roca et al. and Debruyne et al. both studied the mtDNA lineages in African elephants. Despite detecting highly divergent clades, with one clade comprised entirely of savannah elephant mtDNA haplotypes, the two studies came to different conclusions about the classification of African elephants. Roca et al. (2005) maintained their hypothesis that forest and savannah elephants are two different species based on the polyphyletic mtDNA pattern compared to its nuclear markers (Roca et al. 2007, p. 2). Debruyne et al. (2005), however, concluded that because haplotypes carried by savannah elephants were found in the forest elephant clade, the two belonged to a single species (Roca et al. 2007, p. 2). This disagreement has since been

resolved based on the understanding that the shared haplogroup implies a common maternal ancestor, and the cytonuclear dissociation is related to elephant behavior. As female herds moved away gradually from dominant savannah bulls, the nuclear gene pool became displaced, leaving some savannah elephants with traces of mtDNA characteristic of forest elephants but no trace of forest DNA in the nuclear genome (Roca et al. 2005, Lei et al. 2008, Roca et al. 2007, Roca and O'Brien 2005, in Rohland et al. 2010, p. 6). This was supported by Ishida et al.'s (2011, p. 12) findings that the "hybrid zones" have shifted over time as the climate and distribution of forest habitats have changed, which explains the large geographic distribution of the forest elephant mtDNA clade within savannah elephants.

Genotypically mixed elephants were detected in one population in Garamba, seemingly indicating that a narrow hybrid zone exists between savannah and forest elephants (Roca et al. 2001, p. 1476), but the absence of intermediate morphotypes in forest or savannah habitat, lack of nuclear gene flow between species, the inferred lack of reproductive success among hybrid males lead researchers to conclude that the Garamba population does not affect the integrity of the two species model (Roca et al. 2007 p. 2, 11-13). In fact, Ishida et al. (2011, p. 12) later found that most savannah elephants who carried the forest mtDNA haplotype were not hybrids at all, given that approximately 100 percent of their makeup still belonged to the savannah elephant partition, and similarly in Garamba, the majority of individuals partitioned completely as forest elephants.

In 2010, a groundbreaking study used modern DNA sequencing and PCR amplification to compare the American mastodon, woolly mammoth, Asian elephant, African savannah elephant, and African forest elephant (Rohland et al. 2010, p. 2). Along with other profound discoveries about the lineage of elephants, the authors found that forest and savannah elephant populations diverged as long ago as Asian elephants and mammoths diverged, therefore supporting previous morphological, ecological, and genetic studies that classified forest and savannah elephants as distinct species (Roca et al. 2005, Grubb et al. 2000, Roca et al. 2001, Groves and Grubb 2000, Comstock et al. 2002; Rohland et al. 2010, p. 6). Fossil evidence also suggests that forest and savannah elephants may have been separated geographically by a more dominant elephant species from the genus *Elephas*, until that species disappeared in the late Pleistocene (Maglio 1973, Kingdon 1979, Sanders et al. 2010, in Rohland et al. 2010, p. 7).

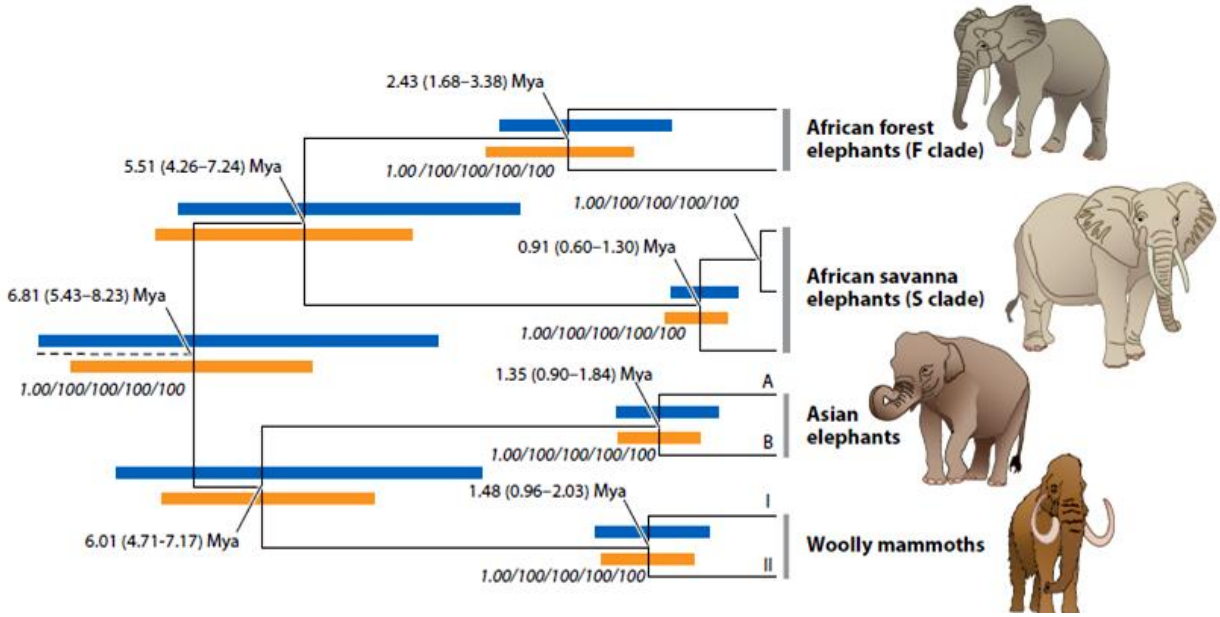


Figure 1: African Elephant Phylogeny. From Roca et al. 2015, Figure 2: "Phylogeny of elephantid species inferred from mitogenomic sequences. Note that the divergence date between forest elephant (F clade) and savanna elephant (S clade) mitochondrial genomes is comparable to the divergence between Asian elephant and mammoth mitochondrial genomes. Within each of the four lineages, the genomes analyzed represent the most basal within-lineage divergences; these indicated that F clade has the deepest within-lineage crown group coalescent date. Blue and orange bars indicate the 95% highest posterior density as determined by using two sets of calibrations. The lower bar relied on a narrower set of calibration dates that excluded fossils identified as being of questionable assignment to genera by Sanders et al. (2010) and assumed the monophyly of the elephantid genera (Shoshani 1996, Maglio 1973, Rohland et al. 2010)."

The mixed populations of West Africa's elephants have been a source of debate among elephant geneticists (Ishida et al. 2011, p. 1-2; Johnson et al. 2007, p. 9). West Africa's elephants have a complicated history of high disturbance that has made their taxonomical classification difficult. Most were eradicated in the early twentieth century for their ivory (Barnes 1999, Roth and Douglas-Hamilton 1991, Douglas-Hamilton 1987, in Ishida et al. 2011, p. 3). Today, less than two percent of the continent's elephants remain in West Africa (Roca et al. 2007, p. 11). Other human disturbance has left this population extremely fragmented and has significantly reduced the native rainforests in which the elephants lived. They now only inhabitat seven percent of their former range in the region (Roca et al. 2007, p. 11), and we cannot assume that the current geographic distributions of West Africa's elephants reflect their historic patterns (Ishida et al. 2011, p. 3).

These disturbances have disrupted West Africa's genetic patterns to a higher degree than in other forest and savannah populations (Roca et al. 2007, p. 11), likely increasing opportunities for hybridization, while some genetic patterns remained in isolated patches of forest elephants (Roca et al. 2007, p. 11). Though an argument can be made for genetic distinctness among West Africa's elephants, there is a lack of evidence for hybridization or that these populations make up a separate species as has been previously suggested (Johnson et al. 2007, Eggert et al. 2007, Groves 2000; Ishida et al. 2011, p. 13).

Forest Elephants (*Loxodonta cyclotis*) and Savannah Elephants (*Loxodonta africana*) Should Be Reclassified as Two Species Under the Endangered Species Act

Roca et al. (2015) conducted a literature review of all the African elephant genetic studies and concluded: "The genetic evidence overwhelmingly indicates that savanna elephants (*Loxodonta africana*) and forest elephants (*Loxodonta cyclotis*) in Africa comprise separate species" (p. 159). Forest and savannah elephants face different conservation challenges and survive in different ecological niches (Maisels et al. 2013, p. 2), and conservation management strategies should be adjusted in accordance with their differences.

Forest and savannah elephants are recognized as separate species in the Integrated Taxonomic Information System (ITIS). ITIS's serial number for forest elephants is 609784 and for savannah elephants is 584939 (www.itis.gov). The African Elephant Specialist Group and Species Survival Commission of the IUCN still recognizes African elephants as one species, but that classification predates the many determinative studies that have been published since that decision was made over a decade ago (AfESG 2003, "Statement on the Taxonomy of Extant *Loxodonta*"; Blanc 2008, IUCN species page: *Loxodonta africana*). The Service should reclassify African elephants as two species, both of which should be, as detailed below, uplisted to Endangered.

III. NATURAL HISTORY

Most of the literature on the natural history of elephants in Africa categorizes them as one species and does not differentiate physiological, behavioral, reproductive, social or other attributes between the two species. Consequently, much of the discussion below refers generally to "African elephants", but where important differences have been documented, such as morphology, diet, and habitat requirements, we note them below.

A. Description

Elephants are the largest land mammal and arguably one of the most charismatic and recognizable species on our planet, but less obvious differences exist among species of elephants. African elephants (*Loxodonta cyclotis, Loxodonta africana*) are larger than Asian elephants (*Elephas maximus*), have larger, more rounded ears, and both males and females typically have tusks, whereas in Asian elephants, only the males do. Asian elephants also have more hair, longer and straighter foreheads, and sometimes have pink, spotted skin.

The two species of African elephants not only exhibit strong genetics differences, but they have different morphological characteristics as well. Forest elephants (*Loxodonta cyclotis*) are smaller than savannah elephants (*Loxodonta africana*), have thinner, straighter tusks, more rounded ears, and differently shaped skulls (Maisels et al. 2013, p. 2). All African elephants also exhibit sexual dimorphism. Male elephants are larger than females, with larger and wider-set tusks, more rounded foreheads, and less curvature in their spines. Forest elephants (left) and savannah elephants (right) are shown below.

Photo by U.S. Fish and Wildlife Service

Photo by Brian Ralphs

B. Behavior

African elephants are highly social, intelligent animals. Similar to humans (Hamilton et al. 2007), nonhuman primates (Kawai et al. 1983), cetaceans (Connor et al. 1992), and some birds (Hegner et al. 1982), elephants live in multilevel, hierarchal societies (de Silva and Wittemyer 2012, p. 1126). Related females will stay together in a herd, led by a matriarch, and herds will often associate with other groups to form extended "kinship" or "bond" groups (Douglas-Hamilton 1972, Moss and Poole 1983; in de Silva and Wittemyer 2012, p. 1127). These extended groups can be organized into four social tiers: tier 1 units are mother-calf units; tier 2 units are groups of mother-calf units that regularly associate, making up the more classically recognized core or family groups; tier 3 units are multiple families that associate with each other, and tier 4 groups are an extension of tier 3 groups (Wittemyer et al. 2009, 2005, in de Silva and Wittemyer 2012, p. 1127).

Bonds between family groups are often kin-based (de Silva and Wittemyer 2012, p. 1127). African elephants maintain a much stronger bond with their social units than Asian elephants and form larger groups (Ibid. at 1136). Alloparental care has also been documented in African elephants (Lee 1987, in de Silva and Wittemyer 2012, p. 1138), and aunts and sisters will often share responsibility in raising a calf.

Researchers have recently discovered that male elephants are actually much more social than was previously thought as well. While they do compete for mates while in musth, they will often travel in groups when mating is not a priority, especially when in areas of high-risk such as near human settlements (Chiyo et al. 2014, p. 1500). They will also socialize with family groups for non-mating purposes and visit elephants they are related to (Chiyo et al. 2011, p. 1097). Older males play a central role in male social networks (Chiyo et al. 2011, p. 1097) by teaching the young ones behaviors and leading them to and from resources. Males that form close bonds, though, are often close in age to reduce competition and maintain adhesiveness in the group (Chiyo et al. 2011, p. 1098; Lee and Moss 2014, p. 152).

Elephants are known to mourn the dead (Douglas-Hamilton 2006, p. 2, 13-14), a behavior that only highly intelligent animals are thought to exhibit. When a family member dies, each member of the herd will approach the body and touch it all over with their trunk. Elephants will comfort

each other and show concern for other distressed elephants even to non-family members (Douglas-Hamilton 2006, p. 13-14).

C. Reproduction

Elephants have extremely slow reproduction cycles and birth rates. In optimal conditions, they may have up to a six percent annual reproduction rate (Wasser et al. 2009, p. 69). Female African elephants become sexually mature anytime between ten to 18 years of age depending on population density and nutritional availability (Perry 1953, Laws 1969, in Allen 2006, p. 830). Oestrus cycles typically last about 14-15 weeks, during which females are only fertile for 2-4 days (Poole 1996, in Allen 2006, p. 830; Leong et al. 2003, p. 434). If they do not conceive, they will ovulate a maximum of four times a year, but females may only be sexually receptive for two to six days every three to nine years (Moss 1983, 2001, Laws et al. 1975, Smith and Buss, 1973, in Leong et al. 2003, p. 434).

Male African elephants reach puberty between 14 and 17 years of age, but most often cannot outcompete older males for mates (Poole 1982, in Poole 1989, p. 842). Musth is a phenomenon in elephants in which males' heightened testosterone levels make them aggressive to other males and signal to females that they are in good condition and able to mate (Bates et al. 2011, p. 1). During this period, they are consistently releasing urine to leave a scent trail for females, and they have swollen temporal glands that secrete scented hormones (Bates et al. 2011, p. 1). This can occur at any time of the year, and the older a male gets, the more consistent their musth periods become (Leong et al. 2003, p. 434; Poole 1987, Rasmussen 2005, in Goldenberg et al. 2014, p. 117). Males often undergo periods of sexual activity asynchronously with females (Goldenberg et al. 2014, p. 112).

Females will typically conceive one calf after two or three mating events (Poole 1996, in Allen 2006, p. 830). Twinning is rare, but elephants do have the capability for it (Allen 2006, p. 230). Elephants have the longest gestation period of any mammal at 22 months (Wittemyer et al. 2007b, p. 44), and their calving intervals range from three to nine years, also depending on population density (Perry 1953, Laws 1969, in Allen 2006, p. 823).

D. Feeding and Ecology

Elephants are herbivorous and generalists that feed on trees, shrubs, grasses, herbs, and fruits depending on availability (Blake 2002, p. 112-115). They may spend 70 to 90 percent of their time foraging and can eat 100 to 300 kg of vegetation in a single day (Osborn, 2004, in Mariki et al. 2015, p. 20). Savannah and forest elephant diets differ, largely due to the availability of forage in their habitat, but each play a unique role in the ecological functions of their respective ecosystems.

Savannah elephants (*Loxodonta africana*) typically have a less diverse diet than forest elephants (*Loxodonta cyclotis*) due to less diversity in their habitat (Blake 2002, p. 112). For example, the desert dwelling elephants of Namibia have the lowest reported dietary diversity (Blake 2002, p. 112). Savannah elephants generally feed on grasses, which make up over 60 percent of their annual diet, with trees, herbs, and shrubs accounting for the rest (Owen-Smith 1988, Field and

Ross 1976, in Blake 2002, p. 115). In contrast, forest elephants are highly frugivorous, but mostly because fruits are more available in the forest. When given the opportunity, savannah elephants will feed on fruits with relish (reviewed in Blake 2002, p. 119).

Both forest and savannah elephants play significant roles in ecological dynamics and are often referred to as keystone species (Lewis 1987, Owen-Smith 1988, Baxter and Getz 2005, in Grahama et al. 2009, p. 445). They play an important function in gap creation, excavation, trail formation, plant predation, and seed dispersal. Elephants disperse seeds from more than 100 plant species over large distances which shapes the ecosystem (Blake 2002, p. 266).

Forest elephants are incredibly important to the maintenance of Central Africa's forests. They disperse more intact seeds than any other species of large vertebrate in African forests and over unprecedented distances when compared to other dispersers (Blake et al. 2009, p. 1). The loss of forest elephants would ultimately lead to a forest that favors a species-poor, abiotically dispersed tree community, lowering the overall diversity of the Congo Basin forest (Blake et al. 2009, p. 8) which is the second largest rainforest in the world and an important carbon sink.

Savannah elephants have an equally important role in maintaining savannah habitats. With too few elephants in a savannah landscape, the land becomes dominated by the yellow-barked acacia. The presence of elephants opens up the forest canopy, allowing a proliferation of species in the light gaps, increasing plant diversity (Western 1989, unpaginated). The maintenance of plains also facilitate high productivity among other grazing animals, as seen in Tsavo, Kruger, and Ruaha (Ibid.).

E. Habitat Requirements

Water availability, forage quality, and space are the most important factors in habitat selection for all elephants (Kangwana 1996, Kikoti 2009, in Mariki et al. 2015, p. 20; Western 1975, Western and Lindsay 1984, Chamaillé-Jammes et al. 2007, Loarie et al. 2009, in Wall et al. 2013, p. 61). Elephants require large tracts of land (Kangwana 1996, Kikoti 2009, in Mariki et al. 2015, p. 20), and due to their massive energy requirements, elephants respond spatially to vegetation availability and are adapted to long distance movement critical for accessing resources that are scarce in time and space (Graham et al. 2009, p. 445; Owen-Smith 1988, in Wall et al. 2013, p. 61). Thus, extensive seasonal migration results as a means to follow forage and water availability, which now often means navigating through farmland and human communities (Kangwana 1996, Kikoti 2009, in Mariki et al. 2015, p. 20).

Water plays a more significant role in determining habitat suitability for savannah elephants than forest elephants because water availability is more variable in their habitats. Thouless (1996) demonstrated that an inverse relationship exists between annual rainfall and home range size for savannah elephants in Kenya (in Graham et al. 2009, p. 445). This is especially apparent in arid and desert ecosystems. In Mali and Namibia, elephants travel enormous distances to reach water and vegetation, with recorded home range sizes of 24,000 and 12,800 square kilometers, respectively (Blake et al. 2003, Leggett 2006, in Graham et al. 2009, p. 445). In fact, the Gourma elephant population in Mali occupies the harshest of elephant environments, and their large scale migrations and congregations clearly demonstrate that elephants follow rainfall patterns (Wall et

al. 2013, p. 67). In Kenya, where the savannah habitat is generally less harsh, elephants were found to travel an average of about 3,500 kilometers per year.

While water may not be as limiting of a factor in forest ecosystems, forest elephants must move to meet their nutritional requirements. Forest elephant distribution correlates with mineral-rich forage in natural forest clearings (bais), and forest elephants will often follow the patchy distribution of fruit (Gessner et al. 2014, p. 60; Blake 2002, p. iii). Individual forest elephants can range up to 2,000 square kilometers and will travel over 50 kilometers in two days to exploit resources over large areas (Blake 2002, p. iii-iv).

Such mobility enables populations to respond to stochastic events, cope with the impact of climate change, and maintain the ecosystem acting as keystone species (Lewis 1987, Owen-Smith 1988, Baxter and Getz 2005, in Graham et al. 2009, p. 445). Identifying and protecting elephant corridors in from human encroachment in both savannah and forest ecosystems is critical to their survival.

IV. POPULATION AND DISTRIBUTION STATUS AND TRENDS

Elephants are wide ranging species that are notoriously difficult to count due to a number of logistical obstacles (IUCN et al. 2013, p. 2). However, due to the improvement in modeling techniques, greater cooperation among range state governments, and an increased need to understand how fast we are losing these species, we are gaining a better understanding of the population trends of regional groups, and eventually, species-wide trends.

The African Elephant Database is a compilation of all elephant population surveys submitted to the African Elephant Specialist Group (AfESG) of the IUCN Species Survival Commission (SSC). It is an important tool and the most comprehensive and authoritative database on the *current understanding* of the distribution and abundance of all elephants in Africa. But this database and the reports that AfESG produces every five years is not at all meant to be a tool to derive population trends (Blanc et al. 2007, p. 13), as it is only a running tally of different population surveys. The most obvious reason for not being able to determine trends from information in this database is that new surveys and surveys using different methodology are added in without consideration for previous years. For example, from 2007 to 2012, the total number of "DEFINITE" elephants in Central Africa increased, but the entire scientific community is well aware that these populations have dramatically declined in abundance and are highly imperiled (Maisels et al. 2013). The increase reflected in the database is due to new surveys in countries where there were no previous data.

To best explain forest (*Loxodonta cyclotis*) and savannah (*Loxodonta africana*) elephant population statuses and trends, first, we will discuss what we know about past, continent-wide elephant population trends. Second, we will explain what is happening with forest and savannah elephant populations currently, divided by four regions commonly referred to by elephant scientists and political boundaries. Finally, we will present the most current abundance estimates from the 2012 African Elephant Database summaries. The 2012 compilation has not been published into a full report, but the summaries are available online. As such, we will reference these data as "AfESG 2012".

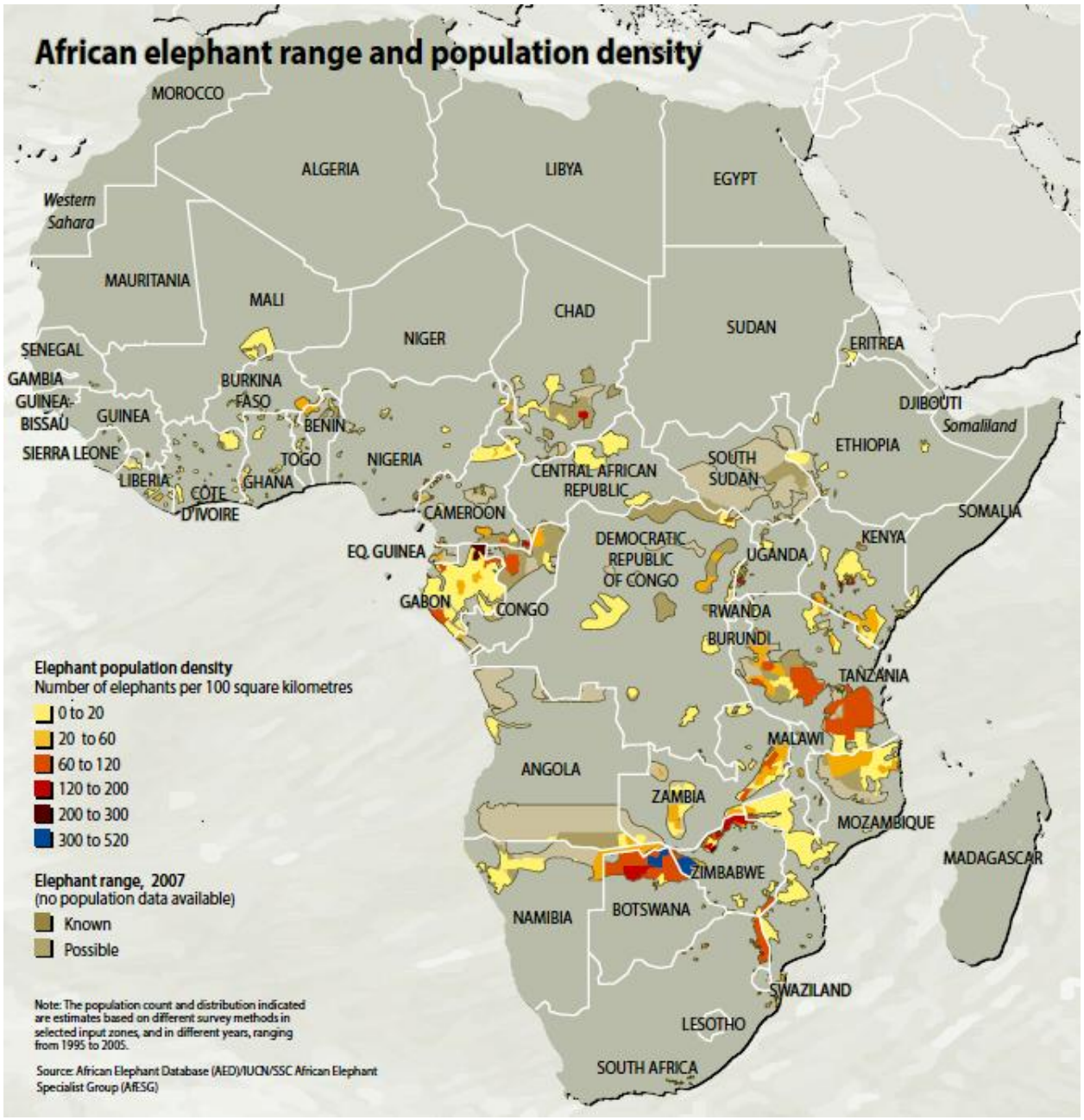
A. Historical Abundance and Range, and Context for Current Trends

Before the first elephant crisis, surprisingly little was known about the continents' population of elephants (Douglas-Hamilton 1987, p. 11). By 1979, after the first wave of high ivory demand had already begun, causing the decline in all elephant populations (Douglas-Hamilton 1987, p. 13), data were still lacking, but over a million elephants were estimated to roam Africa in large, but at this point already fragmented, populations (Douglas-Hamilton 1979a, in Douglas-Hamilton 1987, p. 11). From about 1970 to 1990 hundreds of thousands of elephants were killed, prompting numerous laws and regulations such as a Threatened listing (and a proposed Endangered listing that never went through) under the ESA, passage of the African Elephant Conservation Act, and Appendix I and II listings under CITES (UNEP et al. 2013, p. 22). About 300,000 to 600,000 elephants were estimated to remain (Said et al. 1995, in UNEP et al. 2013, p. 22). When FWS proposed to uplist African elephants to Endangered in 1991 (56 Fed. Reg. 11392), the agency cited a CITES estimate of 608,000 elephants ranging across 5.8 million square kilometers (CITES 1989).

After CITES listed elephants as Appendix I species, populations began to recover in almost all range states, except populations in West and portions of Central Africa that were poached the heaviest and lost the most habitat (we know now that this region actually contains two species of elephants, and forest elephants occur only within this region; Blanc et al. 2007, in UNEP et al. 2013, p. 22). By 2007 there were an estimated 470,000 to 690,000 elephants on the continent (UNEP et al. 2013, p. 22). But around 2008, the tides turned again. A second wave of heavy ivory trafficking (discussed further under Section VI.) among other threats has resulted in yet another dramatic decline in elephant populations (UNEP et al. 2013, p. 22). The latest estimates reveal that the number of elephants remaining ranges somewhere between 419,000 and 650,000 (Ibid.), but many conservationists believe that is an overestimate. Some even believe that the majority of large elephant populations will be extirpated in the next decade if the rate of decline continues as is (Wasser et al. 2008, p. 1065). The much needed "Great Elephant Census", an attempt at estimating the total number of elephants in Africa through aerial surveys conducted by Elephants without Borders and partners, aims to clarify these numbers by 2016.

B. Current Range

The best information we have on total current range comes from the "known" and "possible" estimates of the African Elephant Database, which total 3,365,326 square kilometers. This map is from 2007, but the AfESG only made small adjustments to range in 2012 (AfESG 2012). Density estimates are from 1995-2005 and should be interpreted with caution.



C. Population Status and Trends by Species and Region

As noted earlier, it is extremely difficult to assess accurate, regional population trends for both forest and savannah elephants. There is a lack of comparable surveys within each region, and many areas have no historical records with which to compare their present numbers. Nevertheless, our best estimate for population trends for each species and region are shown below. Each region's population trends are further analyzed in the following sections.

Table 1: Forest and savannah elephant population trends

Region	*Time Interval for Trend Estimate (years)*	*Population Trend*	*Percent Change*	*Reference*
Forest Elephants (*Loxodonta cyclotis*)				
West Africa	-	Declining	Unknown[1]	WWF et al. 2005
Central Africa	9 (2002-2011)	Declining	-62%	Maisels et al. 2013
Savannah Elephants (*Loxodonta africana*)				
West Africa	20 (~1990-2010)[2]	Declining	-33%	Bouché et al. 2011
Central Africa	20 (~1990-2010)[3]	Declining	-76%	Bouché et al. 2011
Eastern Africa	8 (2005-2013)	Declining	-20%	UNEP et al. 2013[4]
Southern Africa	4 (2010-2014)	Declining[5]	Unknown	Wittemyer et al. 2014

[1] West Africa's elephant populations crashed significantly in the 20th century and never recovered. There is a lack of data from this region, but few populations remain and occur in very small numbers, as explained below.
[2, 3] See below for explanation on the time intervals.
[4]These data originate from the African Elephant Database and should be interpreted with slight caution.
[5] Southern Africa's elephant populations have been stable or increasing until just recently when the death rate exceeded the birth rate for the entire region beginning in 2010. Rate of decline is unknown. The change in numbers from the African Elephant Database is mostly due to a change in surveys.

1. Forest Elephants (*Loxodonta cyclotis*)

Forest elephants (*Loxodonta cyclotis*) are in imminent danger of extinction throughout their range. Historically, surveys have been difficult to complete due to the dense canopy and thick undergrowth of the region which impedes aerial and direct counts (Michelmore et al. 1994, p. 90) as well as the inability to travel in the region during various civil conflicts. Results from the few analyses on forest elephant populations that do exist are presented below.

a. Forest Elephant Populations in Central Africa

Ninety-five percent of remaining forest elephants occur in the forests of Central Africa, which includes portions of the Democratic Republic of the Congo (DRC), Gabon, Central African Republic (CAR), Republic of the Congo (Congo), and Cameroon (Maisels et al. 2013, p. 2). Analyses based on average elephant densities in areas free of poaching (usually 0.5-1.0 km^{-2}) conservatively suggest that these forests may have once harbored over a million elephants (Maisels et al. 2013, p. 6). As of 1989, this area held one-third of the entire continent's population, and about 172,000 elephants remained (Blake et al. 2007, p. 945; Michelmore et al. 1994, in Maisels et al. 2013, p. 6; 56 Fed. Reg. 11392). There had not been a range wide survey since.

Table 2: Estimates of forest elephant numbers in Central Africa in 1989 (From Barnes et al. 1995, in Blake 2005, p. 10, Table 1).

Country	Estimated number of forest elephants
Cameroon	12,000
Central African Republic	2,000
Congo	31,000
Equatorial Guinea	400
Gabon	55,000
Democratic Republic of Congo (former Zaire)	72,000
TOTAL	172,400

Now, Central Africa only holds only an estimated 17 percent of Africa's elephants (AfESG 2012). Forest elephant populations have declined by 62 percent in just nine years (2002-2011) and 80 percent in less than two elephant generations (ca. 25 years) (Maisels et al. 2013, p. 8). Less than ten percent (ca. 100,000 individuals) of the species' original projected population remains in less than 25 percent of its former range (Maisels et al. 2013, p. 2, 3, 8). For context, the IUCN considers a species critically endangered when it has declined by more than 80 percent over three generations or in ten years (Maisels et al. 2013, p. 8).

Currently, the forested regions of Gabon, northern Congo, southwestern CAR and southeastern Cameroon contain the region's highest forest elephant densities and almost all the nationally important elephant populations, while most of DRC, eastern Congo and southern CAR have very low densities (Maisels et al. 2013, p. 5).

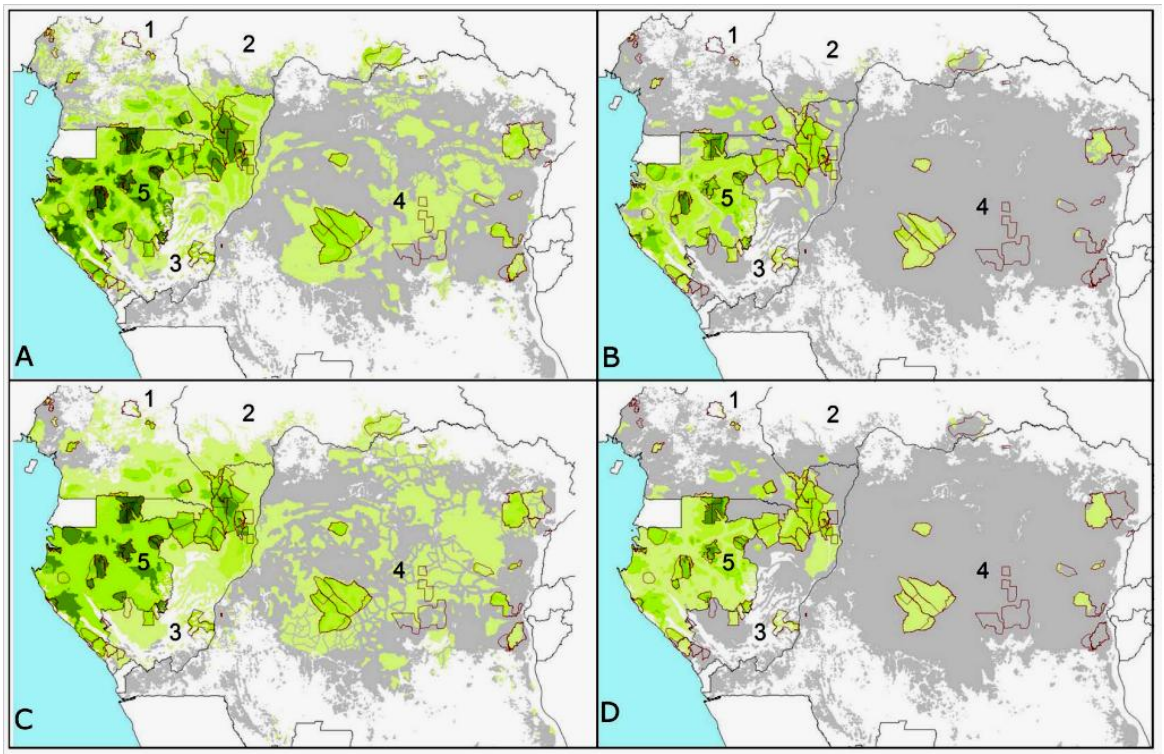


Figure 2: Elephant dung density and range reduction in Central African forests (Maisels et al. 2013, p. 3, Figure 1). (A) and (B) are 2002 and 2011 predictions using model with variables: survey year, Human Influence Index, corruption, and the presence/absence of guards. (C) and (D) are 2002 and 2011 predictions using model with variables: survey year, proximity to road, human population density, and corruption. Increasingly darker shades of green correspond to higher densities, grey represents extremely low elephant density range (the first interval: 0–100 elephant dung piles/km^2) and white is non-habitat (80 survey sites outlined in red). Cutpoints are: 0; 100; 250; 500; 1,000; 1,500; 3,000; 5,000; and 7,500 dung piles/km^2. Countries 1–5 are: Cameroon; Central African Republic; Republic of Congo; DRC; Gabon.

The decline of elephant populations in the DRC represents possibly the most notable devastation. The DRC once contained almost 60 percent of the world's forest elephants. As of 1989, it still maintained 40 percent (Michelmore et al. 1994, in Maisels et al. 2013, p. 6). Now, the DRC carries less than 20 percent of remaining forest elephants, despite holding 62 percent of the available forested habitat (Maisel et al. 2013, p. 3). A dismal one percent of the DRC's elephant population remains and 95 percent of its forests are empty of elephants (Ibid.). Scientists estimate that at the current rate of decline, forest elephants may soon be extirpated from the DRC, Africa's second largest country.

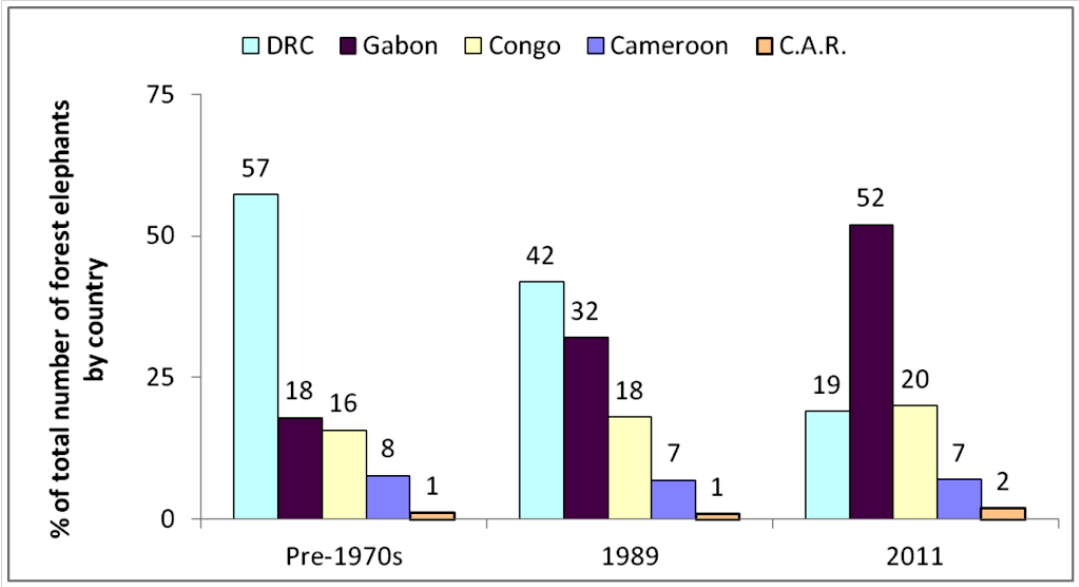


Figure 3: Percentage breakdown of the total number of forest elephants by country. Results are shown for 3 time periods: pre-1970s and 1989 (Michelmore et al. 1994) and 2011 (Maisels et al. 2013) (Maisels et al. 2013, p. 7, Figure 7).

Country wide population statistics are difficult to ascertain, but studies from various protected areas clearly demonstrate how catastrophic the loss of elephants in the DRC has been. In Salonga National Park, Africa's largest protected forest (36,260 km^2), only 1,900 forest elephants remain at a mean density of 0.05 per kilometer (Blake et al. 2007, p. 946), down from 8,300 in 1989 (Alers et al. 1992, in Blake 2005, p. 98). The Okapi Faunal Reserve (RFO) in eastern DRC held one of the largest forest elephant populations in the country in 1996 and is one of the few areas in which surveys were carried out pre and post civil conflict (Beyers et al. 2011, p. 2). Up to half of the RFO population, or roughly 3,300 elephants, was lost from around 1995 to 2007 (Ibid. at 6). The Kahuzi-Biega lowland forest held similar elephant densities as the RFO in the mid-1990s. Ten years later, no elephants were found (Hart et al. 2007, in Beyers et al. 2011, p. 7). Maiko National Park also has a documented decline of over half of its elephants (See Table 3, Ibid., p. 9).

Table 3: Elephant population declines in the DRC (Beyers et al. 2011, p. 9, Table 5).

DRC Elephant Range	Before war (1986-1996)	Civil War (1996-2003)	Post-war Anarchy (2003-2009)	**Percent change**
Okapi Forest Reserve (RFO)	6,439	N.D.	3,288	**-49%**
Kahuzi Biega NP – upland[1]	± 800	N.D.	± 20	**-98%**
Kahuzi Biega NP – lowland [1]	3,720	N.D.	0	**-100%**
Maiko NP	6,000	N.D.	1,000-3,000	**-67%**
*Garamba NP[2]	11,175	5,983	3,696	**-67%**
Totals	**28,134**	**-**	**9,004**	**-68%**

[1]Data from African Elephant Status Report, 2007
[2]Data from de Merode et al. 2005, Emslie et al. 2006, and Hillman-Smith et al. 1995
*Garamba contains both forest and savannah habitat, but recent genetic studies reveal that Garamba elephants partition almost completely with the forest elephant (*Africana cyclotis*) genotype (Ishida et al. 2011, p. 12).

Gabon holds half of the world's surviving forest elephant population making it a crucial location for the maintenance and recovery of this species, despite only having 13 percent of the available forested habitat (Maisels et al. 2013, p. 3). Still, only 30 to 50 percent of Gabon's probable historic numbers remain, and high density elephant populations only exist in 14 percent of its forests, which is an 18 percent decline from 2002 (Ibid.). Gabon held one of the only two areas in which elephant densities are greater than one per kilometer, Minkébé National Park with 22,000 individuals about ten years ago (Blake et al. 2007, p. 946), but even here, from 2004 to 2012, the government estimated they lost at least half (11,000) of this population to poaching (Maisels et al. 2013, p. 6). Protected areas and Forest Stewardship Council (FSC)-certified logging concessions, especially in the northeast and center parts of the country represent the most important sites for forest elephant conservation (Maisels et al. 2013, p. 5).

In CAR, forest elephants only exist in a narrow band of forest along the southern border (Blake 2005, p. 94). Only two regions carry "significant" forest elephant populations: Dzanga-Sangha National Park and Bangassou Forest (Blake et al. 2007, p. 946; Maisels et al. 2013, p. 5), but even those are fragmented and small (Blake 2005, p. 94). There is little doubt that the Bangassou Forest population has diminished over the last 20 years despite a lack of survey data (Blake 2005, p. 97). Scientists guess that between 500 and 1,000 elephants remain (Blake 2005, p. 98; Blake et al. 2007, p. 946). In Dzanga-Sangha National Park, elephant densities decreased by three fold from 1988 to 2004 (Carroll 1988; Blake 2005, p. 101).

Significant forest elephant populations in Cameroon exist in the southeastern corner of the country which includes three national parks: Boumba Bek, Nki and Lobéké, and FSC-certified logging concessions (Maisels et al. p. 6). Surveys in the Boumba Bek/Nki area have been wildly inconsistent, citing estimates ranging from 250 to 7,000 elephants in the early 1990s (Blake 2005, p. 105). This variation could be due to seasonal migration patterns (Ibid.), but by 2004, an estimated 318 elephants remained in Boumba Bek National Park (Blake et al. 2007, p. 946) and roughly 2,000 elephants existed in Nki in 1998 (AFESG 2012). Lobéké has not been surveyed since 1993, but was estimated to hold around 3,700 elephants then (AfESG 2012).

Congo's important elephant sites can be found in northern Congo in Odzala and Nouabale-Ndoki national parks and FSC-certified concessions (Maisels et al. 2013, p. 5). Odzala National Park holds the one of two populations with elephants densities greater than one per kilometer, with an estimated population of 14,000 individuals in 2004 (Blake et al. 2007, p. 946) and 13,400 individuals in 2008 (Wildlife Conservation Society-Congo Program 2008, in AfESG 2012).

One population of elephants may remain in Equatorial Guinea, but its definite size is unknown (Blanc et al. 2007, p. 57). The vast majority of the country is un-surveyed; elephants are thought to be largely absent from the northern half of the country where there are high human densities (Ibid.). Researchers' best guess puts the remaining population somewhere between 300 and 700 individuals (AfESG 2012).

b. Forest Elephant Populations in West Africa

Elephants in West Africa (both forest and savannah) have been under far greater pressure from human disturbance and wildlife trade from an earlier time than those of Central, Eastern, and

Southern Africa (Roth and Douglas-Hamilton 1991, p. 490). Only five percent of the world's forest elephants occur in what remains of West Africa's forests in Côte d'Ivoire, Sierra Leone, Nigeria, Guinea, and Liberia (WWF et al. 2005, p. 22). All populations have experienced past, recent and ongoing declines.

West Africa has experienced such extreme habitat degradation that understanding the past and present status of forest elephants in the region is difficult, and their range cannot be assumed based on biogeographical zoning alone (Roca et al. 2007, p. 11). Roth and Douglas-Hamilton (1991) conducted the first range wide assessment of forest elephants in West Africa. As of then, populations were already small and fragmented. The elephant populations in West Africa collapsed just before World War I and never recovered (Roth and Douglas-Hamilton 1991, Barnes 1999, in Blake 2005, p. 8). In the remnants of the Guinean Forest Zone, an estimated maximum of 5,200 individuals occurred in 1984, though reports after 1984 showed further decline in this population before the study was even published in 1991 (Roth and Douglas-Hamilton 1991, p. 520). Elephants occupied about 16 percent of their former range in the Guinean Forest Zone in over 50 small relic populations with little evidence of migration or connectivity (Ibid.). Populations in Liberia and Côte d'Ivoire made up 79 percent of the forest elephants in West Africa, and populations in Sierra Leone, Guinea, Ghana, and Nigeria were thought to already be headed toward irreversible extirpation (Ibid. at 521).

As of 2005, two-thirds of the remaining forest elephant populations in West Africa consisted of groups of 50 or fewer elephants as a result of decades of habitat destruction and heavy wildlife trade. Ten populations held more than 100 and only three exceeded 500 elephants: Bia/Goasa/Djambamakrou, lying on the border between Ghana and Cote d'Ivoire, Gola forest on the border of Liberia and Sierra Leone and Cross River-Korop-Banyang-Mbo area between Nigeria and Cameroon (WWF et al. 2005, p. 8). These numbers are almost certainly lower today.

Lack of surveys remains an issue for West African forest elephant conservation (AfESG 2012), and there are no data on sex ratios, age structure, mortality, or West Africa's current carrying capacity for elephants (WWF et al. 2005, p. 8). Only a handful of surveys have been completed since the 2005 Strategy for the Conservation of West Africa's Elephants was published, and only three of those were found to have a population of over 100 elephants: Liberia, Sapo National Park at 124; Ghana, Bia Conservation Area at 146, Mole National Park at 401 (AfESG 2012; Danquah and Oppong 2014, p. 6402). Scientists have theorized that an elephant population must exceed 200 individuals if it is to survive a century (Sukumar 1993, in WWF et al. 2005, p. 10).

2. Savannah Elephants (*Loxodonta africana*)

a. Savannah Elephant Populations in West and Central Africa

Savannah elephants in West and Central Africa are just as, if not more, imperiled as their forest counterparts. Lack of data is also a problem for these populations, but scientists agree that they face imminent extirpation from these regions (Roth and Douglas-Hamilton 1991; Bouché et al. 2011, p. 2; WWF et al. 2005; Bouché et al. 2012). Up until the 1950s, savannah elephants had a wide distribution through the Sudano-Sahelian range which covers Senegal, Mauritania, Mali, Guinea, Burkina Faso, Ghana, Togo, Benin, Niger, Nigeria, Cameroon, Chad, Central African

Republic (CAR), and Sudan, but populations have declined by 50 percent in just 15 to 30 years (Bouché et al. 2011, p. 1). Most populations have been reduced to several small pockets of a few hundred, and fewer than 8,000 remained in the surveyed areas (Bouché et al. 2011, p. 5).

West African countries hold about 63 percent of the remaining Sudano-Sahelian population (Bouché et al. 2011, p. 5). This region suffered a 33 percent decline based on surveys from 1980 to 1983 and 2003 to 2007 (Ibid.). Seven out of 12 of the remaining savannah elephant populations in West Africa represent the majority (89 percent) of this region's elephants, and they are concentrated in one area. They are referred to as the "western pool", and they occur in Benin, Burkina Faso, the Côte d'Ivoire, and Ghana (Bouché et al. 2011, p. 7).

Central African countries have experienced a 76 percent decline in their savannah elephant populations since the 1980s (Bouché et al. 2011, p. 5). Similar to the western pool, only seven of the 13 central populations represent the majority of the group (84 percent), and they are mostly found in the Lake Chad Basin of Nigeria, Cameroon, and Chad (Ibid.). The West and Central Africa populations of savannah elephants are separated by 830 kilometers, mainly by the entire country of Nigeria which is the most populous country in Africa (Bouché et al. 2011, p. 7). Isolated groups in protected areas do not offer any genetic flow into these two groups (Ibid.).

Table 4: Central and West Africa savannah elephant population trends (Bouché et al. 2011, p. 5, Table 2, 3).

Central Africa	**Estimate (1985-91)**	**Estimate (2005-10)**
Waza	1071	246
Zakouma	1040	542
Bamingi Bangoran	1607	708
Manovo Gounda	2701	74
Total CA	**6419**	**1570**

West Africa	**Estimate (1985-91)**	**Estimate (2005-10)**
Mole	589	395
Gourma	550	344
Niokolo	50	1
Yankari	280	348
Nazinga	230	548
Po	112	64
Arly Singou	2335	2541
Pendjari	826	869
W	1331	1094
Comoé	1250	10
Kainji	1500	0
Mouhoun	150	22
Bontioli	100	20
Total WA	**9303**	**6256**

Region	**Estimate (1980-91)**	**Estimate (2003-10)**	**Trend**
Central Africa	6419	1570	-76%
West Africa	9303	6256	-33%
Total	**15821**	**7826**	**-50%**

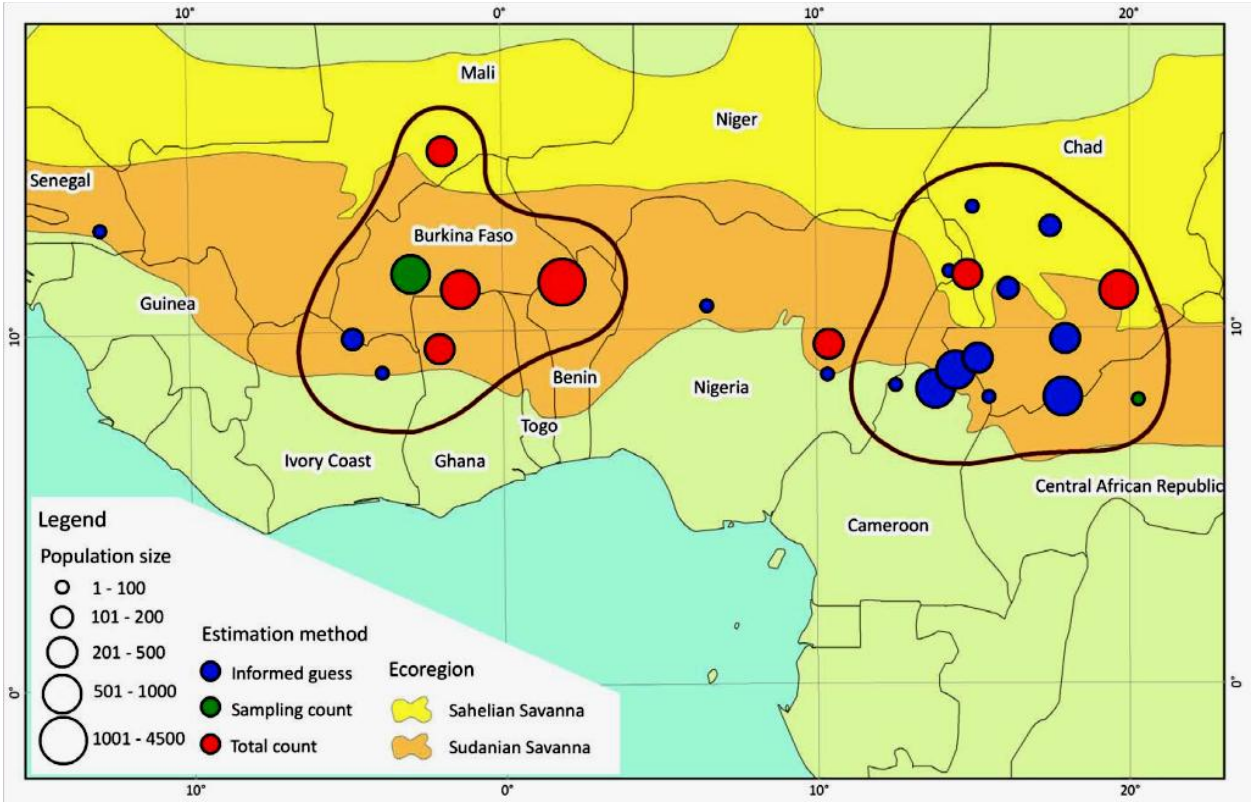


Figure 4: Elephant population's size and distribution in the Sudano-Sahelian Range (Bouché et al. 2011, p. 4, Figure 3).

Shortly after Bouché et al.'s 2011 study, one of the largest elephant massacres occurred in Bouba Ndjida National Park in Cameroon. An estimated 650 elephants were slaughtered (Russo 2013, Mongabay 3/7/13). Bouba Ndjida held 660 elephants in 1991 (Blanc et al. 2007, p. 34) and 232 in 2008, but the difference in numbers could be due to seasonal migration of that population or the different techniques used (AfESG 2012). Ultimately, it is likely that population, which used to be one of the strongest of the Central Africa's savannah elephants, is now functionally extirpated. Bouché et al. (2012) concluded that the elephant population in northern CAR is rapidly headed for extinction as well (p. 7008).

b. Savannah Elephant Populations in Eastern Africa

Eastern Africa used to boast the highest elephant numbers before the 1970s when the first detrimental wave in ivory poaching began (UNEP et al. 2013, p. 23). In 1995, the region – which includes Eritrea, Ethiopia, Kenya, Rwanda, Somalia, South Sudan, Tanzania, and Uganda – harbored an estimated 105,000 elephants (Said et al. 1995, in UNEP et al. 2013, p. 23). By 2005, there were 160,000 elephants; the increase was due to both an improvement in survey methods and a genuine recovery of the species (Blanc et al. 2007, in UNEP et al. 2013, p. 23). But following the second wave of demand for ivory products that began around 2008 (Wittemyer et al. 2014, p. 13118), the population has declined by almost 20 percent, with 130,000 remaining accounting for 33 percent of all remaining savannah elephants (or 28 percent of all Africa's elephants, as cited in AfESG 2012; UNEP et al. 2013, p. 23), though this total number is likely

much lower. Tanzania harbors the majority of Eastern Africa's elephants. Over 109,000 elephants lived in Tanzania in 2009, but preliminary results from the Great Elephant Census show that this country has lost 60 percent of its elephants since then, with 43,521 (± 3,078) elephants remaining (FZS press release, June 1, 2015).

Trends are difficult to determine for all of Eastern Africa's elephant populations due to varying survey efforts, but just as the decline in two of the largest eastern populations, Selous, Tanzania and Tsavo, Kenya, sparked international outcry for the 1989 CITES ban (UNEP et al. 2013, p. 23), the decline in these populations again justify an uplisting to Endangered under the ESA.

In the Selous ecosystem of Tanzania, the decline in elephant numbers is astonishing. This 80,000 square kilometer ecosystem had the second largest single elephant population behind Botswana's (TAWIRI 2010, p. 14). Just forty years ago, Selous held about 109,000 elephants (Ibid.). By 1991, that figure dropped to 22,200 elephants. Like other populations, a steady recovery was observed post-CITES ivory ban until about 2006 when it began to decline again. In 2006, the population had 70,406. By 2013, it declined by 62 percent to 13,084 individuals, the lowest population size in recorded history for the Selous ecosystem (TAWIRI 2014, p. 8).

Figure 5: Elephant population trend in the Selous-Mikumi ecosystem 1976-2013 (TAWIRI 2014, p. 8, Figure 6).

The largest elephant population in Kenya occurs in the 41,660 square kilometer Tsavo ecosystem (Ngene et al. 2013, p. 39). In 1974, there were over 35,000 elephants (Cobb 1976, in Ngene et al. 2013, p. 39), but a 75 percent decline within the protected areas and an 87 percent decline in non-protected areas by 1988 left this population at 6,399 individuals (Omondi et al. 2008, in Ngene et al. 2013, p. 39). The population rebounded after the CITES ban of ivory to 11,733 individuals in 2008 (Ibid.). In 2011, 12,573 elephants occupied the Tsavo ecosystem, which was only a two percent increase in three years. In 2014, an aerial count revealed a 12 percent decrease in the population to 11,076 (The David Sheldrick Wildlife Trust 2014, press release).

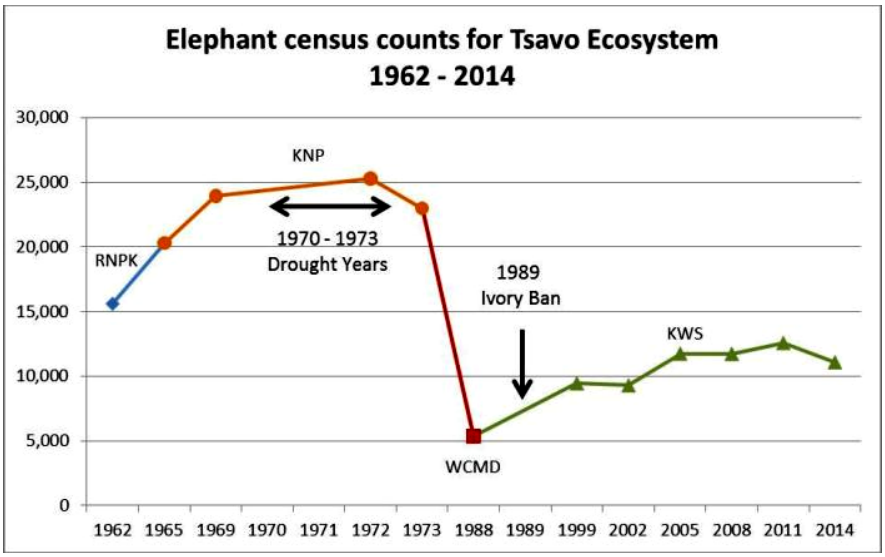


Figure 6: Elephant census counts for Tsavo Ecosystem (The David Sheldrick Wildlife Trust 2014).

c. Savannah Elephant Populations in Southern Africa

Southern Africa – including Angola, Botswana, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe – holds about 64 percent of the continent's savannah elephants (or about half of all elephants, as cited in AfESG 2012). Most populations in this region remained steady or increased until about 2009. Since then, the region has started to follow suit with other regions, with the first evidence of overall regional decline presented by Wittemyer et al. (2014, p. 13118) beginning in 2010. About 250,000 elephants are estimated to currently occur (UNEP et al. 2013, p. 24).

Of the available and comparable surveys conducted in this region, data shows that elephant populations seem to be increasing in Namibia and South Africa and are declining in Zimbabwe, Zambia, and Mozambique (IUCN 2013, p. 2; Douglas-Hamilton 2012, comment letter). Some preliminary results from the Great Elephant Census have revealed shocking declines. Mozambique has lost half of its elephants in just five years, declining from about 20,000 elephants to an estimated 10,300 (WCS press release, May 26, 2015). Mozambique's Niassa Reserve was hardest hit; this population declined fell from about 12,000 elephants in 2012 to 4,440 in 2015 (Ibid.). And while the elephant population has increased in Hwange National Park in Zimbabwe, in northern parts of the country, the number of elephants have fallen from 18,000 in 2001 to 11,500 in 2014 in the Zambezi Valley and the Sebungwe area's population declined from 13,000 to 4,000 (Latham 2015, Bloomberg 2/18/15). The elephant population in the Luangwa Valley ecosystem in Zambia also crashed from 2009 to 2012, declining by 50 percent from 12,352 to 6,361 elephants (Nyirenda et al. 2015, p. 30). Small populations and scanty data exist in Angola, Swaziland, and Malawi (IUCN 2013, p. 2), though studies indicate that elephants in southern Angola and the Caprivi Strip of Namibia suffered during Angola's civil war that ended in 2002 (Chase and Griffin 2011; Chase and Griffin 2009, p. 231).

Botswana holds by far the largest population not only in the subregion but on the continent (IUCN 2013, p. 2). The Chobe District and Chobe National Park is home to most of these

elephants, and this area has been surveyed with comparable methods for 17 years (Chase 2013, p. 17). Populations increased during the early 1990s, but from 2004 they remained the same or declined, though Chase states that populations are most likely stable. Some concerns exist over the reliability of the data given the possibility of the influx and dispersal of elephants beyond country boundaries (Chase 2013, p. 19).

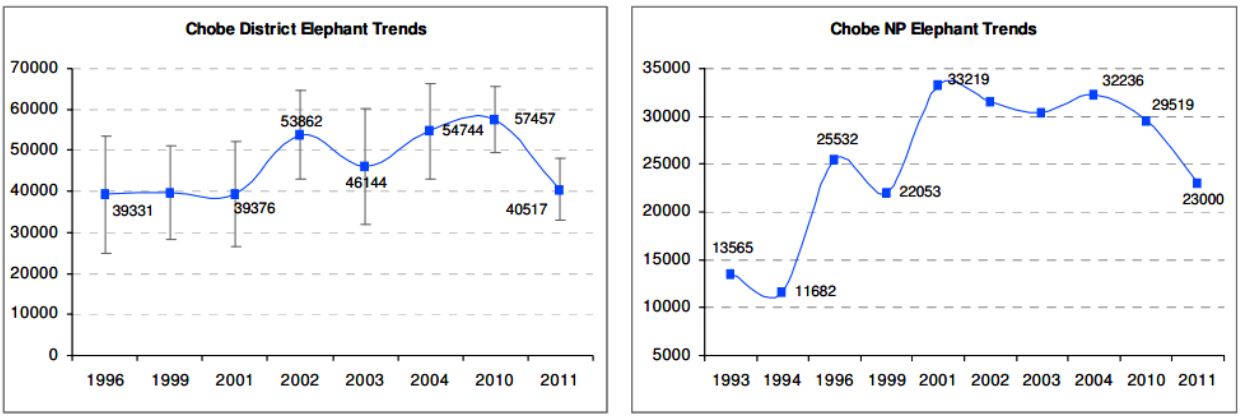


Figure 7: Estimates and 95% CI error bars for Chobe District, CI not provided for Chobe NP (Chase 2013, p. 19, Figure 6).

While significant declines are not as readily apparent in this region as in the others, it is important to again highlight that the overall elephant population for the entire region has begun to decline. Significant losses in elephant populations in Mozambique, Zimbabwe, and Zambia have been recorded while poaching and other threats to elephants continue to rise, as explained in the threats analysis.

D. African Elephant Database Summaries 2012

Below we present data from the preliminary 2013 report from the AfESG. Though not finalized, data summaries are available at www.elephantdatabase.org. Abundance data are categorized under DEFINITE, PROBABLE, POSSIBLE, and SPECULATIVE titles. The categorizations are not cumulative, so to get the total estimate, one must add them together. Adding the DEFINITE and PROBABLE estimates together will most likely provide the best estimate for a population (Blanc et al. 2007, p. 14). Again, it is important to note that both forest and savannah elephants occur within the West and Central regions of Africa, and there is an extreme lack of survey data for West Africa especially.

Despite the inability to compare AfESG estimates for trends, it is important to note that in 1991 when FWS proposed to uplist African elephants as Endangered, the best estimate indicated a population size of 608,000 elephants (56 Fed. Reg. 11392). According to the AfESG's latest DEFINITE and PROBABLE estimates, 523,872 remain – 24 percent less than the level at which FWS first declared that African elephants warranted an Endangered listing. We are not suggesting that this decrease represents population trend, merely that the best guess for total number of elephants today, although large, is still less than when they were considered for an Endangered listing in 1989.

Table 5: African Elephant Database 2012 summary. Countries highlighted green only contain forest elephants, and countries highlighted blue contain both forest and savannah elephants. Countries highlighted in grey contain only savannah elephants. Partitioning elephant species in West Africa is difficult due to the high levels of disturbance in the region, so those distinctions are based on our best guesses given the research available.

	DEFINITE	*PROBABLE*	*POSSIBLE*	*SPECULATIVE*
Central Africa	**16,486**	**65,104**	**26,310**	**45,738**
Cameroon	775	1,079	2,150	10,045
Central African Republic	1,019	113	113	1,040
Chad	454	0	2,000	550
Congo	7,198	30,979	11,071	0
Democratic Republic of Congo	1,708	3,036	5,099	3,831
Equatorial Guinea	0	0	700	630
Gabon	4,996	30,511	12,103	45,738
Eastern Africa	**130,859**	**12,966**	**16,700**	**7,566**
Eritrea	96	0	8	0
Ethiopia	628	0	220	912
Kenya	26,365	771	3,825	5,299
Rwanda	11	17	54	0
Somalia	0	0	0	70
South Sudan	1,172	5,882	5,882	0
Tanzania	95,351	10,278	10,927	900
Uganda	2,223	1,031	903	385
Southern Africa	**267,966**	**22,442**	**22,691**	**49,057**
Angola	818	801	851	60
Botswana	133,088	21,183	21,183	0
Malawi	865	218	218	1,043
Mozambique	17,753	3,340	3,383	2,037
Namibia	16,054	4,472	4,492	0
South Africa	22,889	0	0	0
Swaziland	35	0	0	0
Zambia	14,961	2,975	3,111	542
Zimbabwe	47,366	3,775	3,775	45,375
West Africa	**7,107**	**942**	**938**	**3,019**
Benin	916	48	188	0
Burkina Faso	4,477	320	320	200
Cote d'Ivoire	211	254	155	517
Ghana	857	344	138	58
Guinea	0	64	37	57
Guinea Bissau	0	0	7	13
Liberia	25	99	99	1,363
Mali	344	0	0	0
Niger	85	0	17	0
Nigeria	0	0	108	667
Senegal	1	0	0	9
Sierra Leone	0	0	80	135
Togo	4	0	61	0
TOTAL	**433,999**	**89,873**	**54,636**	**105,380**

In sum, because of the extreme population declines noted in the sections above, and in light of the ESA's listing factors described below, forest and savannah elephants warrant an Endangered listing under the ESA.

V. DISTINCT POPULATION SEGMENTS

A distinct population segment (DPS) is a discrete population segment, that has significance to the population as a whole, and that meets the criteria for being listed as Threatened or Endangered. 61 Fed. Reg. 4721, 4725 (Feb. 7, 1996). The DPS policy defines a "discrete" population as one that:

1. is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation.
2. is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act.

61. Fed. Reg. at 4725. If a population meets one of the two criteria for being considered to be "discrete," then an analysis is undertake to determine if it is significant. A population is significant based on:

1. Persistence of the discrete population segment in an ecological setting unusual or unique for the taxon,
2. Evidence that loss of the discrete population segment would result in a significant gap in the range of a taxon,
3. Evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historic range, or
4. Evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics.

Forest elephants are clearly Endangered throughout their range and a DPS analysis is not necessary for this species. Savannah elephants (*Loxodonta africana*) should also be listed as an Endangered species based on the severe population declines occurring throughout all, or at a minimum, a significant portion of their range, and significant threats of high immanency (*See* below, Section VI.). Protecting even those populations which still boast high numbers as Endangered is important in preventing extinction of the same species in other areas; *i.e.* less stringent regulation for Appendix II listed elephants exacerbates the overexploitation of Appendix I elephants (Blake et al. 2007, p. 946).

However, should FWS somehow find that an Endangered listing is not warranted for all savannah elephants, alternatively, FWS should conduct a DPS analysis and list several DPSs of savannah elephants as Endangered[1]. Currently, the international community commonly refers to

[1] For those elephants that are not listed as Endangered, we ask that FWS adopt a more protective 4(d) rule for elephants considered to be Threatened under the ESA.

four separate elephant populations: West, Central, Eastern, and Southern Africa. While these regional populations are studied and managed generally without distinction between forest and savannah elephants, they remain useful with regard to the savannah elephant and should form the basis of a DPS analysis for that species. For context, it is important to remember that the majority (95 percent) of forest elephants occur within the Central Africa region, with scattered and small populations in the West Africa region as well. Similarly, savannah elephants occur in small and dwindling numbers in the West Africa region and the outskirts of the Central Africa region, and only savannah elephants occur in the Eastern and Southern Africa regions. See maps below.

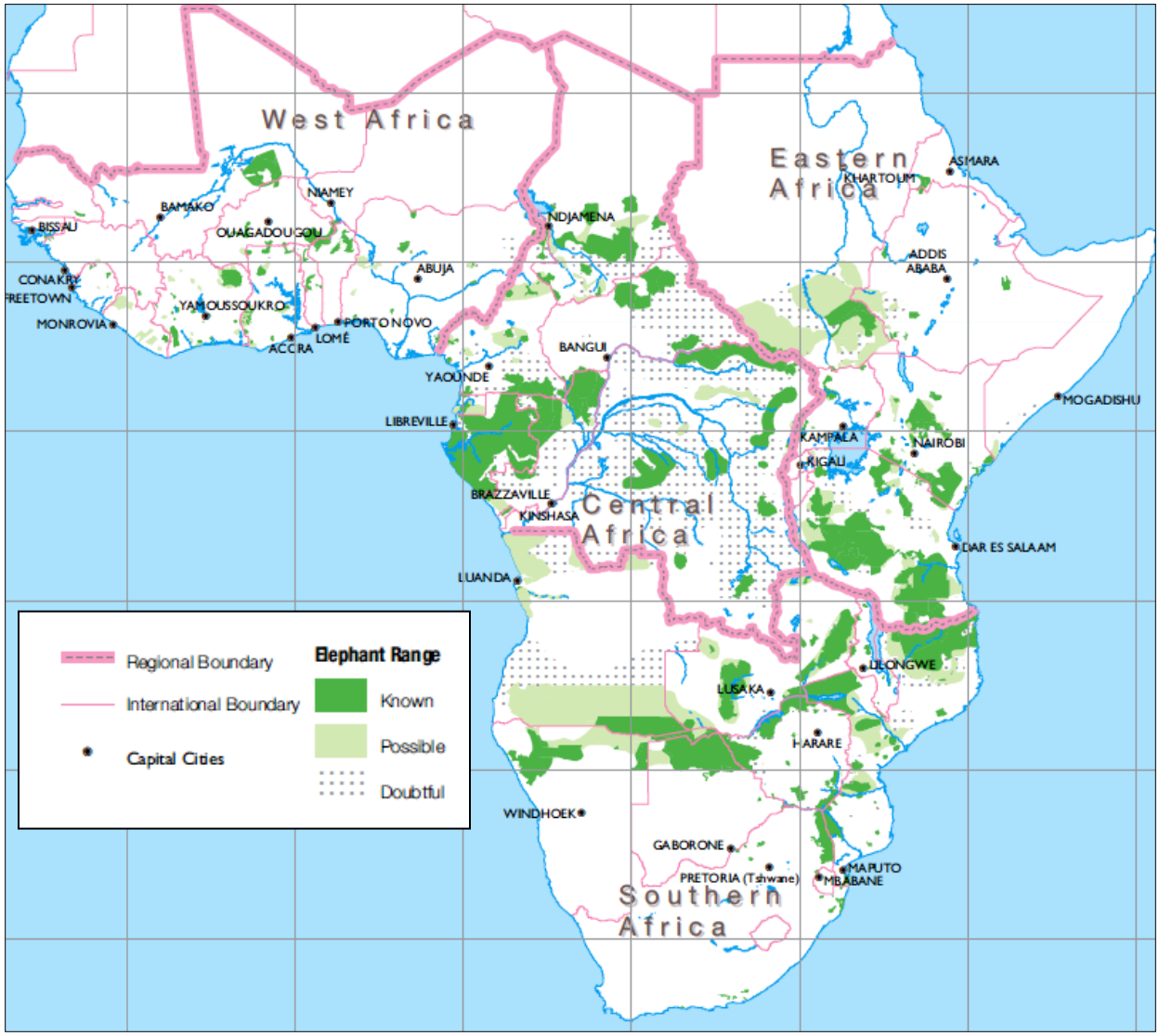


Figure 8: Elephant range delineated by boundaries determined by the AfESG (Blanc et al. 2007, p. 25).

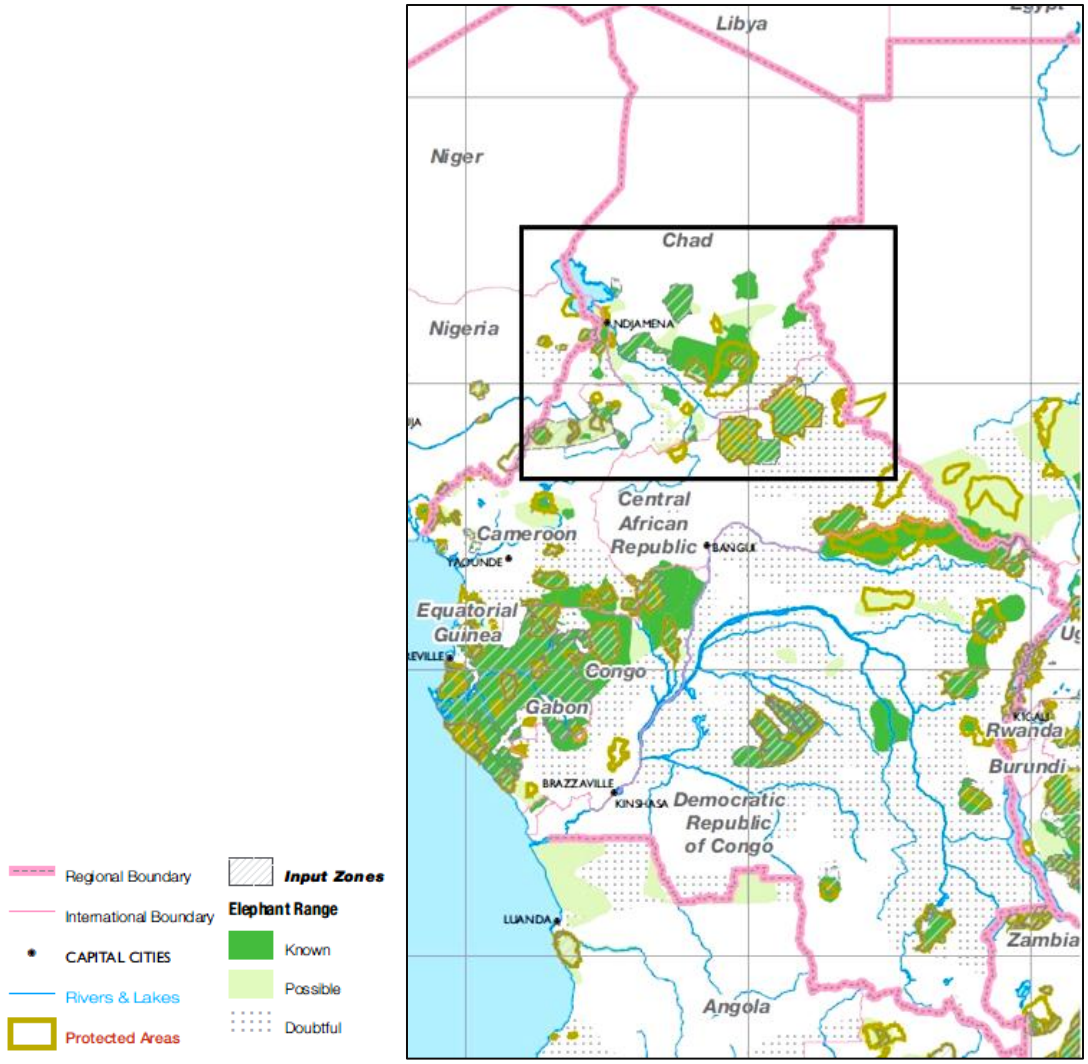


Figure 9: Elephant range in Central Africa with the approximate ranges of savannah elephants partitioned within the black box according to the best available information (modified from Blanc et al. 2007, p. 29).

Countries containing savannah elephant populations within the Central Africa region are Chad, Cameroon, and Central African Republic. FWS should consider adjusting the boundary of any Central Africa DPS to include the one neighboring population in Nigeria that is ecologically connected to the Central Africa region's populations of savannah elephants. The rest of the West Africa region's savannah elephants are almost completely separated from this group by the whole of Nigeria. In West Africa, savannah elephant populations are more difficult to distinguish within the AfESG range map, but the majority of known savannah elephant populations within the context of AfESG's known and possible range map for West Africa are shown below.

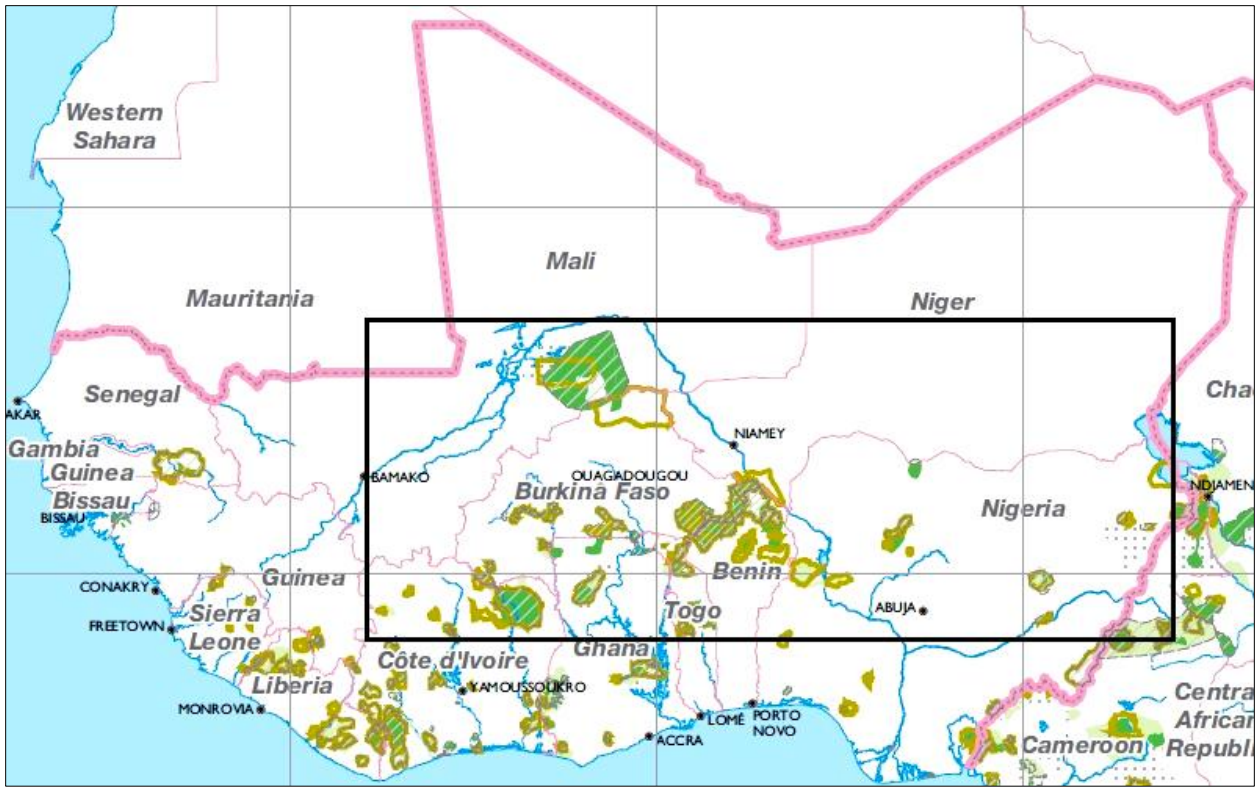


Figure 10: Elephant range in West Africa with the approximate ranges of savannah elephants partitioned within the black box. See Figure 4 (Bouché et al. 2011) for context and comparison (modified from Blanc et al. 2007, p. 165).

The Eastern and Southern Africa regions contain only savannah elephant populations and can be designated into DPSs as such.

Designating these populations as distinct population segments would be consistent with the DPS policy. Ecological, political, and in some cases genetic (e.g. West Africa) factors make all four of these populations discrete, which is made clear in the threats analysis below, and the loss of any four of these regional populations would result in a significant reduction in range of the species as a whole.

VI. THREATS

Forest elephants (*Loxodonta cyclotis*) and savannah elephants (*Loxodonta africana*) warrant protection as Endangered species under the ESA, 16 U.S.C. § 1533(a)(1). Under the ESA, FWS is required to list a species as Endangered if it is in danger of extinction in all or a significant portion of its range. In making such a determination, FWS must analyze the species' status in light of five statutory listing factors:

(A) the present of threatened destruction, modification, or curtailment of its habitat or range
(B) overutilization for commercial, recreational, scientific, or educational purposes;
(C) disease or predation;
(D) the inadequacy of existing regulatory mechanisms;

(E) other natural or manmade factors affecting its continued existence.

16 U.S.C. § 1533(a)(1)(A)-(E); 50 C.F.R. § 424.11(c)(1)-(5).

A species is "endangered" if it is "in danger of extinction throughout all or a significant portion of its range" due to one or more of the five listing factors. 16 U.S.C. § 1531(6). Both forest and savannah elephants are currently in danger of extinction in light of four of these five factors. Habitat degradation, overutilization, and other factors threaten their survival (AfESG 2012) while current regulatory mechanisms are failing to protect them.

Below is a summary of factors threatening elephant populations by region created by Stephenson (2004) that still accurately portrays today's issues for elephants in Africa. Because African elephants are still generally treated as one species, most of the literature documenting threats to elephants follows this regional population scheme which is reflected in many sections of the threats analysis. Where available, we pull out and highlight threats that may more greatly impact forest or savannah elephants and to what degree those threats are harming their populations. Generally, all elephants are highly threatened by habitat loss and degradation, poaching for their ivory, human-elephant conflict, wars, other socio-economic factors, and the inadequacy of existing regulatory mechanisms. Forest elephants are threatened to a higher degree by habitat conversion due to the expansion of natural resource extraction and logging, historical and current hunting, trade pressures, and civil unrest, while the majority of savannah elephants are more likely to be negatively impacted by the rapidly spreading poaching crisis, human-elephant conflict and loss of habitat, climate change resulting in depleted water sources, and barriers to their movement. Both species are threatened by the lack of enforceable regulations to protect their populations, and additionally by the failure to classify them as two species and be managed as so.

Table 6: Estimates of elephant numbers from AfESG 2012 and threats ranked in priority by region from Stephenson (2004). Poaching likely has become a higher threat since these rankings were made, but this nonetheless captures what is mainly responsible for elephant population declines (Adapted from Lee and Graham 2006, Table 1).

Region	Definite	Possible	Threats
East	130,859	12,966	conflict with humans for resources (space, food and water), isolation, poaching
South	267,966	22,442	crop-raiding, compression, poaching, trophy or meat hunting
Central	16,486	65,104	poaching for ivory and bushmeat, large-scale habitat loss as a result of extractive industries (mining, logging)
West	7,107	942	poaching, habitat fragmentation as a result of human activities, conflict with humans

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Elephants are threatened by loss and degradation of their habitat throughout Africa. While ivory poaching presents the most immediate and publicized threat to elephant populations, range and habitat loss are considered the most significant long-term threats to their survival in Africa

(UNEP et al. 2013, p. 17). Currently, 29 percent of the remaining "known" and "possible" elephant range in Africa is regarded as heavily impacted by human development. In just 40 years, this may rise to 63 percent, likely eradicating populations in Central and West Africa, greatly reducing range in Eastern Africa, and ultimately impacting southern ranges (UNEP et al. 2013, p. 17). Consequently, without even factoring in the other threats to elephant populations, based on the best available science, forest elephants are likely to go extinct and the savannah elephant populations of West and Central Africa are likely to be extirpated in 40 years, leaving only a few populations of savannah elephants in Eastern Africa and the last strongholds in Southern Africa. Human population rise, land use changes, human-elephant conflict, fencing, and climate change all pose serious threats to elephant habitat.

1. Human Population Growth and Density

Africa has some of the world's fastest growing human populations, and elephants are running out of space. Both forest and savannah elephants are known to avoid people (Eltringham 1990, Barnes et al. 1991, Happold 1995, Hoare and Toit 1999, in Graham et al. 2009, p. 446; Boer et al. 2012, p. 475). Because of this, high human populations and densities reduce the amount of available habitat for elephants not only directly by converting land for human use, but also indirectly by creating barriers to land otherwise inhabitable by elephants (WWF et al. 2005, p. 10). Lee and Graham (2006, p. 11) estimated that a density of 15 people per six square kilometers, representing about a 40 to 50 percent transformation of land for human use, is the threshold at which elephants disappear.

By 2009, Africa's human population had doubled in 27 years, reaching one billion people (World Population Review 2014). In most countries, the growth rate exceeds two percent (Ibid.). By 2050, the continent could have a population of 1.9 billion people (Ibid.). The space needed to accommodate this many people will drastically reduce that which is available for elephants.

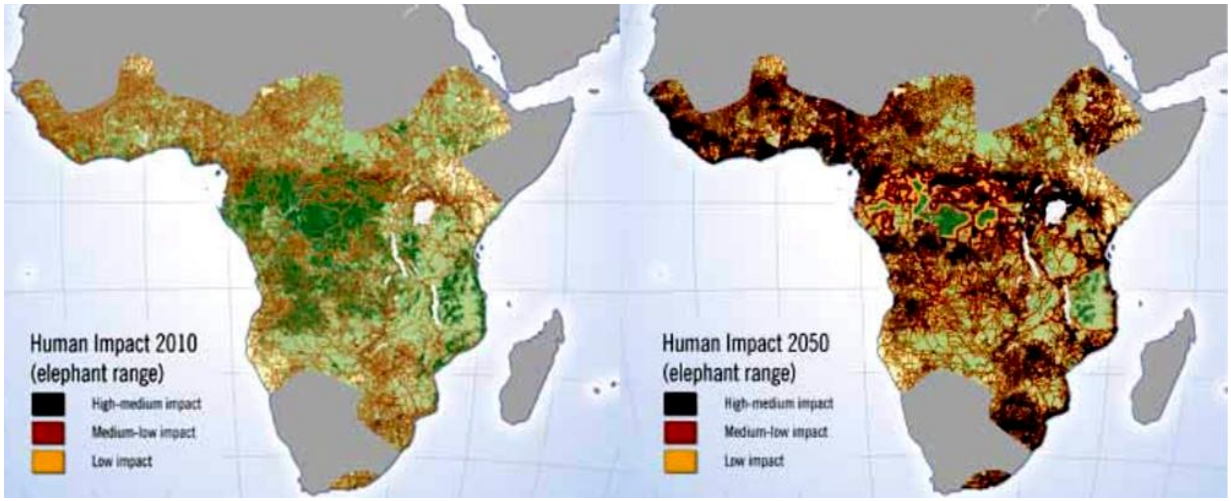


Figure 11: Scenarios of human development pressures and pressure (GLOBIO 2.0) on biodiversity in a larger area surrounding the African elephant ranges using the scenarions provided by the IPCC's Special Report on Emissions Scenarios (SRES) scenarios for 2010 and 2050 (UNEP et al. 2013, p. 20, Fig. 3).

The distribution of the growing human population is especially troubling. The majority of remaining elephant populations occurs within protected areas ("PAs", i.e. national parks, wildlife reserves, World Heritage Sites) in Central Africa, with the exception of FSC-certified logging concessions in Gabon, and PAs serve as refuge from other land-use changes, poaching, and conflict in other areas (Maisels et al. 2013, p. 5). Wittemyer et al. (2008) found that human settlement increases around PAs faster than in rural areas of the same country with the same ecoregion due to the favorable natural and financial resources PAs provide (p. 123, 125). Moreover, the creation of a PA did not result in the increased human population at its edge due to displacement but instead the opposite. Population growth rates were positive inside 85 percent of the PAs surveyed and the remaining 15 percent showed no change at all (Wittemyer et al. 2008, p. 123).

Human population increase in and around PAs increases the likelihood of illegal timber and mineral extraction, poaching and bushmeat hunting, fire frequency, human-wildlife conflicts, harm to biodiversity and species extinction within PAs (Metzger et al. 2010, Milner-Gulland and Bennett 2003, Newmark et al. 1994, in Roever et al. 2013, p. 104; Wittemyer et al. 2008, p. 125). In addition to directly threatening elephant populations and habitat within PAs, settlement around them creates a ring of disturbance that likely isolates elephants from surrounding habitats (Wittemyer et al. 2008, p. 125.).

Parker and Graham (1989) were among the first to show that human density has a direct impact on the contraction of elephant range and declining populations in Eastern Africa (in Blake et al. 2007, p. 950). The plight of forest and savannah elephants in West and Central Africa is further evidence that human density and activity reduces elephant range and populations (WWF et al. 2005, p. 9-10; Maisels et al. 2013, p. 6; Bouché et al. 2011, p. 1) In fact, the remaining populations of West Africa's savannah elephants exist in two clusters, separated almost entirely by Nigeria, Africa's most populous county (Bouché et al. 2011, p. 7).

Similar conclusions can be drawn for elephants in Southern Africa. Elephants in the Caprivi Strip of Namibia are unable to access habitat along the Kwando River due to human settlement (Chase and Griffin 2009, p. 224), and another study revealed that 80 percent of elephant mortalities in northern Botswana occurred within 25km of high human use areas (Roever et al. 2013, p. 99, 104). The protected designation of an area had less influence on elephant mortality than did the location of the PA in relation to human occupation, and so the highest proportions of high risk areas for elephants existed within Chobe National Park. Indeed, the authors found that national parks and reserves did not decrease mortality for elephants in northern Botswana (Roever et al. 2013, p. 99, 104).

2. Land Use Changes and Barriers to Movement

a. Natural Resource Development

Natural resource development and its accommodating infrastructure most notably threatens forest elephants in West and Central Africa, but savannah elephants have been impacted as well. In West Africa, rapid human population growth, expansion of roads, farms, and growth of the logging industry all lead to widespread disturbance of elephant habitats. By the mid-1980s,

elephants had been pushed out of 93 percent of their range (Roth and Douglas-Hamilton 1991, Dougherty 1994, in WWF et al. 2005, p. 7).

Central Africa's forests, mostly including the Congo Basin, holds 95 percent of the remaining forest elephant "known" and "possible" range (Maisels et al. 2013, p. 2) and are at risk of suffering a similar fate. These forests are under significant, industrial-scale development pressures because of their vast quantities of valuable natural resources (Laporte et al. 2007, in Blake et al. 2008, p. 1; Blake 2002, p. 265; Eggert et al. 2013, p. 11; Gessner et al. 2014, p. 59-60; Laurence et al. 2005, p. 1295; Maisels et al. 2013, p. 7). While the rainforests in West and Eastern Africa have been reduced to eight to 12 percent of their former extent, Central Africa's forests still maintain about 60 percent of their range (Laurence et al. 2005, p. 1252). Along with human population growth, industrial logging, slash-and-burn farming, road and infrastructure expansion, and overhunting threaten to degrade the forests, significantly reduce available habitat for forest elephants, and exacerbate hunting pressures already threatening their populations (Blake et al. 2008, p. 1-2; Eggert et al. 2013, p. 11).

Road construction and expansion to facilitate growing logging industries is perhaps the most significant threat to forest elephants and their habitat (Laurence et al. 2005, p. 1252; Blake 2002, p. 265; Beyer et al. 2011, p. 10). More than 30 percent of the forest in Central Africa is under logging concessions, and only 12 percent is protected (Laporte et al. 2007, p. 1451). Roads fragment once contiguous habitats into smaller, isolated patches creating numerous negative ecological consequences, and existing roads breed more roads by facilitating access to further resource extraction and settlement (Blake et al. 2008, p. 1; Laporte et al. 2007, p. 1451). Roads also open up the forest to bushmeat hunters and ivory poachers, which is already a significant threat to elephant populations in the region (Wilkie et al. 1992, Barnes et al. 1997, Fa et al. 2005, in Laurence et al. 2005, p. 1252; Laporte et al. 2007, p. 1451). Laporte et al. 2007 estimated that almost 30 percent of the total forested area is likely to be experiencing increased hunting pressures due to road development and the creation of local markets (p. 1451). Chronic over-hunting and forest loss in West Africa led to a collapse in elephant populations (WWF et al. 2005, p. 8).

Elephants, both forest and savannah, are already known to avoid roads (Blake et al. 2007, p. 947; Wall et al. 2013, p. 64, 67; Chase and Griffin 2009, p. 224; Laurence et al. 2005, p. 1259; Stokes et al. 2010, p. 10). In the Congo Basin, forest elephant density in and around PAs is determined by the area of roadless wilderness rather than PA size (Blake et al. 2008, p. 2), and it is important to note that PAs alone are frequently too small to ensure the long-term survival and viability of forest elephants (Blake et al. 2008, p. 2). Small patches of fragmented habitat reduce the carrying capacity of the area which leads to population decline (Blake 2002, p. 267). Of the 1,893,000 square kilometers of potentially available habitat in the Congo Basin, some 1,229,173 square kilometers (~65 percent) is within 10km of a road (Blake et al. 2007, p. 950).

The Republic of the Congo had the fastest rate of road construction in the region from the 1970s to early 2000s, quadrupling the kilometers of road constructed per year from the periods of 1976-1990 to after 2000 (Laporte et al. 2007, p. 1451). The DRC had the lowest logging road density of Central African nations, largely due to the inability of companies to access forests because of continuous civil unrest in the region, but industrial logging is expected to expand there (Laporte

et al. 2007, p. 1451). Gabon contains the largest remaining concentration of forest elephants (Maisels et al. 2013, p. 3), and currently two-thirds of its remaining forests are logging concessions (Laurence et al. 2005, p. 1252) with roads already negatively impacting forest elephant populations (Laurence et al. 2005, p. 1259). As oil reserves in the region run out and such operations becomes less profitable, the country is expected to rely more on logging. Despite sustainable management plans by the Forest Stewardship Council, expanding road networks will inevitably affect one of the world's most significant forest elephant populations (Eggert et al. 2013, p. 11) as farming plots and villages are already proliferating along the oil and logging roads, increasing hunting pressures in the region (Laurence et al. 2005, p. 1259).

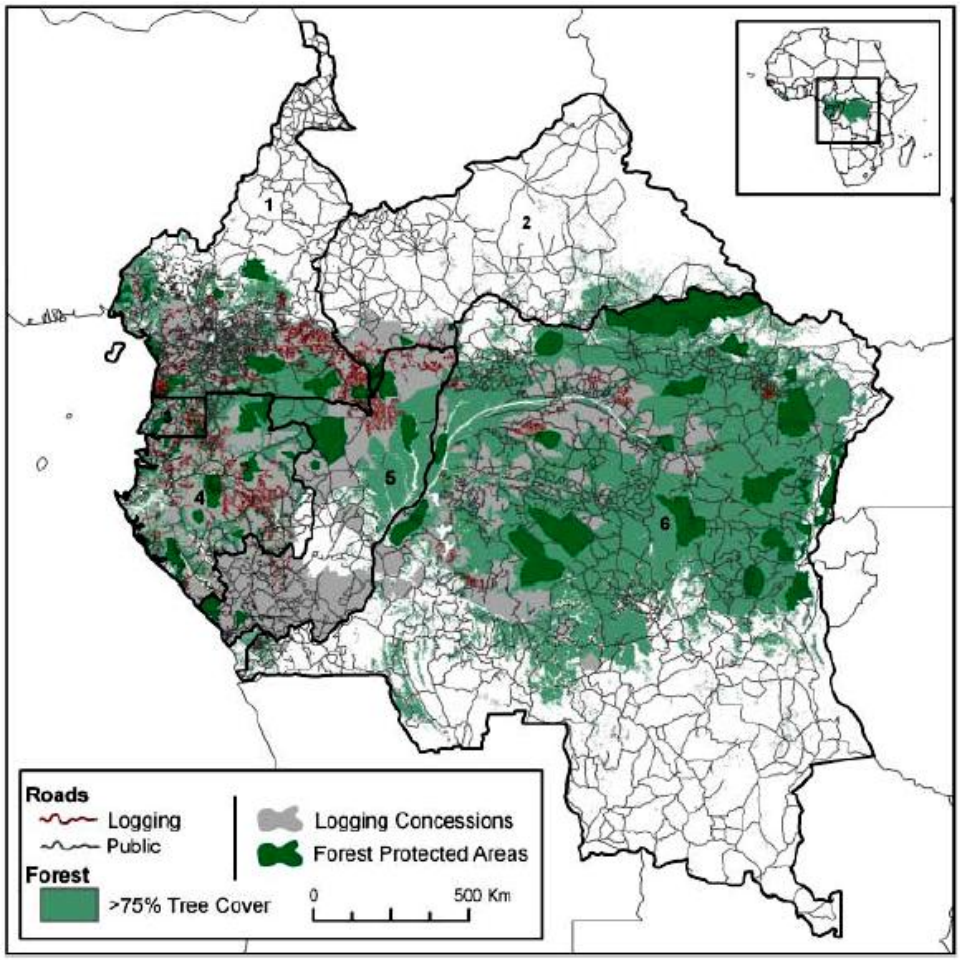


Figure 12: Logging concessions and road distribution in Central Africa for (1) Cameroon, (2) CAR, (3) Equatorial Guinea, (4) Gabon, (5) Congo, and (6) DRC. This is likely a conservative estimate due to cloud cover on some satellite survey days (Laporte et al. 2007, p. 1451, Fig. 1).

b. Fencing and Other Barriers

Throughout Africa, elephants face barriers that block their migrations routes. These include canals, power installations, roads, fences, and other manmade structures that elephants are generally apprehensive to cross (Kangwana 1995, Kothari 1996, Lahm 1994, in Naughton et al. 1999, p. 9). Fencing, in particular, is a widespread and complicated issue for most savannah

elephant populations (Okello and D'Amour 2008, in Ferguson and Chase 2010) because it restricts their movement and therefore their ability to access resources needed for survival (Cushman et al. 2010, p. 365; Chase and Griffin 2009, Loarie et al. 2009, Thomas et al. 2008, in Ferguson and Chase 2010, p. 173). While fencing is a problem in much of Africa, most research on the issue comes from Southern Africa, examples of which are presented below.

Mainly to prevent the spread of foot-and-mouth disease (FMD) from buffalo to cattle, most of the wildlife areas in Namibia, Botswana, Zimbabwe, and South Africa are bounded by thousands of kilometers of veterinary fences (O'Conell-Rodwell et al. 2000, Martin 2005, Sutmoller et al. 2000, Sutmoller 2002, Thomson 1999, in Jori et al. 2011, p. 2). As a result of this confinement, elephant populations grow unnaturally quickly, and they over-exploit their habitat leading to a spiral of habitat destruction and inhospitable conditions for elephants (Blake 2002, p. 266; Ferguson and Chase 2010, p. 175).

Two different attitudes exist in Southern African countries. In some areas, such as Kruger National Park, elephants must not be allowed to exit the park because doing so would damage the fence and allow buffalo to escape and potentially infect cattle (Ferguson and Chase 2010, p. 173). Should FMD be detected in their cattle, beef imports from other countries would cease. Also, elephants breaking through the fences results in human-elephant conflict, as rapid expansion of settlement has occurred around Kruger National Park (Ferguson and Chase 2010, p. 173) and other PAs throughout Africa (Wittemyer et al. 2008). Wildlife is generally at risk to active persecution, loss of habitat, competition with livestock, or overutilization where they have no value outside of protected areas (Prins and Grootenhuis 2000, in Selier et al. 2014, p. 122). In other areas, such as the newly created Kavango-Zambezi Transfrontier Conservation Area (KAZA TFCA), managers aim to figure out how they can facilitate elephant movement around fences to disperse over a large swath of land where there are currently few elephants, without causing human-elephant conflict (Ferguson and Chase 2010, p. 173). This management strategy is a positive move for the conservation of elephants but is incredibly difficult to implement.

In Kruger National Park, elephants break through the fence seasonally, mostly for the marula (*Sclerocarya birrea*) fruiting season, since there is now a higher density of these trees outside of the park (Ferguson and Chase 2010, p. 175). Other reasons for leaving the park may include water scarcity, especially since the closure of boreholes throughout Kruger over the last few decades (Ferguson and Chase 2010, p. 176). An increase in the local elephant population may have facilitated a "risk-prone" group of elephants that increasingly break through the fences (Ferguson and Chase 2010, p. 175), but the fact that elephants take these risks to access resources in any capacity is alarming especially given that human settlement density is an equally significant barrier to elephant movement as fences (Cushman et al. 2010, p. 366; Cushman et al. 2010, p. 365).

In the TFCA, a 135 kilometer long, double electrified Caprivi Border fence and Northern Buffalo fence contributed to the decline of elephants in the Caprivi Strip (Chase and Griffin 2009, p. 231) by essentially terminating all wildlife movement. These veterinary fences have a dominant impact on landscape connectivity (Ferguson and Chase 2010, p. 177). Caprivi Strip elephants are trapped between fences and the Okavango River where they are equally deterred by high human densities (Chase and Griffin 2009, p. 232), while Sioma elephants in Zambia are cut off from the

Okavango panhandle (Cushman et al. 2010, p. 365). Human densities continue to increase in the Caprivi Strip and along the Kwando River as well (Cushman et al. 2009, p. 366). Removal of a 30 kilometer section of the border fence has allowed some elephant dispersal and alleviated some of the local environmental pressures, but significant widening of that corridor is necessary to maintain population levels (Chase and Griffin 2009, p. 232; Ferguson and Chase 2010, p. 177).

Effective management of elephant populations in these areas will depend on managers' ability to facilitate elephant movement. The only way to do this is to prevent further human settlement in key corridor areas, but doing this of course depends on political will and economic priorities (Cushman et al. 2010, p. 366). This research can be applied to other elephant populations, and especially any population that is restricted to smaller areas and fenced in, whether to protect people on the outside or the wildlife within.

c. Agriculture and Desertification

Land degradation (referring to the reduction of the resource potential of the landscape through different processes; UNCED 1992, in Helldén and Tottrup 2008, p. 169) and desertification (referring to land degradation in arid, semi-arid and dry sub-humid areas resulting from a combination of climatic variations and human activities; Ibid.) are widespread problems in Africa, no longer limited to regions bordering the Sahara as once thought (Reich et al. 2001, unpaginated). Mismanagement of land by overusing an area that is under-qualified for those uses, such as intensive agriculture in arid regions, leads to such land degradation. Of course, with a rising human population comes the need for more agricultural land. In combination with drought, failure to implement appropriate technologies, poverty, and local agricultural and land use policies, desertification becomes widespread (Virmani et al., 1994, in Reich et al. 2001). As explained further in the section on climate change below, elephants, particularly savannah elephants already surviving in arid and semi-arid regions, are vulnerable to land use and climatic pressures that reduce the availability of vegetation and water. The UN Food and Agriculture Organization (FAO) estimates that Africa could lose two-thirds of its arable land by 2030 as a result of desertification (Africa Renewal online). As seen below, most savannah elephant populations are threatened by desertification.

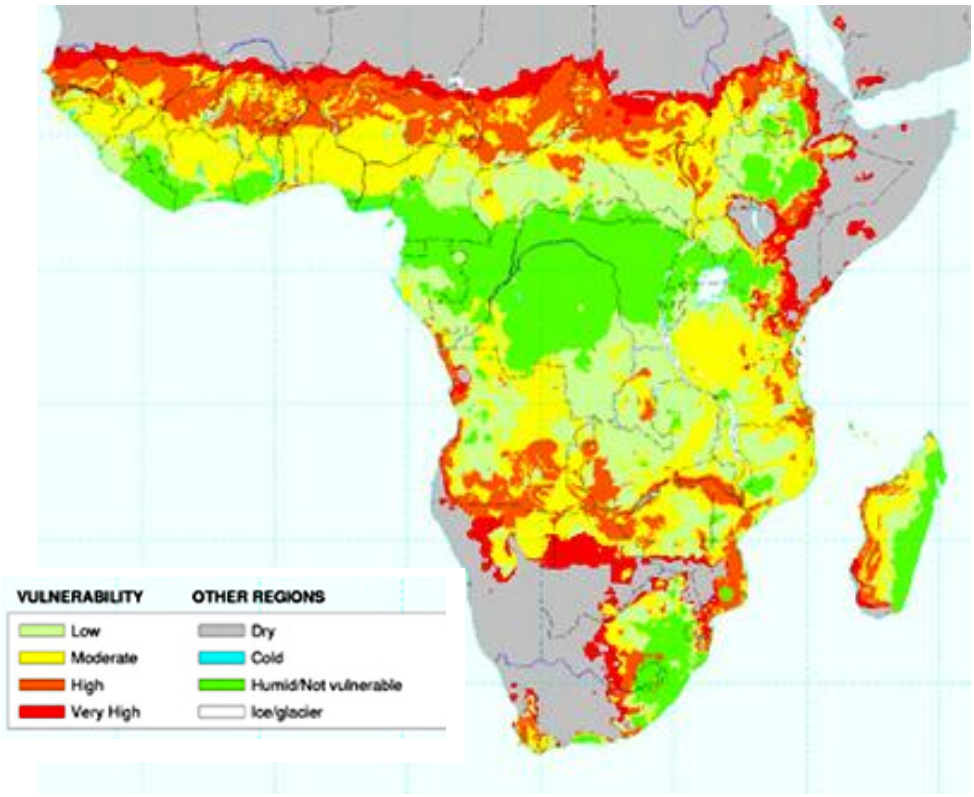


Figure 13: Overall vulnerability to desertification in Africa (Reich et al. 2001, Fig. 1).

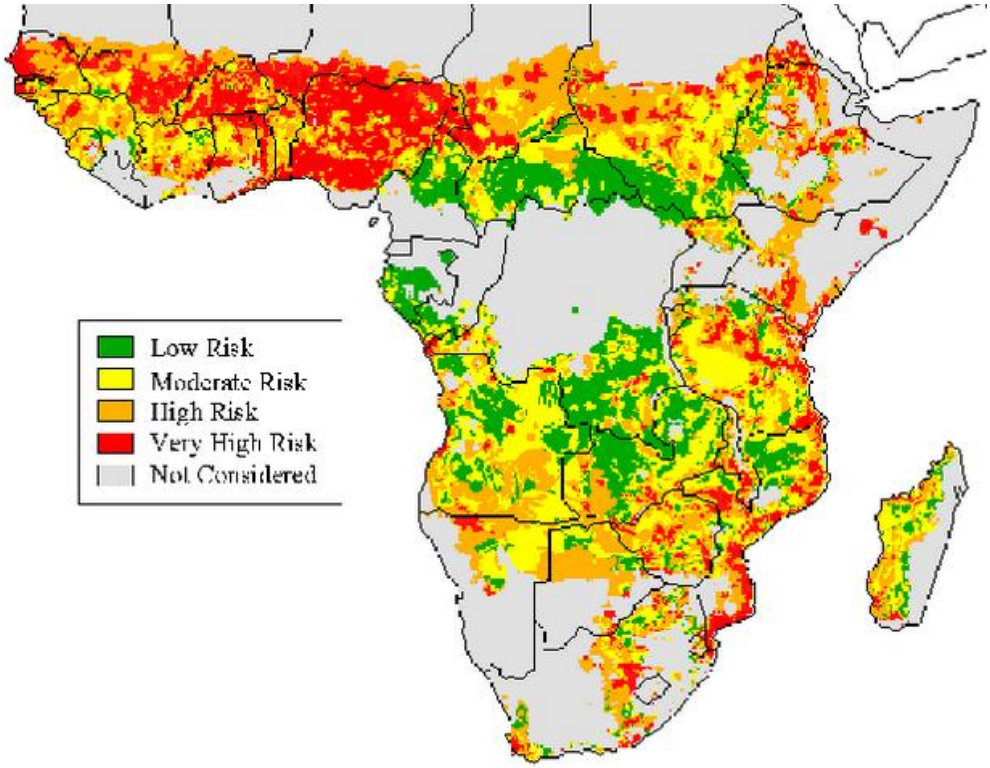


Figure 14: Risk of human-induced desertification in Africa (Reich et al. 2001, Fig. 2).

In total, over 7.5 million square kilometers are at risk of desertification in Africa, impacting almost every sub-Saharan country (Reich et al. 2001).

3. Human-Elephant Conflict

Human-elephant conflict (HEC) occurs throughout the elephant range in Africa, in both forest and savannah ecosystems (Barnes 1996, Thouless 1994, in Sitati et al. 2003, p. 668). Where elephants increasingly come into contact with humans, conflict will increase as well (Sitati et al. 2003, p. 668). Crop-raiding – when elephants enter farms to eat and trample crops – is the most prevalent form of HEC (Hedges and Gunarya 2009, p. 139), thus where elephants exist close to farms, HEC is a large issue (Sitati et al. 2003, p. 668). HEC disrupts the natural behaviors of elephants, or they are relocated, injured, or killed (Naughton et al. 1999, p. 10; Mariki et al. 2015, p. 19; UNEP et al. 2013, p. 41). The AfESG considers HEC to be a major threat to the long-term survival of elephants (Parker et al. 2007, Foreword).

Habitat loss and local extirpation has reduced elephant range since the 1970s, yet HEC has intensified (Naughton et al. 1999, p. 8). Despite their protected status, in many areas where high human and elephant densities coincide, elephants are considered to be pests (Sitati et al. 2003, p. 668). Crop-raiding unquestionably correlates with increasing settlement and cultivation, especially in areas that border reserves where elephants have been concentrated because of habitat loss and poaching (Thouless 1994, Hoare 1999, Hoare and duToit 1999, Walpole et al. 2003, Weladji and Tchamba 2003, Osborn and Hill 2005; Sitati et al. 2005, Graham 2006, Walpole and Linkie, 2007, Sitati and Tchamba, 2008, Warner 2008, Karimi 2009, Kikoti et al. 2010, Mackenzie and Ahabyona 2012, in Mariki et al. 2015, p. 20; Naughton et al. 1999, p. 8; Sitati et al. 2003, p. 675). In some instances, though, a decrease in human settlement and abandonment of farms have increased HEC as well, as witnessed with the forest elephants in Gabon and Congo (Naughton et al. 1999, p. 10). Southern Africa also has a unique situation in which 80 percent of the elephant range occurs outside of protected areas, leading to increased conflict with local communities there (Blanc et al. 2007, Abensperg-Traun 2009, in Selier et al. 2014, p. 123). No matter what the situation, communities on the front lines of conflict often resist efforts to conserve elephants and will seek reimbursement from their governments and retaliation against offending elephants (Naughton et al. 1999, p. 10; Mariki et al. 2015, p. 19).

In addition to increasing human populations and settlement, other trends in land use changes act as barriers for elephant migrations and inadvertently draw elephants closer to people. For forest elephants in Central Africa, logging and farm abandonment creates favorable secondary vegetation that draw elephants closer to villages, while soil degradation has necessitated planting in scattered plots further away from villages, increasing their vulnerability to crop-raiding (Lahm 1996, Mascarenhas 1971, Barnes et al. 1991, in Naughton et al. 1999, p. 8-9). For savannah elephants in semi-arid and arid ecosystems, artificial water sources created for communities and pastoralists draw elephants close to villages, especially in the dry season and during drought years when water resources are limited (Thouless 1994, in Naughton et al. 1999, p. 9; Dapash 2002, Zubair et al. 2005, Graham 2006, Lee and Graham 2006, Warner 2008, Lamarque et al. 2009; in Mariki et al. 2015, p. 20). As discussed earlier, elephants also face barriers that block

their migration routes throughout the continent, sometimes making them aggressive, exacerbating conflict (Kangwana 1995, Kothari 1996, Lahm 1994, in Naughton et al. 1999, p. 9).

Social and political changes in recent years have also led to more intense HEC. Many African communities have shifted from pastoral livelihoods to farming resulting in greater land use changes (Naughton et al. 1999, p. 8). Plus, an increase in privatized land ownership has eroded traditional farming strategies in which communities worked together to combat crop raiding, so now the impact of crop-raiding focuses on the individual rather than the collective damage (Agrawal 1997, Bell 1984, Lahm 1996, in Naughton et al. 1999, p. 9-10). Politicians are now paying closer attention to conflicts, calling for action to protect communities against elephants, raising public awareness of HEC (Dublin et al. in Barnes 1996, anon. 1994, Hoare 1995, Kangwana 1995, in Naughton et al. 1999, p. 9-10). In combination with centralized, state ownership of wildlife and prohibitions on hunting, the overall tolerance level for elephant co-existence has decreased (Naughton-Treves 1997, Western 1997, in Naughton et al. 1999, p. 9). Similarly, communities that often have to bear the costs of conservation without receiving any benefits from it will resist conservation efforts in a number of harmful ways (Mariki et al. 2015, p. 21).

Conservationists and wildlife managers have implemented numerous strategies to mitigate HEC: e.g. targeting 'habitual raiders' (Hoare 2001), chili peppers (Hedges and Gunaryadi 2009), beehive fences (King et al. 2012), fencing and other physical barriers (Kioko et al. 2008; Hoare 2003; Omondi et al. 2004), and compensation (Dickman et al. 2011). But each strategy has its political, biological, or financial limitations (Hoare 2012, p. 70). Where savannah elephant populations have grown in Southern Africa, culling as a method to prevent HEC has been utilized. However, this has proven to be ineffective (Selier et al. 2014, p. 130). Culling "problem elephants" would only be effective if it deterred elephants from entering the area in the future. In fact, males were observed continuously moving into an area with high poaching pressures in Malawi, and younger bulls are more often responsible for crop-raiding (Bell 1981, Chiyo et al. 2005, Ahlering et al. 2011, in Selier et al. 2014, p. 130). Ultimately, the only way to prevent HEC to protect people and elephants is to prevent cultivation and settlement within remaining elephant range and especially through elephant corridors (Sitati et al. 2003, p. 675). This becomes increasingly impossible with expanding populations, limited resources, and lack of political will.

Given elephants' plight in the ivory trade, human-elephant conflict is often overlooked as an international conservation issue, while on the ground, elephants have a higher pest profile than many other more damaging species due to their sheer size and danger to humans (Naughton-Treves, Treves and Rose 2000, Hoare 2001, in Sitati et al. 2003, p. 668). Poaching for ivory is likely intensifying HEC since elephants that are subject to extreme hunting pressures will form large groups that cause greater damage (Southwood 1977, in Naughton et al. 1999, p. 8), while at the same time HEC drives the illegal killing of elephants (UNEP et al. 2013, p. 41). Hundreds of elephants are directly killed as a result of HEC as well as an unknown number that suffer from a lack of conservation support from those communities combating HEC (Hema et al. 2011, Webber et al. 2011, in UNEP et al. 2013, p. 41). HEC therefore poses significant, ongoing challenges to the survival of elephants in Africa.

4. Climate Change

Global climate change is happening at an unprecedented rate and threatens numerous species and their habitats (IPCC 2014). Average temperatures in Africa are projected to rise at least 2°C if not 3-6°C by the end of the century which will result in major changes in ecosystem structure and function (Niang et al. 2014, p. 1202). Precipitation projections are less understood in parts of Africa with complex topography, but the IPCC reports that a reduction in precipitation is likely in the Northern and Southwestern regions of the continent (Ibid.). Changes are expected in species' ecological interactions and geographical ranges, with predominately negative effects on biodiversity (Thuiller et al. 2006, p. 425).

Species respond to climate change in many different ways depending on their sensitivity to environmental changes, the exposure they have in their range, and their adaptive capacities (Huey et al. 2012, cited in McCain and King 2014, p. 1766; Dawson et al. 2011, p. 53). Climate and extreme weather events are mechanistically linked to body size, individual fitness, and population dynamics of diverse species (Parmesan and Yohe 2003, p. 40). Large-bodied mammals are generally at a high risk of extinction due to the energy expended in their life-histories (reviewed in McCain and King 2014, p. 1767). This is definitely true in the case of elephants, which require large amounts of food and water and need to travel great distances to access them.

Much remains unknown on how Africa and its elephants will be impacted by climate change, but there is a general consensus that water availability will decrease, leading to competition among people and wildlife for this resource. The World Wildlife Fund considers elephants to be highly vulnerable to climatic changes due to their need for 150-300 liters of water a day (WWF Climate Assessment: African elephants), while the IPCC predicts with high confidence that climate change will amplify existing stresses on water availability and exacerbate the vulnerability of agricultural systems, especially in semi-arid areas (Niang et al. 2014, p. 1202). Thuiller et al. (2006) found that 30 percent of 277 tested African mammals are critically endangered by climate change, assuming unlimited migration ability and not factoring in land use changes (p. 434), and that national parks, especially those in xeric and desert shrublands, will not be able to meet their mandate of protecting current mammalian diversity within park boundaries (p. 437). Additionally, species restricted to only a few sites are naturally vulnerable to local extinction, especially mammals that directly threaten human lives (Thuiller et al. 2006, p. 434). So, even before an ecosystem reaches the point of being unable to support elephants, the conflict between humans and elephants over competition of water, food, and space will cause further population decline, most likely in areas currently holding the last remaining robust populations.

The impacts of climate on savannah elephant populations have already been realized (Bouché et al. 2011, p. 7-8; Bouché et al. 2012, p. 7008; Wall et al. 2013, p. 64; Ngene et al. 2013, p. 39). Drought not only causes direct mortality in elephants, but a single year drought may impact populations for two to three years afterwards (Wittemyer et al. 2013, p. 8). Drought in Tsavo in the early 1970s killed at least 6,000 to 9,000 elephants in the region (Ngene et al. 2013, p. 39). This same drought reduced the surface water of Lake Chad in northern Africa by 70 percent which drove herders south into CAR and into PAs to find water and pastures for their cattle, competing with elephants and reducing the amount of available habitat to them (Bouché et al.

2011, p. 8). The Gourma elephant population in Mali, which already survives in the harshest conditions on the continent (Wall et al. 2013, p. 61), also must compete with people, cattle, and more recently agricultural growth for water where lakes in the north dry out completely. Elephants and transhumant herders in this region are completely reliant on seasonal rainfall and their migration patterns to access this water (Wall et al. 2013, p. 64). In Samburu, Kenya, notable elephant declines were caused by a recent drought in 2009-2010 (Wittemyer et al. 2013, p. 8).

Climate change and variability is one of the primary drivers for land use change (Bouché et al. 2011, p. 8). Increased water stress will push people and cattle further into the range of elephants, elevating human-elephant conflict, reducing their range, and increasing poaching in light of closer contact and localized agricultural and economic hardship (Bouché et al. 2012, p. 7008). Additionally, it will multiply existing threats to human security including food and economic security, which can drive political instability and conflict (Niang et al. 2014, p. 1204). This will have a drastic snowball effect on elephant populations as conflict and land use change negatively impacts their populations (Lee and Graham 2006, p. 17).

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Both forest and savannah elephants are highly overutilized for commercial and recreational purposes. The prolific trade in illicit ivory presents the most immediate and significant problem for elephants across the continent, while legal markets and trophy hunting confuse the public and hinder conservation efforts.

1. Ivory Trade

Unprecedented levels of elephant poaching to feed both legal and illegal ivory markets are rapidly driving forest and savannah elephants to extinction. The current offtake exceeds the intrinsic growth capacity of both African elephant species (Wittemyer et al. 2014, p. 13118), and by some estimates, if the current rate of poaching continues, we could see the extirpation of most elephant populations in Africa within the decade (Wasser et al. 2008, p. 1066). For this section, since most analyses on ivory trade and its impact on elephant populations are conducted by CITES programs, the threats are described by region. Where the literature allows, we attempt to put into perspective the impacts of ivory trade and poaching on forest elephants and savannah elephant populations separately. This is especially important because when examining the impact of the ivory trade, which is the most immediate and significant threat to most populations, if one looks at the continent as a whole containing one species, the level of decline in both population numbers and range, while alarming, does not look as catastrophic as it truly is. However, when one considers the very real and imminent danger of losing an entire species and decimating the other down to only a few populations in Eastern and Southern Africa, which will eventually likely succumb to poaching pressures as well if the trade is not halted, the need to take immediate action becomes abundantly clear.

a. Background and Context for Current Threats

Ivory is carved and made into musical instruments, figurines, jewelry, religious objects, and other traditional and decorative items. It has been traded for hundreds of years, and more

recently, it has become a status symbol of wealth and power, mostly in Asian countries and especially for China's growing middle class (Nishihara 2003, p. 55; Vigne and Martin 2014, p. 5, 6). Following a decline in the African elephant population from over a million elephants to 600,000 (Douglas-Hamilton 1987, p. 11; UNEP et al. 2013, p. 22) due to poaching for their ivory to feed the insatiable demand, in 1989 CITES uplisted African elephants from Appendix II to Appendix I species, effectively banning the international trade in elephants and their products (*See* Section VI. D. of this petition; Lemieux and Clarke 2009, p. 453; Wasser et al. 2009, p. 68). This had an immediate positive effect on the ground. Poaching came to a halt (Lemieux and Clarke 2009, p. 453); western nations poured aid into anti-poaching efforts, and elephant populations began to recover (Wasser et al. 2009, p. 68). However, some countries fought the ban, arguing that their own conservation programs were successful and relied on funding from ivory sales.

Resolution Conf. 7.9 allowed for changes in the listing of elephant populations, and in 1997 Namibia, Botswana, South Africa, and Zimbabwe's elephants were downlisted to Appendix II (Lemieux and Clarke 2009, p. 454). In 1999, Botswana, Namibia and Zimbabwe were allowed to sell 50 tons of stockpiled ivory to Japan (Stiles 2004, in Lemieux and Clarke 2009, p. 454). Then in 2007, CITES approved another sale of 110 tons of stockpiled ivory from these three countries plus South Africa to China and Japan, the sale of which occurred in 2008 (Wasser et al. 2010, p. 1331). Many conservationists believe these sales flooded the ivory market and renewed demand, causing the illegal trade to flourish to levels worse than before the ban in 1989 (Wasser et al. 2009, p. 69; Douglas-Hamilton and Maisels, 2012 comment letter; Bennett 2014, p. 2; Vigne and Martin 2014, p. 5).

The wholesale price of ivory rose from US$200 per kilogram in 2004 to US$850 per kilogram by 2007 and doubled again by 2009 (Wasser et al. 2009, p. 69). By 2006, elephant poaching in Africa had become arguably worse than it was before the 1989 Appendix I listing, and an estimated eight percent of the entire African elephant population was being wiped out annually (Wasser et al. 2009, p. 69). That mortality rate exceeds the six percent annual reproductive rate under optimal conditions as well as the 7.4 percent annual poaching mortality rate that instigated the CITES Appendix I listing (Douglas-Hamilton 1988, Said et al. 1995, in Wasser et al. 2008, p. 1066).

b. Current Trends in Illegal Ivory Trade and Poaching

Two main programs were implemented by CITES in 1997 that aim to monitor the illegal trade in ivory and its impact on elephant populations. The first is the Elephant Trade Information System (ETIS), and its objectives are:

i) measuring and recording levels and trends, and changes in levels and trends, of illegal hunting and trade in ivory in elephant range States, and in trade entrepôts;

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

iii) establishing an information base to support the making of decisions on appropriate management, protection and enforcement needs; and

iv) building capacity in range States. (CoP16 Doc. 53.2.2, p. 1)

All CITES Parties are requested to report any illegal seizures of ivory within 90 days of the transaction to the ETIS (Underwood et al. 2013, p. 1).

The Monitoring of the Illegal Killing of Elephants (MIKE) is the second CITES program relevant to elephant conservation. There are some 60 designated MIKE sites in 30 African countries which include many of the continent's prime national parks such as Chobe, Etosha, Kruger, Ruaha, South Luangwa and Tsavo, as well as some of its most famous Game Reserves, such as Selous and Niassa (AfESG 2012, p. 4). Together they represent about 30 to 40 percent of the continental elephant population (Ibid.). From the MIKE program, scientists derive the Proportion of Illegally Killed Elephants (PIKE) which helps detect regional levels of illegal harvest (Wittemyer et al. 2014, p. 13117). A threshold proportion of 0.54 indicates that a population is under substantial poaching pressure and is in need of intervention to prevent extirpation (Wittemyer et al. 2014, p. 13120).

Figure 15: MIKE sites in Africa

Data from these two programs show that the illegal trade in ivory has drastically increased and is an immediate threat to elephant populations across Africa.

i. The Global Illegal Ivory Trade, Analyses of the ETIS

The ETIS by itself has inherent limitations that make determining trends practically impossible – not all illegal transactions are seized; the seizure rate is unknown; not all seizures are reported;

and the reporting rate is unknown (Underwood et al. 2013, p. 1-2). But by identifying predictors of variation in the seizure and reporting rate between countries and over time, Underwood et al. (2013) were able to reduce these major sources of bias in order to produce the best available information we have on the trends of illegal ivory trade (p. 7). They did this by using two indexes: the Transaction Index, which assess the frequency of illegal trade by depicting the global trade into six ivory type and weight classes (Raw <10kg, Raw 10-100kg, Raw 100+kg, Worked <10kg, Worked 10-100kg, Worked 100+kg), and the Weight Index, which assesses the scale of illegal trade in ivory by dividing raw and worked ivory into three weight classes (<10kg, 10-100kg, 100+kg) (CoP16 Doc. 53.2.2, p. 5, 8). The results using these analyses with data from 1996 to 2011 are presented below (Underwood et al. 2013).

From 1998 to 2011, the illegal ivory trade increased threefold, and it doubled from 2007 to 2011 alone (p. 4). Nearly 300 tons of ivory was seized throughout the world from 1996 to 2011 (CoP16 Doc. 53.2.2, p. 4). Large consignments of ivory made up at least 70 percent of the confiscations in all years, increasing to an alarming 82 percent in 2011 (p. 4). In 2011, 70 percent of all transactions and 90 percent of worked ivory involved the small worked ivory class, indicating an increase in end-use consumption and demand over the previous three years (p. 4). Large, worked consignments made up seven percent of the total weight of ivory and were mostly in transactions from Asia and Central Africa (p. 4).

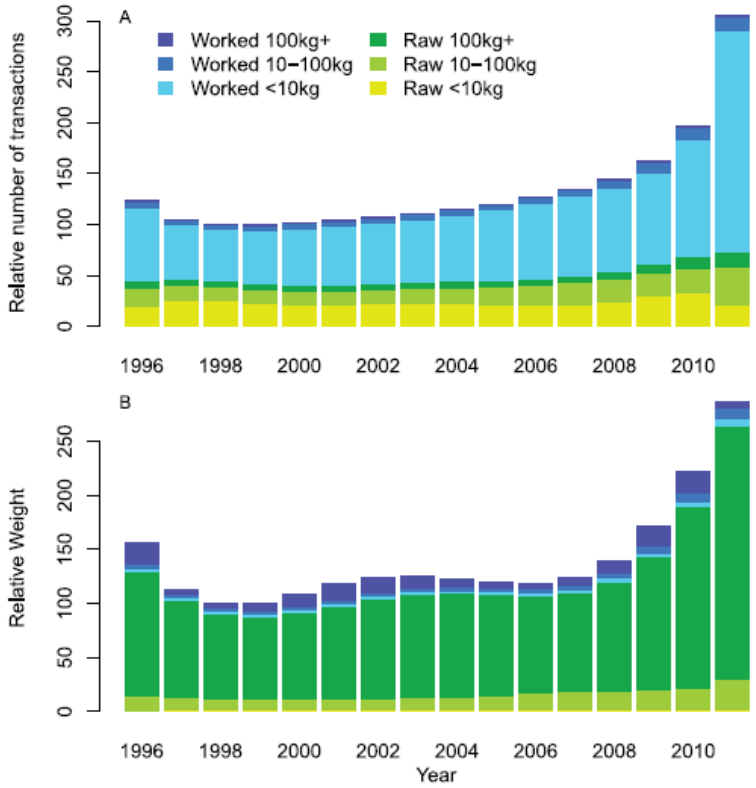


Figure 16: Illegal ivory seizures divided by ivory class and weight according to the Transactions Index and Weights Index (Underwood et al. 2013, p. 8, Fig. 5).

ii. Regional Illegal Ivory Trade within Elephant Range States: Results of the ETIS Cluster Analysis

The ETIS Cluster Analysis aims to reveal the most important players and their roles in the illicit trade in ivory for the purposes of management decisions and designing enforcement objectives (CoP16 Doc. 53.2.2, p. 10). Again, the ETIS cannot be taken as a full representation of the patterns in illegal trade, especially since several countries have never even reported to the ETIS (Angola, Benin, Equatorial Guinea, Liberia, Senegal, Somalia, and Togo). But smoothing techniques help detect regional trends as well, adjusting for biases in the data which might be the result of improved law enforcement or better reporting (CoP16 Doc. 53.2.2, p. 3-5).

Central Africa, Southeast Asia, and East Africa comprised 30, 20, and 16 percent (respectively) of all ivory transactions from 2009 to 2011 (Underwood et al. 2013, p. 4). Ivory processing occurs throughout the trade chain, but most ivory processing and the largest domestic markets in the world are in Asia, and more critically, Central Africa (Ibid.) where both forest and savannah elephants are under enormous poaching pressure (Maisels et al. 2013; Bouché et al. 2012).

Central Africa

Cameroon plays a significant role in the illegal ivory trade in Central Africa and in the decline of forest elephants by providing an exit point for ivory from the DRC, Gabon, and Congo through its seaport in Douala (Underwood et al. 2013, p. 5). All of these countries remain important sources of ivory in the illegal market, contributing to the ongoing, devastating decline of elephants in this region (CoP16 Doc. 53.2.2, p. 15; Maisels et al. 2013). Nigeria, while further West than the Central African elephant populations of question here, rarely supplies ivory to the market itself, mostly because elephants are almost completely absent from the country (Bouché et al. 2011, p. 7). However, it does still serves as an exit point for ivory obtained elsewhere and along with the DRC is considered to be major sources of illicit ivory in international trade (CoP16 Doc. 53.2.2, p. 15, 20).

Eastern Africa

Seizures from Tanzania, Uganda, and Kenya accounted for three quarters of Eastern Africa's transaction in raw ivory (Underwood et al. 2013, p. 5). Uganda serves as a regional entrepôt for ivory originating from forest elephants in Central Africa, especially the DRC (Blanc et al. 2002, in Underwood et al. 2013, p. 5; CoP16 Doc. 53.2.2, p. 21). The Ugandan military may even be involved, with military helicopters allegedly ferrying illicit ivory out of Garamba National Park (Gettleman, 2012, in CoP16 Doc. 53.2.2, p. 21), but more typically large consignments of ivory are transported by truck and shipped to Asia from Uganda (CoP16 Doc. 53.2.2, p. 21). Kenya and Tanzania have become the two most prominent countries connecting African ivory with Asian demand (CoP16 Doc. 53.2.2, p. 20). Sixteen large-scale ivory shipments, totaling some 35 tons of ivory, moved through the seaports of Mombasa, Dar es Salaam, and Zanzibar, representing nearly half of the 34 large-scale seizures by numbers and 58 percent of the total weight of seizures from 2009 to 2011 (CoP16 Doc. 53.2.2, p. 20). This data led CITES to sanction Kenya and Tanzania as source countries. The prominent shift in trade routes from Central/West African ports to those in Kenya and Tanzania (Ibid.) represents alarming evidence that savannah elephants in Eastern Africa are equally vulnerable and threatened by poaching and the illegal trade of ivory. Just recently, the largest shipment of illegal ivory in over a decade,

worth six million USD, was seized in Singapore and was from Mombasa, Kenya (AFP, Business Insider 5/19/2015).

Southern Africa

Illegal routes and markets are emerging in Southern Africa, where most elephants are listed as Appendix II species. South Africa is increasingly implicated in large-scale ivory movements (CoP16 Doc. 53.2.2, p. 20). In 2009, 1.5 tons of worked ivory from Zimbabwe was seized, and two cases in 2011 totaled over 3.8 tons of raw ivory destined for Asian markets out of Cape Town with genetic analysis of the ivory revealing South African origination (Ibid.). Of more concern is the erratic reporting to ETIS from South Africa in recent years (Ibid.). South Africa was sanctioned by CITES along with Tanzania and Kenya as an important player in providing illegal ivory (Underwood et al. 2013, p. 6).

Angola has never submitted reports to the ETIS, but field observations suggest that the ivory trade there is increasing rapidly (Milliken et al. 2006, p. vi). Raw ivory is easy to acquire and likely from a mix of some Angolan elephants and mostly Central African elephants (Ibid.). Known to have highly unregulated domestic ivory markets, Mozambique remains a country of concern as well, especially in light of recent reports of ivory from two stockpiles going missing (see SC62 Doc. 46.1.; M. Foloma, pers. comm. to TRAFFIC 2012, in CoP16 Doc. 53.2.2, p. 22). Reporting from Mozambique is typically rare, but based on Milliken et al.'s (2006) findings, the ivory trade is growing rapidly there as well and is in blatant violations of CITES regulations (p. vii). Just recently, 340 elephant tusks weighing 1,160kg (equaling 170 elephants) was seized in Mozambique (All Africa, 5/14/15).

iii. Regional Illegal Ivory Trade for Major Importing Countries

Europe and North America were the top consumers of ivory in the 1990s, but China's market is now more than double the size of Europe's and North America's combined (Underwood et al. 2013, p. 4). Europe used to be a transit point for ivory from Africa to Asia, but now there are direct routes, which is mainly why transactions have decreased there (Ibid.). Not unsurprisingly, the majority of all ivory weight classes come from China, but Thailand has now become the most significant player for raw ivory. Other markets certainly drive the illegal harvest of ivory, but both China and Thailand are principal end-use countries for ivory, with China far outweighing Thailand (Ibid.). Neither of these two largest participants in illegal ivory trade appear to be effectively reducing their country's demand.

China

It is well known that China has the largest ivory markets and is the largest importer of elephant tusks in the world (Vigne and Martin 2014, p. 5). China is now making an average of two ivory seizures a day, and this underscores how rampant the illicit ivory trade in China has become (CoP16 Doc. 53.2.2, p. 19). Prices per kilogram of raw ivory more than doubled from 2010 to 2014 (Vigne and Martin 2014, p. 5) while the main consumer of most ivory products is now mainland Chinese, instead of foreigners like in the early 2000s (id. at 6). Some businessman even buy ivory as an investment, indicating that they do not see the demand or price for ivory going

down at any point (Vigne and Martin 2014, p. 80). Indeed, the price of raw ivory in China is still rising, with one kilogram of raw ivory now worth US$2,100 (Save the Elephants, in The Guardian, 7/3/14).

The number of legal ivory factories in China increased from nine in 2004 to 37 in 2013, and the number of legal retail outlets increased from 31 in 2004 to 145 in 2013, with many undoubtedly acting as covers for the numerous unlicensed, illegal markets witnessed by field researchers (Vigne and Martin 2014, p. 6, 7). Out of the surveyed markets in Beijing and Shanghai, there were three and eight times more illegal outlets than legal ones (respectively), which is nothing compared to the number of illegal markets occurring in the rest of the country (Vigne and Martin 2014, p. 21, 80). The penalties for selling ivory without a certificate are unclear, and despite a clear increase in an attempt to curb illegal ivory, a deterrent effect emerging from these efforts has not been documented (CoP16 Doc. 53.2.2, p. 19). The rampant ivory market in China presents significant and ongoing threats to African elephants.

Thailand

As stated previously, Thailand has become a significant player in raw ivory consignments (Underwood et al. 2013, p. 4). Large seizures of ivory are routinely stopped at the point of importation, but rarely are domestic markets tracked. Any ivory that makes it through customs, which judging by the amount sold in markets is a hefty amount, will then freely make its way through the domestic supply chain (CoP16 Doc. 53.2.2, p. 18). Despite showing a commitment to shut down its illegal ivory markets, surveys show that the quantity of ivory openly for sale remains high and is increasing (Doak 2014, p. 10). Ivory taken from domestic Asian elephants in Thailand is legal to sell. This highly unregulated market allows the proliferation of the illegal ivory market with African origins (Doak 2014, p. 3). The domesticated male elephants in Thailand could not have possibly supplied the amount of ivory available in markets in Thailand from 2013 to 2014 (Doak 2014, p. 10). In fact, domesticated male elephants in the country could not even provide the number of bangles alone that are on sale at the markets (Ibid.). This growing market in Thailand currently shows no sign of slowing and directly impacts African elephant populations.

Other Countries

China and Thailand are certainly not alone in their participation of the illegal trade. In Japan, though the ivory market has decreased in size since 2003, ivory still holds a strong traditional value in the country (CoP16 Doc 53.2.2, p. 17). The Philippines were recently exposed for their trade in illicit ivory as religious artifacts (Christy, National Geographic Magazine, Oct. 2012). The United States had the second largest domestic market for ivory in 2008 (Stiles and Martin, p. 5). In addition to these countries, numerous nations have been implicated in the trade as transit countries.

iv. Trade Routes for Illegal Ivory

For context and reference, below are the observed trade routes for large-scale (in this case, ivory >500kg) of illegal ivory shipments. Notice that at the beginning of this century, West and Central

Africa were still major exit points, but there has been a prominent shift East and South (Milliken 2014, p. 9).

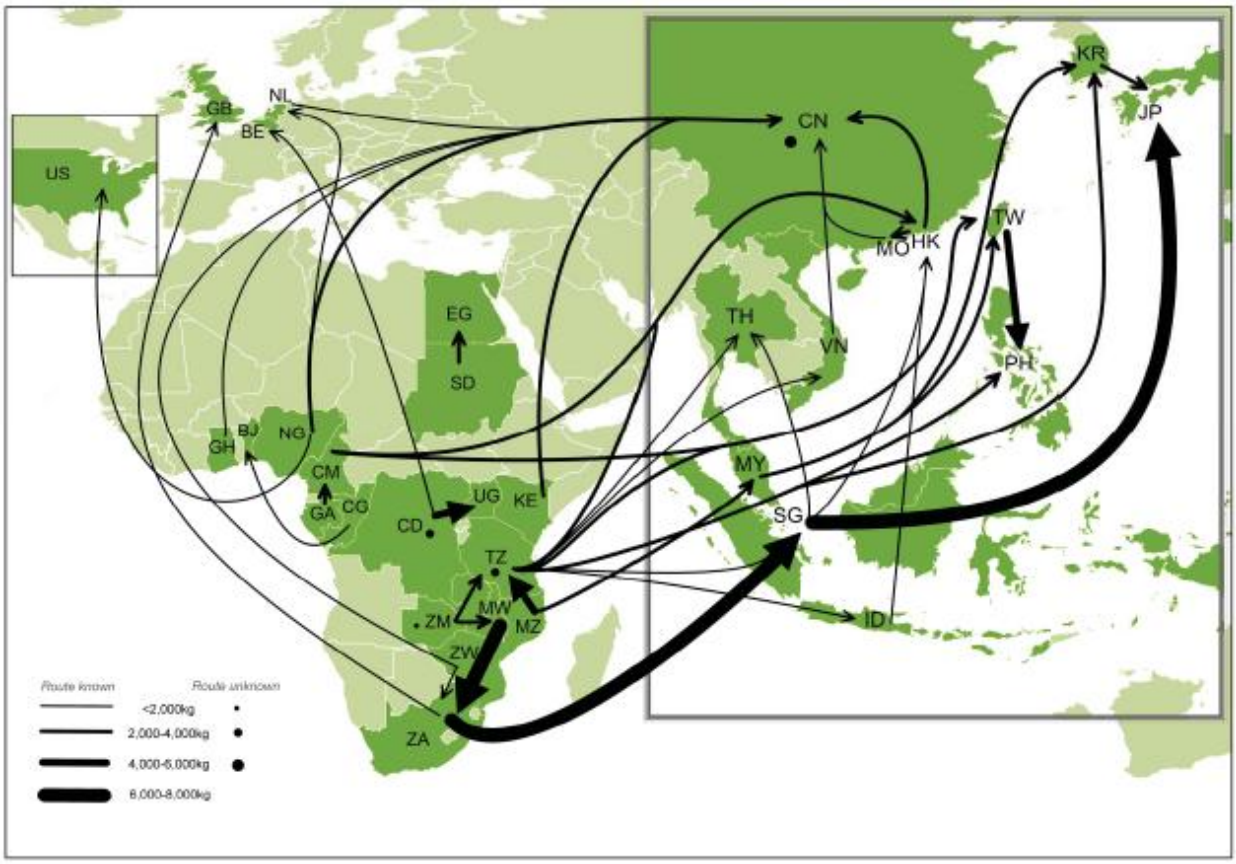


Figure 17: Trade routes for large-scale (>500kg) seizures of ivory, 2000 – 2008 (ETIS, 03 November 2013, in Milliken 2014, p. 10, Fig. 8)

Figure 18: Trade routes for large-scale (>500kg) seizures of ivory, 2009 – 2011 (ETIS, 03 November 2013, in Milliken 2014, p. 10, Fig. 9)

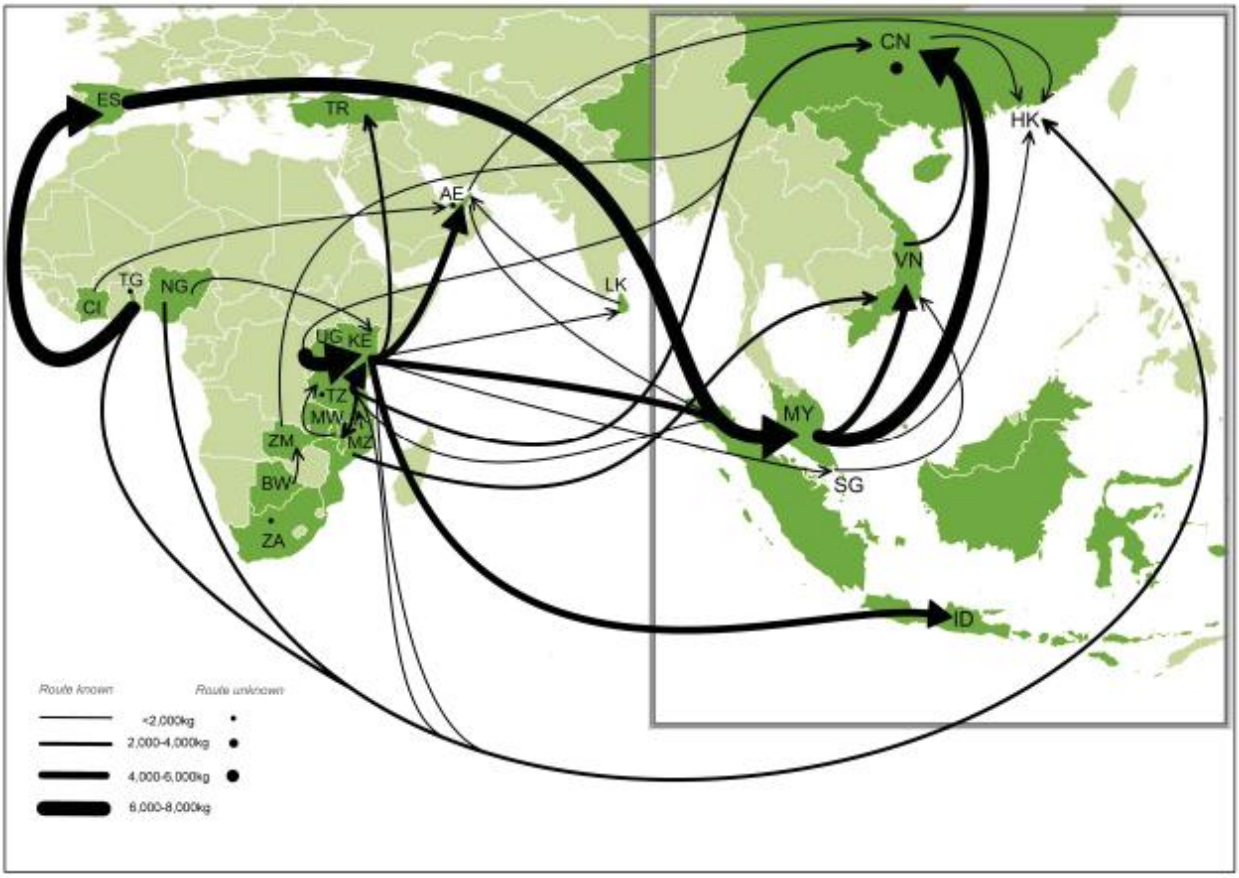


Figure 19: Trade routes for large-scale (>500kg) seizures of ivory, 2012 – 2013 (ETIS, 03 November 2013, in Milliken 2014, p. 11, Fig. 10)

The 2013 ETIS analysis concludes,

> This ETIS analysis should be interpreted as serious cause for concern. Illicit trade in ivory has greatly increased since CITES CoP15, reaching the highest level in at least the last 16 years. This increase is reflected not only in the relative weight of illicit ivory in trade, but also when measured in terms of the relative number of illicit ivory trade transactions that are occurring each year globally … The presence of organized crime syndicates is an increasingly entrenched feature behind the illicit trade, and governance shortcomings seriously undermine effective law enforcement along the trade chain. At the national level, almost no large-scale ivory seizures are being properly investigated, forensic evidence is rarely, if ever, taken and analyzed, and accountable and transparent ivory stockpile management remain elusive in most countries (CoP16 Doc. 53.2.2, p. 27).

Even with the improvement in analyses of the ETIS, managers struggle to answer some of the most pertinent questions in African elephant conservation, such as: what are the absolute quantities of illegal ivory in circulation; how long does it take to accumulate a large consignment; and how many elephants are killed per year (Underwood et al. 2013, p. 7). For instance, seized ivory shipments may not come from a recently poached elephant and could

come from a stockpile instead such as the 1,335 kilograms recently stolen from Uganda's stockpile (Green 2014, Reuters 11/18/14).

Wasser et al. (2008) showed with DNA forensics that large consignments of ivory are likely the result of organized crime syndicates that target specific populations for intense exploitation (p. 1070). Coupled with analyses from MIKE/PIKE data, such efforts can help us gain a better understanding of the scale of illegal trade, poaching, and the impacts it has on elephant populations.

v. Continental Poaching Rates and Impacts on African Elephant Populations

Like the ETIS, MIKE and PIKE data should be interpreted with caution due to limitations in the data, but the results are in good agreement with what would be expected from the ETIS analyses, which boosts confidence in their robustness (AfESG 2012, p. 4).

From 2006 to 2011, there was a steady increase in levels of illegal killing, with 2011 showing the highest levels of poaching since monitoring began in 2002 (AfESG 2012, p. 4). Preliminary results for 2014 show that poaching rates remain at these high levels (CITES, press release 2014).

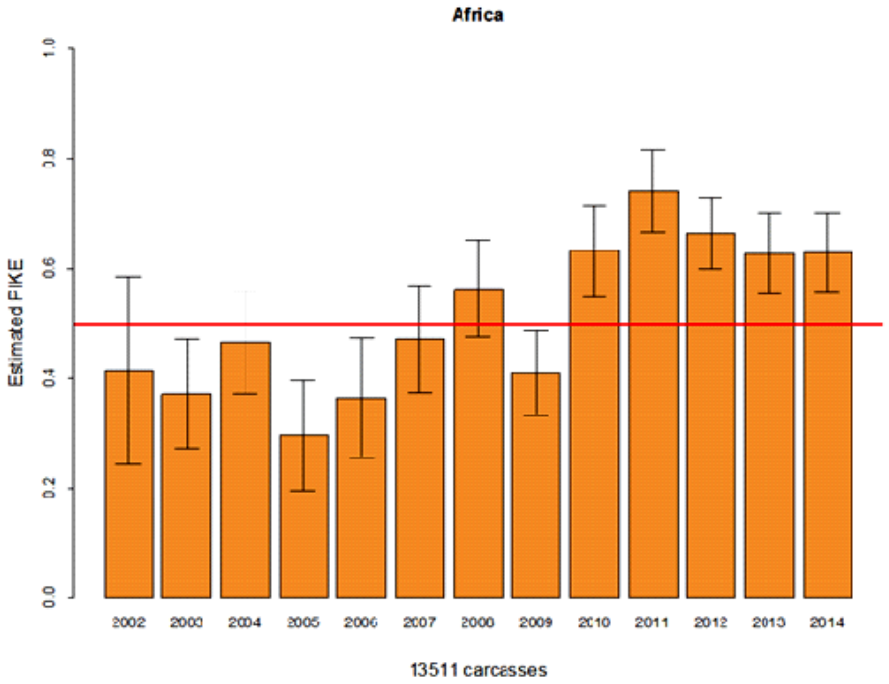


Figure 20: Elephant poaching trends in Africa with 95 % confidence intervals. Poaching levels (PIKE) above the horizontal line at 0.5 (i.e. where half of dead elephants found are deemed to have been illegally killed) are likely to be unsustainable (CITES, press release 2014, Fig. 1).

Modeled PIKE levels for 2012 translate to about 15,000 elephants killed across all MIKE sites in that year, or about 7.4 percent of the total elephant population at those sites (AfESG 2012, p. 8). Based on an average five percent reproductive rate, this suggests that the overall populations across all MIKE sites declined by 2.4 percent in 2012 (Ibid.).

Results from an analysis conducted by Wittemyer et al. (2014) tell a more complete story, however. By using PIKE data in combination with demographic data obtained from the intensively studied Samburu population in Kenya, the authors showed that a better estimate of 33,630 elephants were killed per year from 2010 to 2012, meaning about 100,000 elephants were poached for ivory in just three years across the continent (p. 13118). Judging by Kenya's Samburu population, this equates to skewed sex ratios (since older elephants, especially males, have the largest tusks) and social disruption, leading to collapsed families and orphans not surviving to reproduce (Wittemyer et al. 2014, p. 13118). These results are strongly correlated with black market ivory prices and mirrored increases in raw ivory seizures (Ibid.).

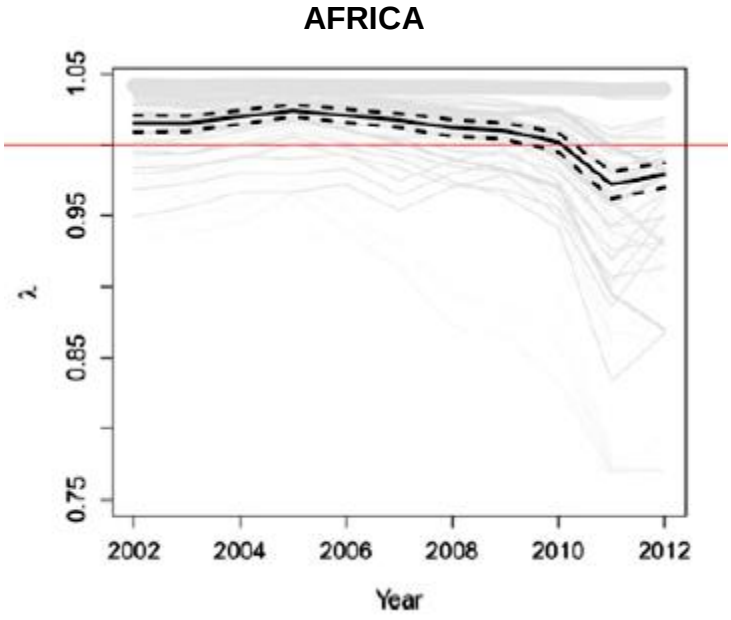


Figure 21: Modeled trends in annual population changes between 2002 and 2012 for 306 elephant populations across Africa. Gray lines represent the site-specific annual population changes, where the thickness represents relative population size. Black lines represent the aggregate trends. Dashed lines represent the 95% confidence interval of aggregate trends (Wittemyer et al. 2014, p. 13119, Fig. 2).

vi. Forest and Savannah Elephant Poaching Rates

We separated out the PIKE values given for each MIKE site through 2011 for forest and savannah elephants to get a better idea of the poaching pressures each species faces. Unsurprisingly, since most of Central Africa MIKE sites are where forest elephants occur and there is very little data from their western range, they show similar trends with the regional Central Africa assessment (below). When the forest elephant is examined as a species by itself versus as a portion of African elephants as a whole, particularly alarming trends are apparent. Immediate action is needed to save this species.

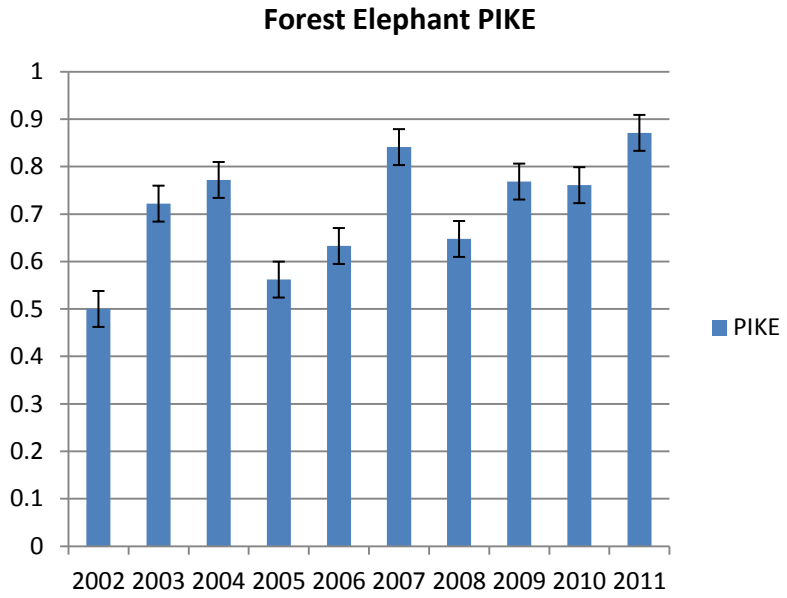


Figure 22: PIKE data for only forest elephants (*Loxodonta cyclotis*) 2002-2011. Data from CoP16 MIKE report.

For savannah elephants, most of the data comes from eastern populations, so their trends look similar to that of the continental trends, as described below under regional trends.

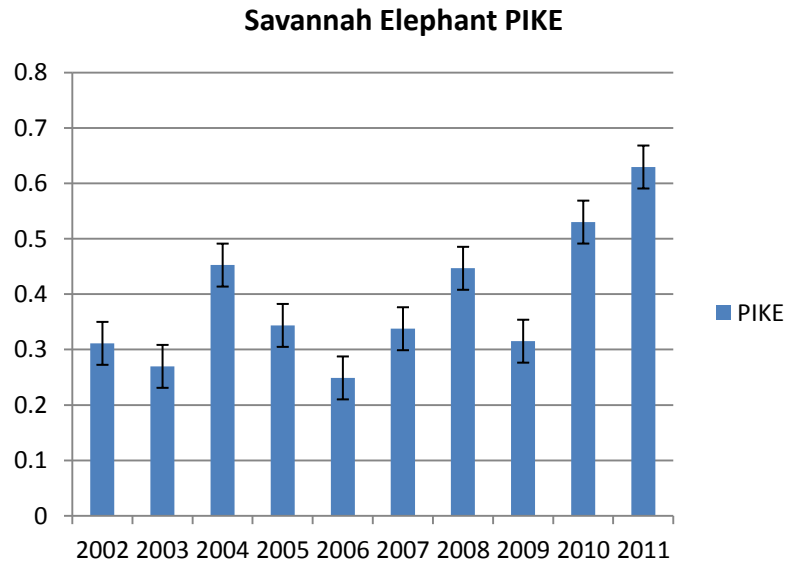


Figure 23: PIKE data for only savannah elephants (*Loxodonta africana*) 2002-2011. Data from CoP16 MIKE report.

vii. Selective Pressures Created by Poaching

More studies are needed to quantify the impacts poaching has on sex ratios, but we can generally assume that poachers most heavily target older male elephants because they have the largest tusks and provide the highest reward. This is supported by the results of a demographic study of

elephants in northern Kenya subject to high poaching pressures in which males had a lower life expectancy (Wittemyer et al. 2013, p. 7, 8) and the recent killing of two of the most beloved and closely monitored old bulls in Africa, Satao (Dell'Amore 2014, National Geographic 6/16/14) and Mountain Bull (Sanjayan 2014, CBS News 5/16/14). This creates an additive component that drives elephant population decline by skewing sex ratios and impacting reproductive success, especially in light of the fact that males older than 35 years do most of the mating (Wittemyer et al. 2013, p. 8; Ginsberg and Milner-Gulland 1994, Milner et al. 2007, Allendorf et al. 2008, Poole 1989, Hollister-Smith et al. 2007, in Selier et al. 2014, p. 129, 130). Sex ratio of 77 females per male elephant has been suggested as a potential threshold below which fecundity decreases (Dobson and Poole 1998, in Selier et al. 2014, p. 129). Losing these bulls also leads to social problems (Slotow et al. 2000) that often involve elevated aggression among younger bulls which exacerbates risky behaviors and HEC (Slotow and van Dyk 2001, Bradshaw et al. 2005, in Selier et al. 2014, p. 130). Similarly, losing older females disrupts family structure. Using the heavily exploited population in northern Kenya as an example again, numerous well known and stable family groups were completely lost due to the absence of breeding females (Wittemyer et al. 2013, p. 8).

viii. Regional Poaching Rates and Impacts on Elephant Populations

West Africa

Poaching trends for West Africa's elephants (which includes both forest and savannah populations) are difficult to ascertain because there is consistently low monitoring and reporting from this region (AfESG 2012, p. 5). We did not separate the PIKE data for this region between forest and savannah elephants because there is so little data, with many years only reporting one or two carcasses found. Also important to note is that this region only contains a small fraction of the continent's total elephants. Still, from the data we have, poaching levels are alarmingly high. Wittemyer et al. (2014) did not include West Africa in their analysis. We include the published PIKE results from 2013 next to preliminary results from CITES's press release for context and comparison.

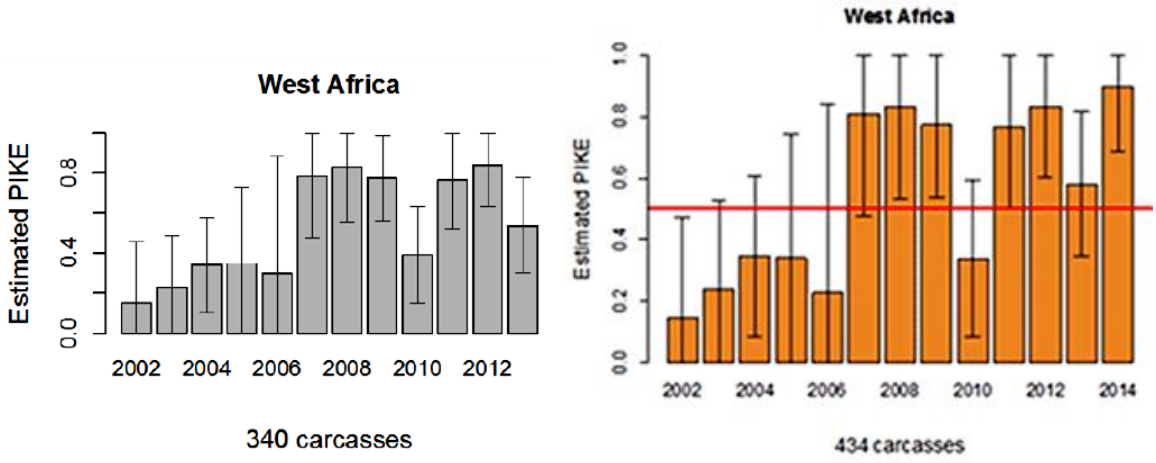


Figure 24: West Africa PIKE trends with 95 % confidence intervals analyzed through 2013 (left) and with preliminary 2014 results (right). The numbers of carcasses on which the graphs are based are shown at the bottom of each graph (AfESG 2012, p. 6, Fig. 3; CITES, press release 2014).

Elephant populations in West Africa, which here include both forest and savannah populations, have long been overhunted for their ivory (Leblan 2014, p. 160). Most populations crashed in the early 1900s long before the ban in 1989 (Wilson and Ayerst 1976, Roth and Douglas-Hamilton 1991, in WWF et al. 2005, p. 7; Blake et al. 2003, p. 8). In contrast to other areas of Africa, these populations never recovered after the colonial era and World War I, nor did they rebound after the commercial ban on ivory trade in 1989 (Spinage 1973, in WWF et al. 2005, p. 7). Still, Côte d'Ivoire and Nigeria managed to lose over 1,000 elephants to poaching in recent decades (Fischer 2005, in Bouché et al. 2011, p. 7). Current trade in ivory originating from these two countries now exceeds that which their remaining live elephant populations could produce and now mostly come from Central Africa (Bouché et al. 2011, p. 7). Niger, Senegal, and Côte d'Ivoire have World Heritage Sites that are also MIKE sites, but good data is only available for Niger's W du Niger which shows an increased PIKE value of 0.83 in 2011 compared to 0.42 from 2002 to 2010 (CoP16 Doc. 53.1, p. 8).

Central Africa

Poaching rates have been consistently highest in Central Africa, which is evident by the alarming population crash seen in that region (Maisels et al. 2013; Wasser et al. 2010, p. 1331; Wittemyer et al. 2014, p. 13118). It is also important to note that this data likely represents the "best case" scenario because MIKE sites are deliberately chosen among the longest established PAs in some of the most remote locations in the region (Blake et al. 2007, p. 950). Plus, gaining a clear understanding of the scale of poaching in Central African forests is difficult due to an historic lack of comprehensive, range-wide information on distribution and density (Maisels et al. 2013, p. 2) and because poaching massacres may go undetected in the thick forests (Blake et al. 2007, p. 945).

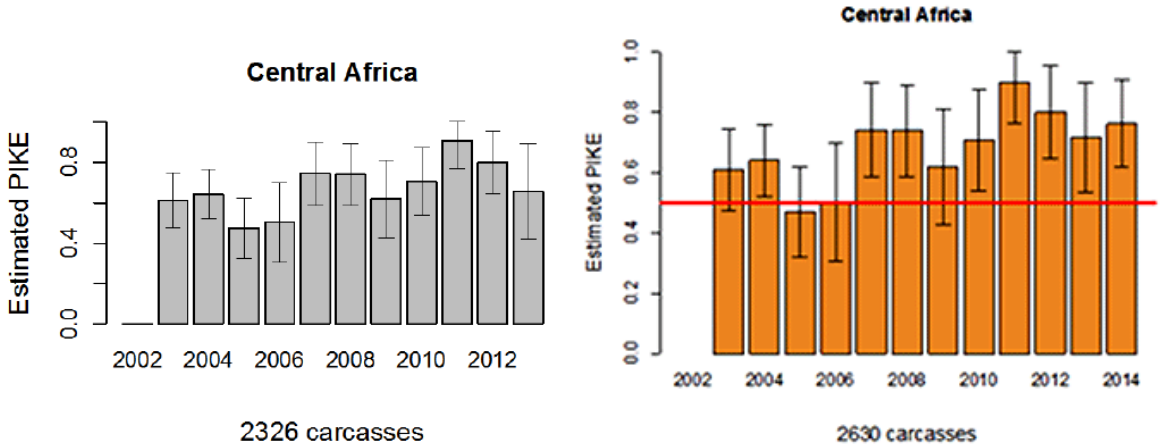


Figure 25: Central Africa PIKE trends with 95 % confidence intervals analyzed through 2013 (left) and with preliminary 2014 results (right). The numbers of carcasses on which the graphs are based are shown at the bottom of each graph (AfESG 2012, p. 6, Fig. 3; CITES, press release 2014).

We did separate PIKE data for forest and savannah elephant populations in Central Africa because carcass data was fair, although there are only four MIKE sites (Waza, Sangba, Zakouma, Virunga) for savannah elephants.

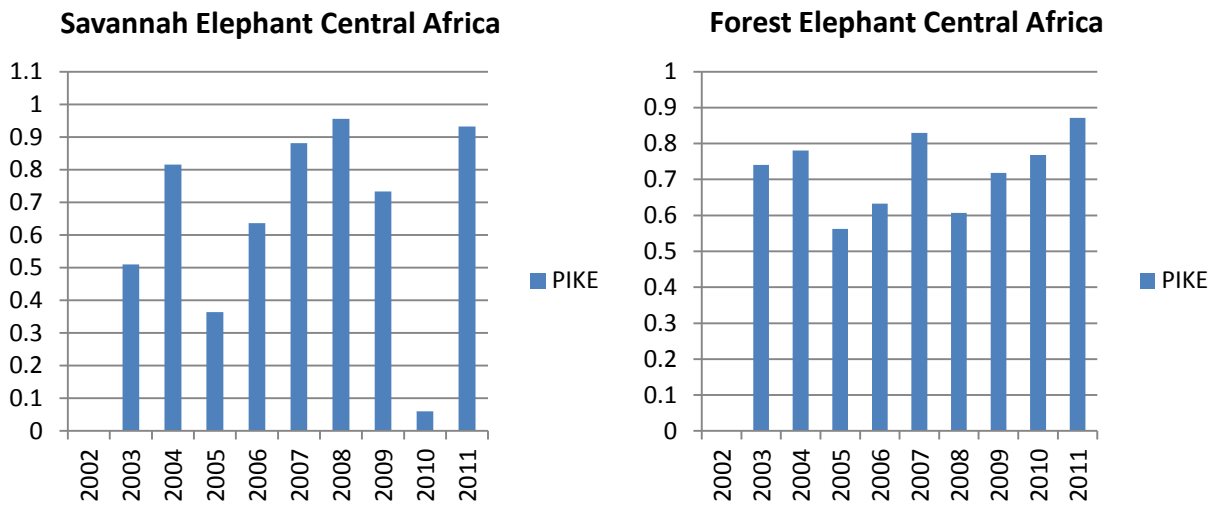


Figure 26: PIKE values for forest (*Loxodonta cyclotis*) and savannah elephant (*Loxodonta africana*) populations from 2002-2011, data from CoP16 MIKE report. The stark drop in PIKE value for savannah elephants in 2010 is due to lack of data and is not representative of the trend.

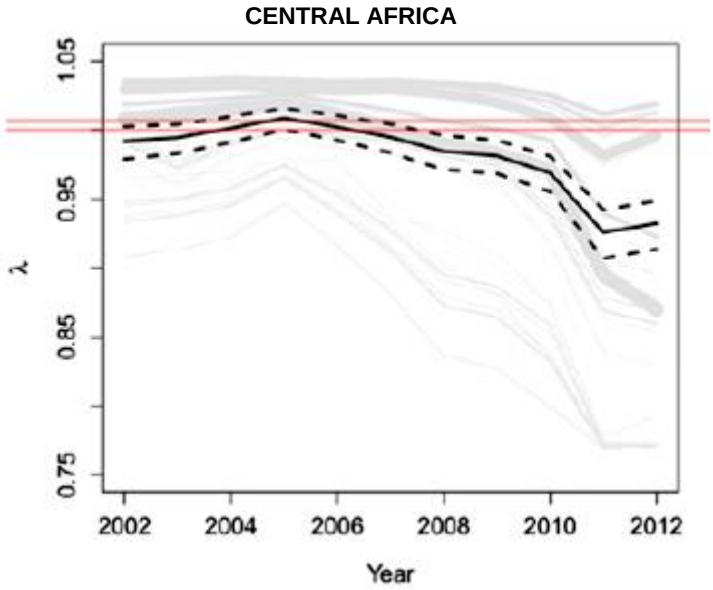


Figure 27: Modeled trends in annual population changes between 2002 and 2012 for 306 elephant populations across Africa by region for Central Africa. Gray lines represent the site-specific annual population changes, where the thickness represents relative population size. Black lines represent the aggregate trends. Dashed lines represent the 95% confidence interval of aggregate trends (Wittemyer et al. 2014, p. 13119, Fig. 2).

Maisels et al. (2013) estimated that forest elephants of Central Africa had declined by 62 percent from 2002 to 2011. This is on par with Wittemyer et al.'s (2014) empirical analysis using PIKE data which showed a 63.7 percent decline in the entire region (p. 13118), which includes some savannah elephant populations. Wittemyer et al. (2014, p. 13119) estimated that about 42,000 elephants were poached in central Africa from 2010 to 2012, based on the average of results from two modeling techniques.

Central Africa has been the site of some of the most distressing poaching events in the last few years, including one of the most devastating single poaching events on record in Cameroon's Bouba Ndjida National Park where up to 650 savannah elephants were slaughtered by poachers on horseback from Sudan (Omondi et al. 2008, Platt 2012, in Maisels et al. 2013, p. 6; Russo 2013 Mongabay 3/7/13). Shortly after, 86 elephants, including pregnant females and calves were discovered killed in Chad. They were killed in less than a week (Hicks 2013, The Guardian 3/19/13). In 2013, Gabon announced losing half of their forest elephants in Minkebe National Park – as many as 11,000 individuals may have been killed in eight years (ANPN 2013, in Maisels et al. 2013, p. 6). In 2009, 200 savannah elephant carcasses were discovered in Northern CAR, and the true number of elephants killed was estimated to be three times that amount (Chardonnet and Boulet 2008, in Bouché et al. 2012, p. 7007). Where the rate of poaching has decreased in CAR, it is likely only because it is no longer a profitable due to too few and obscure elephant populations (Bouché et al. 2012, p. 7007). In the DRC's Garamba National Park, 22 forest elephants were slaughtered by a Ugandan helicopter for their ivory in 2012 (Gettleman 2012, New York Times 9/3/12), and poaching has continued unabated ever since; 68 elephants were poached in 2 months in the summer of 2014 (Hance 2014, Mongabay 6/15/14) while 30 were killed by the Sudanese army in two weeks just a couple months ago (Frances-Presse 2015, The Jakarta Post 3/23/15).

Wasser et al. (2008) provided further evidence that populations in this region are heavily targeted for ivory harvest by analyzing the DNA from two large ivory seizures from Singapore/Malawi and Hong Kong/Cameroon (p. 1067). The Hong Kong/Cameroon analysis verified forest elephant (Gabon centered) origins for all ivory products in this seizure (p. 1069).

Eastern Africa

Eastern Africa, which only includes savannah elephants, has the largest number of carcass records and the PIKE trends unsurprisingly match that of the continental one (AfESG 2012, p. 5).

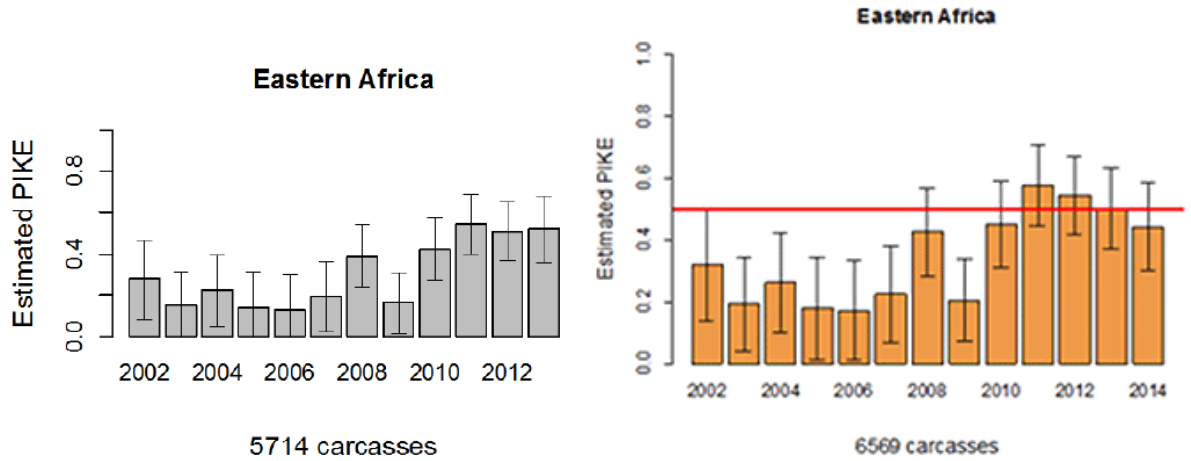


Figure 28: Eastern Africa PIKE trends with 95 % confidence intervals analyzed through 2013 (left) and with preliminary 2014 results (right). The numbers of carcasses on which the graphs are based are shown at the bottom of each graph (AfESG 2012, p. 6, Fig. 3; CITES, press release 2014).

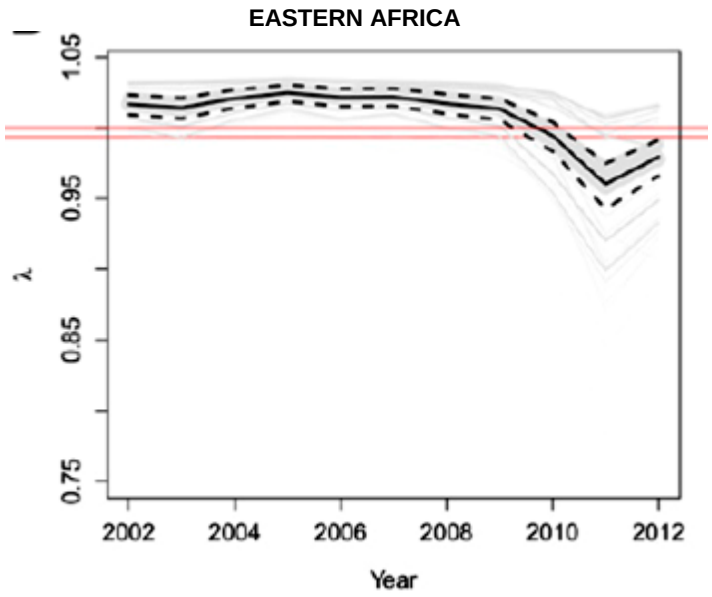


Figure 29: Modeled trends in annual population changes between 2002 and 2012 for 306 elephant populations across Africa by region for Eastern Africa. Gray lines represent the site-specific annual population changes, where the thickness represents relative population size. Black lines represent the aggregate trends. Dashed lines represent the 95% confidence interval of aggregate trends (Wittemyer et al. 2014, p. 13119, Fig. 2).

Wittemyer et al. (2014) found that Eastern Africa's savannah elephant populations has succumbed to poaching pressures with evident decline beginning in 2010 (p. 13118), and an estimated 24,000 elephants were killed from 2010 to 2012 (p. 13119). Two of the largest elephant populations in Eastern Africa, Tsavo, Kenya and Selous, Tanzania, have documented declines due to poaching, with the Selous population declining by 67 percent in just four years from 2009 to 2013 (Lotter and Clark 2014, p. 20; Ngene et al. 2013). Selous Game Reserve's PIKE values rose from 22 percent in 2003 to 64 percent in 2009, well over the sustainable limit (CoP16 Doc. 53.1, p. 8; Wasser et al. 2010, p. 1332). That illegal killing is causing the decline of elephants in Selous is further evidenced by Wasser et al.'s analysis of ivory seizures from Hong Kong and Taiwan that showed all ivory originated from Selous or Niassa populations (2010, p. 1332). And reports indicate that illegal killing is as high or higher in western Tanzania than in Selous (CITES 2009, in Wasser et al. 2010, p. 1332). In the Tsavo ecosystem, PIKE levels have fluctuated since 2002, but they rose to 68 percent in 2010 and 61 percent in 2011 (CoP16 Doc. 53.1, p. 13). Samburu-Laikipia holds possibly one of the most heavily monitored and researched group of savannah elephants, and PIKE values there were also at 61 percent in 2011 (Ibid.).

Southern Africa

Savannah elephant populations in southern Africa remained stable or increased while other populations declined because of poaching pressures until 2010, when the region began experiencing overall decline as well (Wittemyer et al. 2014, p. 13118).

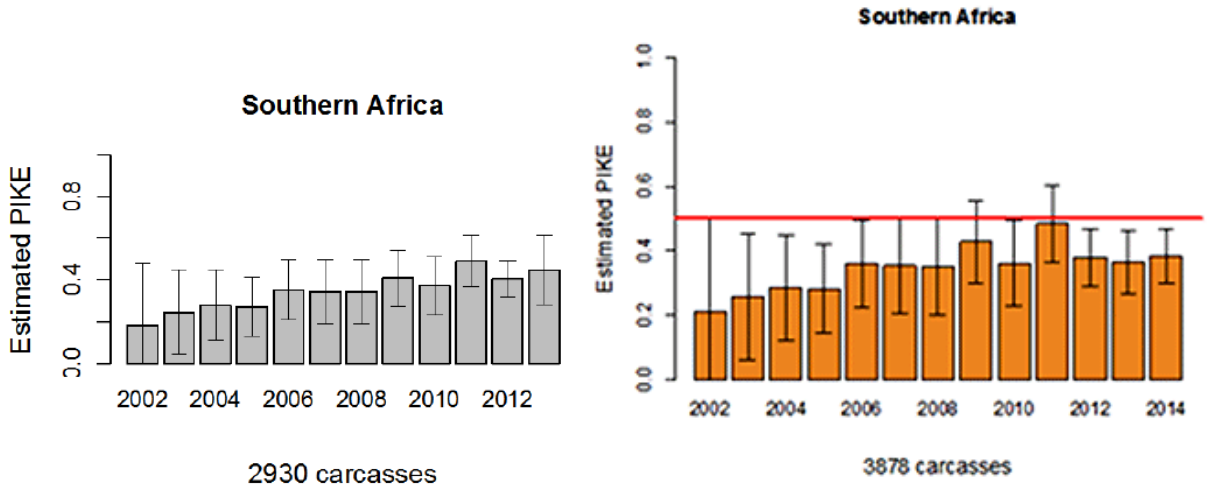


Figure 30: Southern Africa PIKE trends with 95 % confidence intervals analyzed through 2013 (left) and with preliminary 2014 results (right). The numbers of carcasses on which the graphs are based are shown at the bottom of each graph (AfESG 2012, p. 6, Fig. 3; CITES, press release 2014).

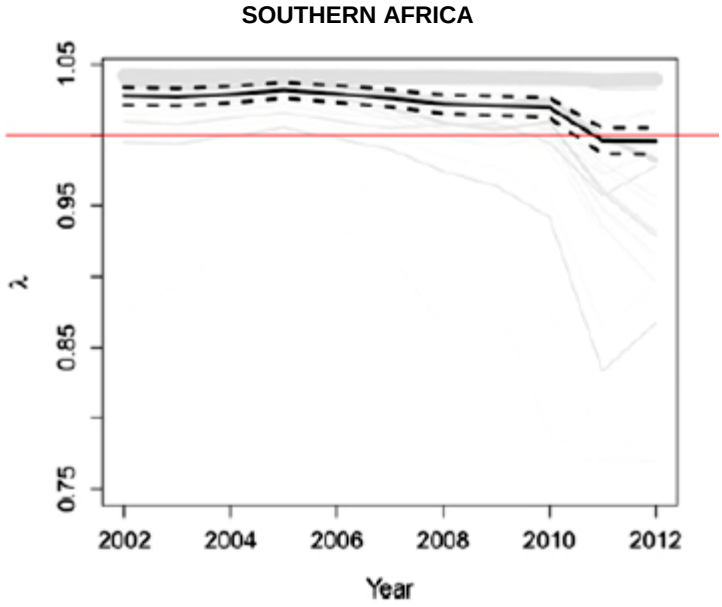


Figure 31: Modeled trends in annual population changes between 2002 and 2012 for 306 elephant populations across Africa by region for Southern Africa. Gray lines represent the site-specific annual population changes, where the thickness represents relative population size. Black lines represent the aggregate trends. Dashed lines represent the 95% confidence interval of aggregate trends (Wittemyer et al. 2014, p. 13119, Fig. 2).

It makes sense that once ivory stocks become depleted in Central and Eastern Africa, syndicates will turn south. Indeed, MIKE provides evidence that poaching is moving south (Douglas-Hamilton 2012, comment letter), threatening even the most stable remaining populations. For the first time PIKE data shows that these populations are being poached at an unsustainable rate. Zimbabwe, Mozambique, and Zambia had very high PIKE levels between 64 and 89 percent, and only the Chobe, Kruger, and Etosha populations seem to have avoided this trend for now, though poaching nevertheless does occur in small numbers there as well (id.; CoP16 Doc. 53.1,

p. 13). An estimated 41,000 elephants were killed in Southern Africa from 2010 to 2012 (Wittemyer et al. 2014, p. 13119). Wasser et al. (2010) analyzed one of the largest ivory seizures in history from Singapore, and almost all the ivory originated from Zambia (p. 1332). Additionally, tested seizures from Hong Kong and Taiwan indicated that ivory came from Niassa Reserve in Mozambique (Ibid.). Hwange National Park, Zimbabwe, also made international headlines when over 300 elephants were killed by cyanide poisoning for their ivory (Thornycroft and Laing 2013, The Telegraph 10/20/13).

We also note that while elephants may be, for the most part, not yet suffering catastrophic declines in this region, the level of rhinoceros poaching in the region has skyrocketed. Rhino horn sells for US$65,000 per kilogram (Caulderwood 2014, International Business Times 4/9/14), compared to that of US$2,100 per kilogram for ivory. It therefore makes sense that rhino horn would be the top target for poachers in the area. Despite a fantastic track record of bringing back populations rhino from the brink of extinction, both black and white rhino numbers have declined by 24 and 19 percent respectively in Mozambique, and South Africa's poaching rate has reached five percent, halting the growth of their rhino populations (Milliken 2014, p. 16). It is quite possible, and perhaps likely, that poaching networks operating in the region currently focusing on rhinoceros will expand and/or switch to elephant poaching in the near term. At a minimum, the proliferation of rhinoceros poaching demonstrates that anti-poaching institutions in place in Southern Africa are inadequate to respond to a rapid increase of poaching activity in the region.

2. Legal Trade in Ivory and Other Elephant Parts

While the illegal trade in ivory runs rampant, legal markets for ivory and elephant parts are growing (Doak 2014; Vigne and Martin 2014). The most comprehensive analysis on the scale of legal trade in ivory and its impacts on elephant populations to date can be found in IFAW, HSUS/HSI, and Fund for Animals' petition to uplist African elephants (Feb. 2015). It is generally believed that legal trade allows for the persistence of a black market by providing it cover (Bennett 2014; Stiles 2015; Milliken et al. 2006). We cannot possibly fight illegal poaching when such a large market for legal ivory exists.

C. Disease and Predation

Forest and savannah elephants are susceptible to a number of naturally occurring wildlife diseases, but these are not known to be a cause for population declines at this time. However, in combination with fragmentation, small population sizes, and rapid climatic changes, these could become a threat in the future and should be monitored.

Elephants are rarely preyed upon by lions (Power and Compion 2009, p. 36), and predation does not threaten their populations. However, recent research shows that lion predation on elephants increases drastically during the dry season and drought years (Power and Compion 2009 p. 42-43; Loveridge et al. 2006, p. 528) and when the age structure of herds is altered by poaching (McComb et al. 2009, p. 3). Therefore, predation could be unnaturally exacerbated by droughts as a result of climate change and the removal of old matriarchs through poaching.

D. Inadequacy of Existing Regulatory Mechanisms

The trade in ivory presents the most immediate threat to elephant populations. Despite the numerous international and national laws and regulations in place to protect elephants and limit trade in their parts, populations remain in decline and therefore these regulations are clearly inadequate. This is made most evident by the high and ever increasing poaching rates recorded throughout Africa, spreading to even those elephant populations previously well protected, and by the lack of indication for any decrease in demand for ivory products by the world's top importers. This is due in part to lack of enforcement but also to exemptions that create loopholes in the wildlife trade and confusion among the public as to what ivory is and isn't legal. Additionally, debate on whether or not to open the trade or close it fully remains between regions of Africa, with southern nations generally arguing for open trade to control their local elephant population growth while most other countries fight to keep their borders secure and their elephants out of the market. Clearly, a combination of open and closed trade is not working, since ivory trafficking has exploded since some countries were allowed to sell some of their ivory stocks in the late 90s and early 2000s. An agreement among elephant range states to work together to close the market for ivory and reduce demand as well as enforcement support from international states with active ivory markets is urgently needed to save elephants from extinction.

Below we present current international and U.S. laws that provide protections for elephants as well as the limitations of these provisions.

1. CITES

a. Appendices

The Convention on International Trade in Endangered Species of Flora and Fauna (CITES) is a trade agreement designed to ensure that international trade in animals and plants does not threaten their survival. The Convention recognizes that "wild fauna and flora in their many beautiful and varied forms are an irreplaceable part of the natural systems of the earth which must be protected for this and the generations to come." CITES, preamble (March 3, 1973).

Wildlife and plants are protected under CITES by being placed on one of three appendices. Currently, all elephant populations in Africa except for those in Botswana, Namibia, South Africa, and Zimbabwe, are listed as Appendix I species. Botswana, Namibia, South Africa, and Zimbabwe's elephants are listed in Appendix II.

Appendix I species are those species that are "threatened with extinction which are or may be affected by trade. Trade in specimens of these species must be subject to particularly strict regulation in order not to endanger further their survival and must only be authorized in exceptional circumstances" CITES, Art. II para. 1.

Export and import permits are required for Appendix I species. For export permits the following are required:

(a) a Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species;

(b) a Management Authority of the State of export is satisfied that the specimen was not obtained in contravention of the laws of that State for the protection of fauna and flora;

(c) a Management Authority of the State of export is satisfied that any living specimen will be so prepared and shipped as to minimize the risk of injury, damage to health or cruel treatment; and

(d) a Management Authority of the State of export is satisfied that an import permit has been granted for the specimen.

CITES, Art. III, para. 2. For an import permit, either an export permit or a re-export permit is required as well as the following:

(a) a Scientific Authority of the State of import has advised that the import will be for purposes which are not detrimental to the survival of the species involved;

(b) a Scientific Authority of the State of import is satisfied that the proposed recipient of a living specimen is suitably equipped to house and care for it; and

(c) a Management Authority of the State of import is satisfied that the specimen is not to be used for primarily commercial purposes.

CITES, Art. III, para. 3. To obtain a re-export certificate for an Appendix I species, the following requirements must be met:

(a) a Management Authority of the State of re-export is satisfied that the specimen was imported into that State in accordance with the provisions of the present Convention;

(b) a Management Authority of the State of re-export is satisfied that any living specimen will be so prepared and shipped as to minimize the risk of injury, damage to health or cruel treatment; and

(c) a Management Authority of the State of re-export is satisfied that an import permit has been granted for any living specimen.

Appendix II includes (a) “all species which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival”; and (b) “other species which must be subject to regulation in order that trade in specimens of certain species referred to in sub-

paragraph (a) of this paragraph may be brought under effective control" CITES, Art. II para. 2(a)-(b).

CITES, Art. III, para. 4. Appendix II species are subject to more lax requirements than Appendix I species. Only an export permit (or re-export permit) and monitoring is required for trade in Appendix II species. CITES, Art. IV para. 2-3. An export permit for an Appendix II species is subject to the same requirements as for Appendix I species except that an import permit is not required. CITES, Art. IV para. 2.

Botswana, Namibia, South Africa, and Zimbabwe elephant population are listed in Appendix II for the exclusive purpose of allowing trade in: hunting trophies for non-commercial purposes; live animals to appropriate and acceptable destinations, as defined in Resolution Conf. 11.20, for Botswana and Zimbabwe and for *in situ* conservation programs for Namibia and South Africa; hides; hair; leather goods for commercial or non-commercial purposes for Botswana, Namibia and South Africa and for non-commercial purposes for Zimbabwe; individually marked and certified ekipas incorporated in finished jewelry for non-commercial purposes for Namibia and ivory carvings for non-commercial purposes for Zimbabwe; and trade in registered raw ivory (for Botswana, Namibia, South Africa and Zimbabwe, whole tusks and pieces) subject to the following:

i) only registered government-owned stocks, originating in the State (excluding seized ivory and ivory of unknown origin);

ii) only to trading partners that have been verified by the Secretariat, in consultation with the Standing Committee, to have sufficient national legislation and domestic trade controls to ensure that the imported ivory will not be re-exported and will be managed in accordance with all requirements of Resolution Conf. 10.10 (Rev. CoP16) concerning domestic manufacturing and trade;

iii) not before the Secretariat has verified the prospective importing countries and the registered government-owned stocks;

iv) raw ivory pursuant to the conditional sale of registered government-owned ivory stocks agreed at CoP12, which are 20,000 kg (Botswana), 10,000 kg (Namibia) and 30,000 kg (South Africa);

v) in addition to the quantities agreed at CoP12, government-owned ivory from Botswana, Namibia, South Africa and Zimbabwe registered by 31 January 2007 and verified by the Secretariat may be traded and despatched, with the ivory in paragraph g)

iv) above, in a single sale per destination under strict supervision of the Secretariat;

vi) the proceeds of the trade are used exclusively for elephant conservation and community conservation and development programmes within or adjacent to the elephant range; and

vii) the additional quantities specified in paragraph g) v) above shall be traded only after the Standing Committee has agreed that the above conditions have been met; and

Split listing African elephants creates enforcement problems in trade regulations (Jenkins 2002, p. 8). Split listing makes it difficult to ensure that products entering international trade only come from Appendix II sources (Ibid.), and measures are required to ensure that this trade does not create an avenue or demand for Appendix I species products to enter the market (Ibid.). Indeed, allowing a more lenient trade of elephant parts from southern nations is putting forest and savannah elephant populations currently experiencing intensive poaching at higher risk (Blake et al. 2007, p. 946).

b. Permit Exemptions

CITES also contains several exemptions from its trade permit requirements. Those relevant to the conservation of African elephants include the following:

Pre-Convention: For "specimens" "acquired before the provisions of the present Convention applied to that specimen," the import and/or export permit requirements for that species do not apply so long as the Management Authority issues a certificate that the specimen is Pre-Convention. CITES, Art. VII para. 2; see also 50 C.F.R. § 23.5 (defining Pre-Convention); 50 C.F.R. § 23.45 (*); 50 C.F.R. § 23.15(f) (discussing Pre-Convention ivory).

Personal or Household Effects: Import and/or export permits are not required for personal or house hold effects. These specimens are exempt except for where:

(a) in the case of specimens of a species included in Appendix I, they were acquired by the owner outside his State of usual residence, and are being imported into that State; or

(b) in the case of specimens of species included in Appendix II:

(i) they were acquired by the owner outside his State of usual residence and in a State where removal from the wild occurred;

(ii) they are being imported into the owner's State of usual residence; and

(iii) the State where removal from the wild occurred requires the prior grant of export permits before any export of such specimens; unless a Management Authority is satisfied that the specimens were acquired before the provisions of the present Convention applied to such specimens.

CITES, Art. VII para. 3.

Non-Commercial Loans: The non-commercial loan, donation, or exchange "of herbarium specimens, other preserved, dried or embedded museum specimens, and live plant material which carry a label" between registered scientists or scientific institutions does not require import and/or export permits. CITES, Art. VII para. 6.

To sum up, CITES trade regulations for ivory has several limitations. (1) It only applies to international trade. The connection between domestic ivory markets and illegal killing has been explicitly linked (Doak 2014; Milliken et al. 2006; Vigne and Martin 2014), and therefore CITES does not provide adequate regulatory mechanisms here. (2) Hunting trophies are almost always exempt, as long as the elephant range country has an export quota that has not been met. This allows for the export, import, and re-export of elephant products, whereby ivory can easily make its way to market (IFAW 2014). Problems with trophy hunting are further explained in the next section. (3) It only applies to ivory acquired after the elephants were listed in 1989. Because it is impossible to tell how old an ivory item is with dating it, which is expensive and largely unavailable to the public, this creates a loophole that allows illegal ivory to continue circulating (Uno et al. 2013, p. 11740). And (4) exceptions are granted for non-commercial purposes, such as for scientific or educational purposes (museum artifacts, etc.). This exemption, absent of domestic regulation in the importing country, does nothing to prevent an item from being sold once imported.

c. Terms Defined by CITES Resolutions and the U.S. Fish and Wildlife Service

Several of the terms or criteria used to issue import or export permits have been further defined by resolution at various Conventions of the Parties and by FWS. We draw attention to two of them to highlight the inadequacy of their implementation.

Detrimental to the Survival of the Species: FWS's CITES regulations explain "Detrimental activities, depending on the species, could include, among other things, unsustainable use and any activities that would pose a net harm to the status of the species in the wild. For Appendix-I species, it also includes use or removal from the wild that results in habitat loss or destruction, interference with recovery efforts for a species, or stimulation of further trade." 50 C.F.R. § 23.61(b).

Not Primarily for a Commercial Purpose: CITES and FWS's implementation of the convention recognize that "[t]rade in Appendix-I species must be subject to particularly strict regulation and authorized only in exceptional circumstances." 50 C.F.R. § 23.62(a); Resolution Conf. 5.10 (Rev. CoP15), para. 1. The resolution recognizes that an "activity can generally be described as 'commercial' if its purpose is to obtain economic benefit (whether in cash or otherwise), and is directed toward resale, exchange, provision of a service or any other form of economic use or benefit." Resolution Conf. 5.10 (Rev. CoP15), para. 2.

The clear protective intent behind these definitions is often lacking in their actual implementation. This is apparent in the case of import/export permits for hunting trophies. Selier et al. (2014) found that the current hunting quotas for the Greater Mapungubwe Transfrontier Conservation Area (GMTFCA), which includes parts of Zimbabwe, Botswana, and South Africa, were unsustainable (p. 129). Because trophy hunting targets large males (Ginsberg and Milner-Gulland 1994, Milner et al. 2007, in Selier et al. 2014, p. 129), similar to poaching, selective pressures cause skewed sex ratios that at a certain threshold reduces the fecundity of a population and negatively alters the behaviors of younger herds, increasing risk-prone behaviors and human-elephant conflict (Selier et al. 2014, p. 129-130). Plus, despite being a highly migratory

species, elephant quotas almost never collaborate with neighboring countries or consider additive impacts to their populations due to land-use changes (Selier et al. 2014, p. 130). Besides having a direct impact on population levels, trophy hunting does nothing to reduce human-elephant conflict (Selier et al. 2014, p. 130) and is contradictory to conservation efforts. Justifying trophy hunting by its large price tag only further encourages the commercialization of imperiled species, which is exactly what makes elephants imperiled in the first place. Additionally, when wildlife is viewed as a commodity only available to a wealthy few, then the animals are tied only to their market value while ecological conservation objectives for the species are ignored (Geist 1988, p. 18).

As for other products such as personal or pre-convention items, management authorities have incredible leeway in determining which items are "not for commercial purpose", and CITES regulations have very little ability to control what happens to an item once it enters a country. Using the import of raw ivory from sport-hunted trophies again as an example, tusks are considered non-commercial based on the agreement that hunters are not to sell their trophies when returning home with them. Investigations and common sense tells us that eventually many of these trophies will end up for sale on the internet or at an auction, without proper documentation (IFAW 2014, p. 1; Stiles 2015, p. 15; Fears 2014, Washington Post 10/17/14).

d. Elephant Specific Resolutions

i. The Elephant Trade Information System (ETIS) and Monitoring the Illegal Killing of Elephants (MIKE)

The ETIS and MIKE programs are implemented by CITES to monitor the illegal trade in ivory and make recommendations based on their findings, as described earlier in this petition. The CoP stated itself in its 16th Resolution that:

> As presently implemented, CITES mechanisms and strategies, for example compliance with the requirements for internal trade in ivory articulated in Resolution Conf. 10.10 (Rev. CoP14) and the action plan for the control of trade in African elephant ivory of Decision 13.26, are failing to produce positive results. CoP16 Doc. 53.2.2 (Rev. 1) – p. 27

ii. Resolution Conf. 10.10

Resolution Conf. 10.10 (Rev. CoP12) on Trade in Elephant Specimens was adopted to address the undeniable link between domestic ivory markets and the illegal killing of elephants (Martin and Stiles 2000, Milliken et al. 2002, Courouble et al. 2003, in Milliken et al. 2006, p. 2). This resolution recommends Parties place comprehensive internal legislative, regulatory, enforcement and other measures to, among other recommendations:

1. register or license all importers, exporters, manufacturers, wholesalers and retailers dealing in raw or worked ivory;

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

    i) compulsory trade controls over raw ivory; and

    ii) comprehensive and demonstrably effective stock inventory, reporting, and enforcement systems for worked ivory;

3. and maintain an inventory of government-held stockpiles of ivory

Few elephant range states and countries with legal ivory markets have moved to implement these recommendations, including the United States (CoP16 Doc. 52.). Lack of documentation for legal ivory stocks makes it impossible to track possible illegal sales. The United States has no record of how much ivory was in the country before the ban in 1989, and it is inherently difficult to complete such a record now (Allgood et al. 2013, p. 70).

CITES regulations as currently adopted and implemented are failing to protect elephant populations as demonstrated by their widespread decline due to the trade in their parts.

2. U.S. Laws

a. Endangered Species Act

The ESA is the most comprehensive legislation for the preservation of threatened and endangered species ever enacted by any nation. Its fundamental purposes are "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved [and] to provide a program for the conservation of such endangered species and threatened species . . . ." 16 U.S.C. § 1531(b). The term "conserve" means "the use of all methods and procedures which are necessary to bring any endangered or threatened species to the point where the measures provided pursuant to this chapter are no longer necessary." 16 U.S.C. § 1532(3). Foreign listed species do not receive recovery plans and their critical habitat is not designated.

Species may be listed as "threatened" or "endangered". A "threatened species" is one that is "likely to become an endangered species within the foreseeable future through all or a significant portion of its range." 16 U.S.C. § 1532(20). An "endangered species" is one that is "in danger of extinction throughout all or a significant portion of its range." Id. § 1532(6). Currently, African elephants are listed as threatened under the old classification scheme in which there was only one species (*Loxodonta africana*) (47 Fed. Reg. 31384).

For threatened species, under Section 4(d) the ESA provides:

> Whenever any species is listed as a threatened species pursuant to subsection (c) of this section, the Secretary shall issue such regulations as he deems necessary and advisable to provide for the conservation of such species. The Secretary may by regulation prohibit

> with respect to any threatened species any act prohibited under section 1538 (a)(1) of this title, in the case of fish or wildlife,

16 U.S.C. § 1533(d). In other words, the Service has to issue regulations to conserve threatened species and may issue regulations that extend the prohibitions in Section 9 (or section 1538) to the species. The 4(d) rule for African elephants prohibits the import and export of elephants and their parts with exceptions. Those exceptions are: raw or worked ivory if it is (1) a bona fide antique of greater than 100 years of age on the day of import, or (2) was exported from the United States after being registered with the FWS; worked ivory for export in accordance with the permit requirements of 50 CFR parts 13 and 23; and sport hunting trophies, provided that:

> (A) The trophy originates in a country for which the Service has received notice of that country's African elephant ivory quota for the year of export;
>
> (B) All of the permit requirements of 50 CFR parts 13 and 23 have been complied with;
>
> (C) A determination is made that the killing of the animal whose trophy is intended for import would enhance survival of the species; and
>
> (D) The trophy is legibly marked by means of punch-dies, under a marking and registration system established by the country of origin, that includes the following information: Country of origin represented by the two-letter code established by the International Organization for Standardization (see appendix A to chapter I) followed by the registration number assigned to the last two digits of the year of registration and the weight of raw ivory to the nearest kilogram. Any mark must be placed on the lip mark area and indicated by a flash of color which serves as a background for such mark.

50 C.F.R § 17.40(e).

b. African Elephant Conservation Act

The purpose of the African Elephant Conservation Act is to "perpetuate healthy populations of African elephants." 16 U.S.C. § 4201. In passing the Act, Congress found (among other things) that: "[t]he United States, as a party to CITES and a large market for worked ivory, shares responsibility for supporting and implementing measures to stop the illegal trade in African elephant ivory and to provide for the conservation of the African elephant." 16 U.S.C. § 4202(8).

The Act prohibits:

> Except as provided in section 4222 (e) of this title [pertaining to sport hunted trophies], it is unlawful for any person—
> (1) to import raw ivory from any country other than an ivory producing country;
> (2) to export raw ivory from the United States;
> (3) to import raw or worked ivory that was exported from an ivory producing country in violation of that country's laws or of the CITES Ivory Control System;

(4) to import worked ivory, other than personal effects, from any country unless that country has certified that such ivory was derived from legal sources; or
(5) to import raw or worked ivory from a country for which a moratorium is in effect under section 4222 of this title.

16 U.S.C. § 4223. By distinguishing "raw" vs. "worked" ivory this statute has failed to prevent the United States becoming the second largest importer of worked ivory, a status that likely contributes to elephant poaching in Africa (Allgood et al. 2013, p. 42).

c. Lacey Act

The Lacey Act provides the backbone to other FWS implemented rules on foreign species. It does this in three ways: (1) it makes it a federal offense to violate U.S., state, tribal, or foreign wildlife trade statutes, treaties, and regulations; (2) it imposes labeling requirements for shipments and makes it a crime to violate these requirements; and (3) it prohibits the falsification of information, records, or accounts regarding species that have been imported, exported, transported, sold, purchased, or received in interstate or foreign commerce (Stiles 2014, p. 3).

d. Director's Order No. 210

In accordance with the National Strategy for Combating Wildlife Trafficking (2014), FWS issued Director's Order (No. 210) to strengthen regulations for ivory imports and exports. This order included strong limits on the importation of ivory including shifting the burden of proving that an ivory exemption is applicable on the importer, exporter, or seller, rather than the agency, but loopholes remain for the illegal market. The rules are outlined below with the revisions. The Director's Order:

1. Shifted the burden of proving that an ivory exemption is applicable on the importer, exporter, or seller, rather than the agency;
2. Enforced the June 9, 1989 African Elephant Conservation Act moratorium such that the only exceptions made for ivory imports are:
    a. Raw or worked African elephant ivory imported by an employee or agent of a Federal, State, or tribal government agency for law enforcement purposes.
    b. Raw or worked African elephant ivory imported for genuine scientific purposes that will contribute to conservation of the species.
    c. Worked African elephant ivory imported for personal use as part of a household move or as part of an inheritance, provided that the worked elephant ivory:
        i. Was legally acquired prior to February 26, 1976;
        ii. Has not subsequently been transferred from one person to another person for financial gain or profit since ~~February 26, 1976~~ February 25, 2014; and
        iii. The item is accompanied by a valid Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) pre-Convention certificate.
    d. Worked African elephant ivory imported as part of a musical instrument, provided that the worked elephant ivory:
        i. Was legally acquired prior to February 26, 1976;

ii. Has not subsequently been transferred from one person to another person for financial gain or profit since ~~February 26, 1976~~ February 25, 2014;
iii. The person or group qualifies for a CITES musical instrument certificate; and
iv. The musical instrument containing elephant ivory is accompanied by a valid CITES musical instrument certificate or an equivalent CITES document that meets all of the requirements of CITES Resolution Conf. 16.8.

e. Worked African elephant ivory imported as part of a travelling exhibition, provided that the worked elephant ivory:
i. Was legally acquired prior to February 26, 1976;
ii. Has not subsequently been transferred from one person to another person for financial gain or profit since ~~February 26, 1976~~ February 25, 2014;
iii. The person or group qualifies for a CITES travelling exhibition certificate; and
iv. The item containing elephant ivory is accompanied by a valid CITES travelling exhibition certificate or an equivalent CITES document that meets the requirements of 50 CFR 23.49.

The United States had the second largest ivory market in the world behind China as of 2008 (Stiles and Martin 2008, p. 5), possibly only surpassed now by Thailand. The exceptions made for ivory imports and exports under the 4(d) rule for African elephants, the African Elephant Conservation Act, and the Executive Order have left crucial loopholes open, allowing for the illegal market for ivory to persist in the United States.

Because few countries have a registration system in place to document their legal ivory stocks, prior to the Director's Order, antique items have been easily granted CITES and USFWS permits. Additionally, there are few enforcement mechanisms in place to stop household items and sport hunted trophies from being sold once imported (Fears 2014, Washington Post 10/17/14). This was found to be the likely case in California, where the United States' second largest market for ivory occurs, with over 100 vendors. In Los Angeles, between 47 and 60 percent of the ivory openly for sale in markets was likely illegal according to federal law (Stiles 2014, p. 15). In San Francisco, a likely 52 percent of ivory sold was illegal under federal law (Ibid.). In general, antique faking was found to be common (Ibid.). The incidence of illegal ivory in the state has risen from about 25 percent in 2006 to about half in 2014, following the global trend in an increase of domestic, illegally manufactured ivory (Ibid.). Stiles also highlighted confusion among ivory vendors as an issue in California (p. 16).

The United States, under the ESA, has a responsibility to ensure that its activities do not harm the survival of the species. In the past, FWS has concluded that funds from trophy hunting supported the conservation of the species, but there is very little information on if this funding overrules the consequences of allowing an imperiled species to be considered a commodity by the international community. And, in the case of elephants, tourism revenues dwarf trophy hunting revenues Namibia, Botswana, and South Africa. The only country in southern Africa still boasting high elephant numbers that truly relies on these revenues is Zimbabwe (Selier et al. 2014, p. 123), and FWS suspended imports of sport-hunted elephant trophies from there last year

due to poaching and the inability to make a "not detrimental to the species" finding under CITES's guidelines (USFWS April 4, 2014 press release). Plus, there have been a number of cases where sport hunted trophies are sold to buyers that take the ivory to illegal markets in Asia or to markets within the United States (Fears 2014, Washington Post 10/17/14). There are ethical dilemmas with allowing one to pay to hunt an animal, and not allowing one to pay to buy the animal product. With current levels of ivory trade, we must exterminate the notion that African elephants can be sold.

Finally, despite the positive direction the United States is taking with ivory regulations, the agency is unable to properly enforce them due to being highly understaffed and overworked. The Washington Post (Fears, 10/17/14) recently brought attention to this issue. Fewer than 330 Fish and Wildlife inspectors and agents are in charge of monitoring the largest ports in the United States. This is the same number of agents as 30 years ago, despite the rampant increase in wildlife trade, becoming one of the highest valued black market trades, worth an estimated $20 billion per year, behind only drugs, guns, and human trafficking. The Wildlife Conservation Society estimates that up to 30 percent of wildlife products imported to the United States are illegal.

E. Other Factors

The conservation of African elephants is complex, and its success depends on a number of confounding social, political, and economic factors. Forest and savannah elephants are equally susceptible to the impacts of war, political instability, and socio-economic factors, as indicated by measured population declines as a result of these factors in every region. However, ongoing political conflicts in West and Central Africa is especially driving the decline in forest elephants and certain savannah elephant populations, and spreading conflict in northeastern Africa threatens savannah elephant populations in that region as well. Economic instability impacts savannah elephant populations in parts of east and southern Africa, as seen in Angola, Mozambique, and Kenya. Corruption still threatens most elephant populations even if conflict is not presently occurring.

1. War and Political Instability

It is well documented that war and other forms of civil conflict and political instability have a negative impact on not only humans, but wildlife as well, especially in Africa (Dudley et al. 2002, Hanson et al. 2009, in Chase and Griffin 2011, p. 353), and especially for large species (Shambaugh et al. 2001, in Douglas and Alie 2014, p. 271). Elephants have suffered as a result of a number of civil conflicts in Africa, and are threatened by political instability leading to future conflicts (Abmoya 2004, in Blake et al. 2007, p. 951; Lee and Graham 2006, p. 17; Beyers et al. 2011, p. 1; White 2014, p. 173; Chase and Griffin 2009, p. 224; Chase and Griffin 2011, p. 354).

Elephants may be harmed as a result of civil conflict through a number of ways. Displaced people may seek refuge in remote areas, reducing habitat for elephants, while wildlife products such as ivory are sold for food, arms, and ammunition (Plumptre et al. 1997, Dudley et al. 2002, Milliken, Pole & Huongo 2006, Muir 2006, in Chase and Griffin 2011, p. 354). Militias

themselves also often rely on easily extractable natural resources to fund their activities (Beyers et al. 2011, p. 1). Elephant casualties may also occur as a direct result of war activities, such as the accidental set off of landmines (Agostinho 2004, in Chase and Griffin 2011, p. 359). All of this occurs while wildlife conservation efforts and the maintenance of national parks and other protected areas collapse (Beyers et al. 2011, p. 1).

Unfortunately, many regions of Africa have been plagued with civil unrest for the last 50 years, (Draulans and Krunkelsven 2002; Beyers et al. 2011, p. 6), and elephant populations have declined as a consequence (Lee and Graham 2006, p. 17). Twenty African states have experienced civil war since 1960 (Draulans and Krunkelsven 2002, in Lee and Graham 2006, p. 17). The Fund for Peace ranks each country by their vitality and stability. Similarly, Transparency International ranks each nation by its level of corruption. African nations, many of which contain elephants, make up the majority of the world's most fragile and corrupt states. Additionally, at least half of Africa's high conflict zones negatively impact two-thirds of remaining forested lands (Beyers et al. 2011, p. 6).

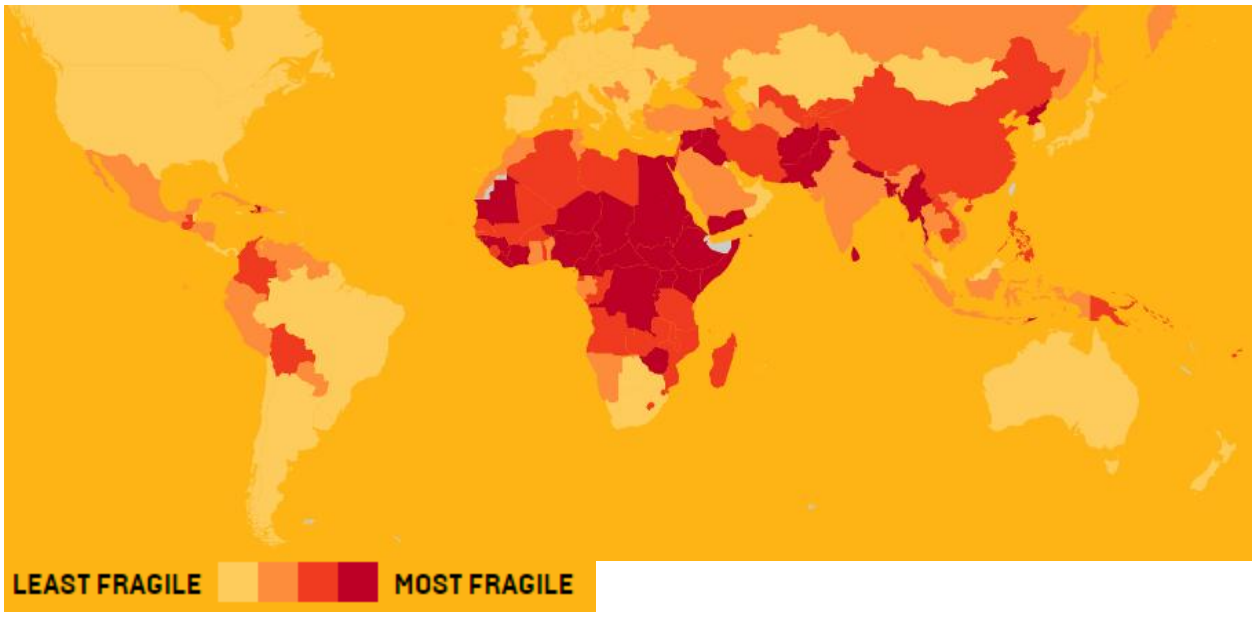


Figure 32: Map of the Fragile States Index (Fund for Peace 2013)

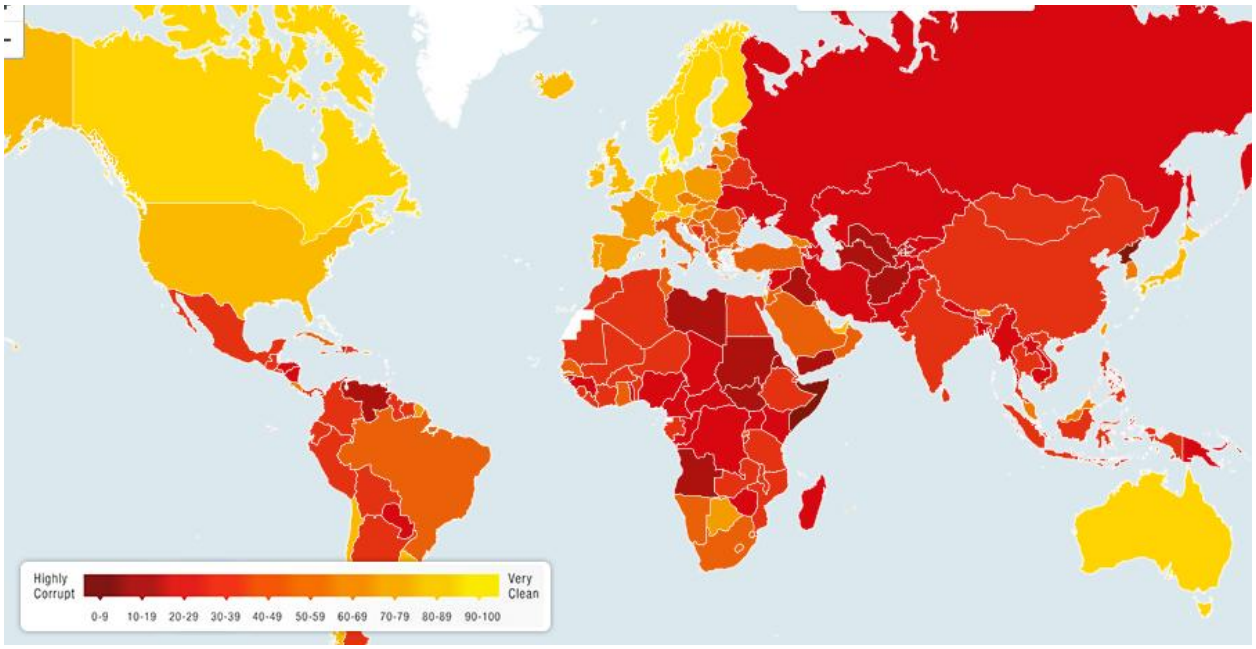


Figure 33: Corruption Perceptions Index 2014 map (Transparency International 2014)

Central Africa has a long history of conflict and turmoil with deeply-rooted and complex issues with governance, institutions, an abundance of natural resources, the spread of tropical diseases, and uncontrollable borders (Flint 2009, ICG 2010, Taylor 2003, in White 2014, p. 176). The DRC, Chad, CAR, Sudan, and South Sudan in particular form what is referred to as a "regional conflict complex" (Pugh and Cooper 2004, p. 2). During the civil war in the DRC from 1995 to 2006, all elephant populations declined (Beyers et al. 2011, p. 1). The Okapi Faunal Reserve (RFO) held one of the largest remaining forest elephant populations in the DRC before the war, and at least half were lost during it (Beyers et al. 2011, p. 6). At least 23 tons of ivory were taken out of the reserve. Assuming that one elephant carries an average of 6.9 kilograms of ivory, this equates to 3,434 dead elephants (Ibid.). In the lowland forest of the Kahuzi-Biega, rebel factions associated with the genocide in Rwanda took over, and park authorities quickly lost control of the area and were killed (Beyers et al. 2011, p. 7). The elephant population there was wiped out completely, with no signs of elephant even ten years later (Hart, J et al. Inventory and Monitoring report No 7, Nov 2007, Wildlife Conservation Society, DRC, in Beyers et al. 2011, p. 7). In Garamba, 80,000 refugees and the establishment of the Sudan People's Liberation Army (SPLA) from the civil war in Sudan had already displaced the elephant population starting in 1991, with many surviving off bushmeat and ivory sales (Beyers et al. 2011, p. 7; Lee and Graham 2006, p. 17). Some of the bloodiest fighting in recent decades was seen in Ituri National Forest in eastern DRC, and an estimated 17,000 kilograms of ivory was removed from the park in just six months. Using 6.9 kilograms of ivory per elephant again, this equates to a slaughter of over 2,400 elephants within a 25,000 square kilometer forest block (Abmoya 2004, in Blake et al. 2007, p. 951).

The direct impact of conflict on elephants was easily witnessed in Southern Africa as well. During Angola's 27-year intermittent civil war, over four million people were displaced, and 100,000 elephants were exterminated in rebel-controlled territories (Sogge 1992, Anstey 1993, Cock and Mckenzie 1998, Breytenbach 2001, in Chase and Griffin 2011, p. 354). The rebel

army, UNITA, sold elephant ivory and rhino horn to pay for arms and used the animals' meat to feed its soldiers (Kumleben Commission 1996, Breytenbach 2001, in Chase and Griffin 2011, p. 354). Elephants in the Caprivi Strip bordering Angola suffered as well, with numerous carcasses discovered in the early 1990s (Rodwell, Tagg, and Grobler 1994, in Chase and Griffin 2011, p. 358).

Elephants in Central Africa versus other regions are likely most at risk of extinction due to civil conflict. Active rebel groups remain a threat in these countries, such as the Lord's Resistance Army (LRA) and the Darfurian militia group, Janjaweed, who have been documented poaching elephants for subsistence and funding (UN 2013, in White 2014, p. 173), and the Democratic Forces for the Liberation of Rwanda (FDLR), March 23 Movement (M23), and Allied Democratic Forces (ADF) (ACLED 2014) who may be involved in such activities. CAR has also seen surging violence in recent years which has forced tens of thousands to flee their homes (BBC 2015, Country profiles: Central African Republic).

Elephants in other regions are just as vulnerable to any threats that may arise in the future. Insurgent groups spilling over from Somalia have wreaked havoc in Kenya, and Angola remains highly corrupt, just to name a couple examples. "Ivory funds terrorism" has been a popular mantra among politicians and conservationists, and it is true that the persistence of terrorist groups and conflict leads to elephant poaching and vice versa. Additionally, the impacts of conflict persist long after the war ends; institutional changes, changes in human settlement and the proliferation of weapons continue to threaten elephants in and around regions of past conflict (Beyers et al. 2011, p. 9).

The breakdown in political and institutional governance that occurs during and after civil conflict threatens the survival of all African elephants, as documented in the last 30 years (Lee and Graham 2006, p. 17). In the context of wars, debates over consumptive utilization, land-use planning, and the ivory trade can become almost meaningless, and years of conservation investment are rendered largely worthless (Ibid.).

2. Other Socio-Economic Factors

The MIKE program has found statistically significant relationships among various ecological, biophysical, and socio-economic factors at the site, national, and global levels. Poverty at the site level, governance at the national level, and demand for illegal ivory at the global level are consistently strong predictors of poaching levels and trends, and the relationships between these factors and PIKE data can be demonstrated by using human-infant mortality as an indicator of local poverty, the Corruption Perceptions Index for national governance (which is discussed further in the section above), and ETIS data for global demand. These relationships show that elephant conservation in the context of preventing poaching is highly congruent with socio-economic statuses at the local, national, and global levels.

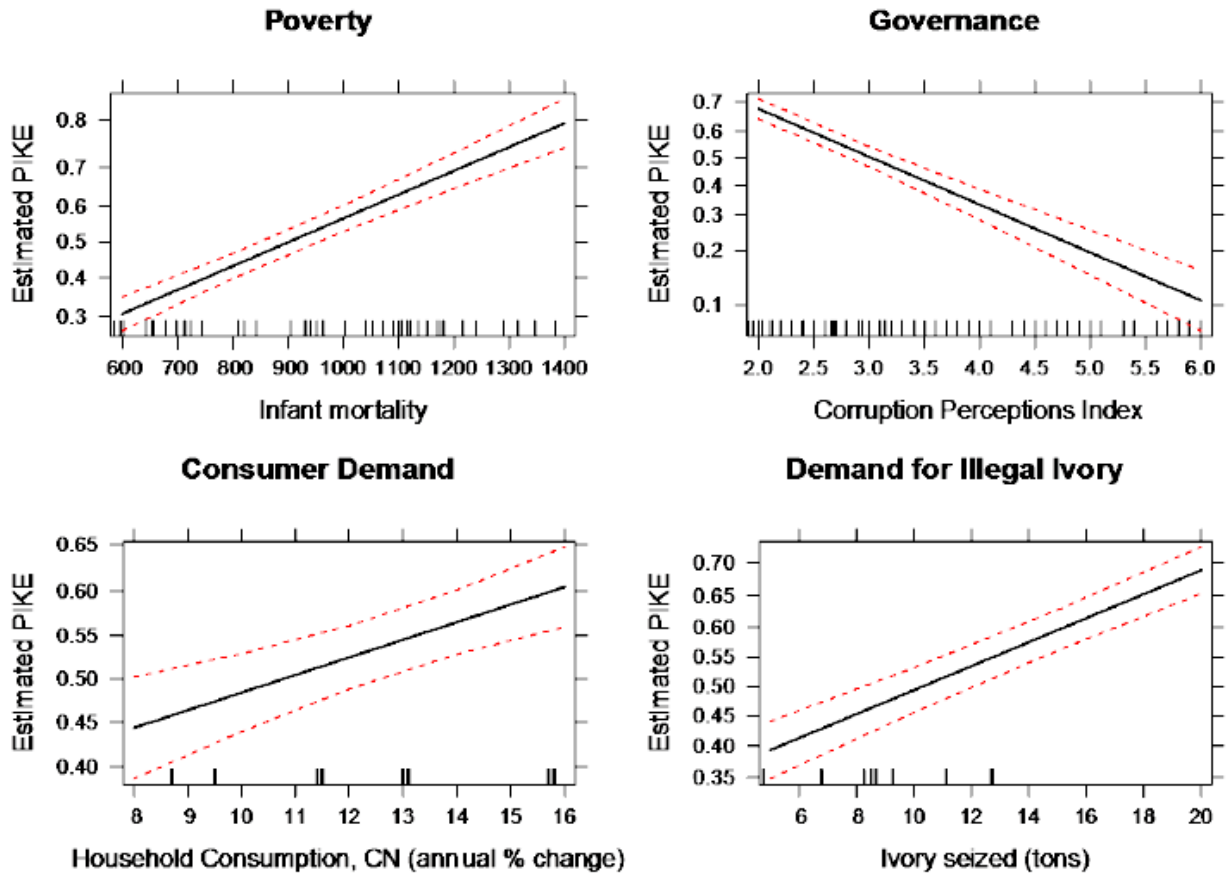


Figure 34: Relationships between PIKE and poverty, governance and demand covariates. For each graph, all other covariates are held constant at their means. Dotted lines represent confidence bands (AfESG 2013, p. 8, Fig. 5).

At the local level, elephant conservation in a broader sense goes hand in hand with the economic and educational states of their residing country (Boer et al. 2012, p. 475). Major political and economic transitions drive land-use changes and the attitudes people have toward conservation (Kuhl et al. 2009, in Wittemyer 2011, p. 2). Ecological variables such as rainfall used to be the primary factors in predicting the spatial distribution of elephants, but now country-specific characteristics have become more important in influencing elephant densities (Boer et al. 2012, p. 475). In a continental-wide study on elephant densities, Boer et al. (2012) found that the most significant of these country-specific factors were literacy rates, Gross Domestic Product (GDP), and corruption, with high elephant densities strongly correlated with increasing literacy rates and GDP, and low densities correlated with high levels of corruption (p. 475). It is generally understood that education increases local conservation behavior (Vanclay 2001, Kideghesho et al. 2007, in Boer et al. 2012, p. 475), and the direct impacts of a country's GDP can be seen on a smaller scale using the rise and fall of price for cattle (Wittemyer 2011, p. 2).

Economics and education as drivers of elephant population decline may be especially evident on smaller, local scales, and should be considered in management decisions. In pastoral communities, Wittemyer (2011) found that adult elephant mortality was closely related to the local economic conditions (p. 2). When faced with economic hardship, a local decline in wildlife

abundance or an increased take of wild species is likely (Ibid.). The effectiveness of conservation policies likely improve with alleviated poverty and improved education (Adams et al. 2004, Burn et al. 2011, Sachs and Reid 2006, in Boer et al. 2012, p. 476). Tourism plays a significant role in the maintenance of local economies, especially in eastern and southern countries boasting "the big five". Poaching, conflict, and disease outbreaks have negative impacts on the tourism industry, which in turn hurts local economies which creates a downward spiral in the maintenance of elephant populations (UNWTO 2014, p. 3). As indicated earlier by the rankings of countries by their fragility and levels of corruption, most elephant populations in Africa are or will likely be significantly impacted by current and future socio-economic factors.

3. Small Population Size

Small, isolated populations of elephants are subject to increased extinction risk from stochastic environmental, genetic, or demographic events (Brewer 1994, p. 616), and large-bodied mammals are generally more at risk due to their life history needs (Blake 2002, p. 267). Loss of genetic diversity can lead to inbreeding depression and an increased risk of extinction due to the loss of genetic viability and reduced population growth rate (Allendorf and Luikart 2007, p. 338–343). Elephants have suffered a significant loss in their absolute range and exist in fragmented populations throughout most of the continent – especially those in West and Central Africa. This puts them at a higher risk of localized extinction (Thomas et al. 2004, Thuiller et al. 2005b, in Thuiller et al. 2006, p. 434). A population of 2,000 elephants may be the smallest viable number in genetic terms necessary for its survival and that such a population needs at least 2,000 square kilometers of *good* habitat (Pitman, no date, in 56 Fed. Reg. 11392). Another study found almost 5,500 sexually mature elephants were needed to ensure the long term (40 generations) survival of a population (Reed et al. 2003, p. 32). Throughout the ranges of both the forest and savannah elephants, such viable populations are becoming increasingly rare and are likely to continue to decrease.

VII. CONCLUSION

According to the best available science, there is no question that two species of African elephants exist, forest (*Loxodonta cyclotis*) and savannah (*Loxodonta africana*), and that both warrant uplisting to Endangered under the ESA. Both species are imperiled by four of the five listing factors set out by the statute: habitat loss and degradation, overutilization, inadequacy of existing regulatory mechanisms, and other natural or manmade factors. Clearly, conservation efforts up until this point have not been effective in stopping the decline of elephants, and FWS must act promptly to provide the further protections for forest and savannah elephants that both species so desperately need.

REFERENCES

Abensperg-Traun, M. 2009. CITES, sustainable use of wild species and incentive-driven conservation in developing countries, with an emphasis on southern Africa. Biological Conservation 142:948–963.

Abmoya Apobo C. 2004. Rapport sur braconnage a l'e´ le´phant et sur la commerce de l'ivoire dans et a` la pe´riphe´rie de la Re´serve de Faune a Okapis (RFO), Ituri, DRC. Kinshasa (Democratic Republic of Congo): Institut Congolais pour la Conservation de la Nature. 33 p.

Adams, W.M., Aveling, R., Brockington, D., Dickson, B., Elliott, J., Hutton, J., Roe, D., Vira, B., Wolmer, W., 2004. Biodiversity conservation and the eradication of poverty. Science 306, 1146–1149.

AfESG. 2003. Statement on the taxonomy of extant Loxodonta, December 2003. IUCN. 2. Available: www.iucnredlist.org/documents/AfESGGeneticStatement.pdf. Accessed 2013 Feb 20

AfESG. 2012. 2013 Provisional African Elephant Status Report. Available at: http://www.elephantdatabase.org/preview_report/2013_africa/Loxodonta_africana/2012/Africa

Africa Renewal. Online. "Desertification a threat to Africa's development". Accessed June 2, 2015. Available: http://www.un.org/africarenewal/web-features/desertification-threat-africa%E2%80%99s-development

AFP. 2015. "Singapore just seized $6 million of illegal ivory" Business Insider, May 19, 2015. Accessed May 20, 2015. <http://www.businessinsider.com/afp-singapore-nets-biggest-ivory-seizure-in-decade-2015-5>

Agostinho, J. 2004. Personal communication in Chase and Griffin 2011. HALO Trust Angola. E-mail to Dr. John Hanks, March 2004.

Agrawal, A. 1997. Community in conservation: beyond enchantment and disenchantment. Conservation and Development Forum, Gainesville, Florida.

Ahlering, M. A., J. J. Millspaugh, R. J. Woods, D. Western, and L. S. Eggert. 2011. Elevated levels of stress hormones in crop-raiding male elephants. Animal Conservation 14:124–130.

Alers, M. P., A. Blom, C. Sikubwabo Kiyengo, T. Masunda, and R. Barnes. 1992. Preliminary assessment of the status of the forest elephants in Zaire. African Journal of Ecology 30:279-291.

All Africa. 2015." Mozambique: Police Seize Huge Haul of Ivory and Rhino Horns". May 14, 2015. Accessed May 20, 2015. <http://allafrica.com/stories/201505150081.html>

Allen, W.R. 2006. Ovulation, pregnancy, placentation and husbandry in the African elephant (*Loxodonta africana*). Phil. Trans. R. Soc. B. 361, 821–834

Allendorf, F.W., and G. Luikart. 2007. Conservation and the genetics of populations. Blackwell Publishing , Inc.

Allendorf, F. W., P. R. England, G. Luikart, P. A. Ritchie, and N. Ryman. 2008. Genetic effects of harvest on wild animal populations. Trends in Ecology and Evolution 23:327–337.

Allgood, B., M. Ratchford, and P. LaFontaine. 2013. U.S. Ivory Trade: Can a Crackdown on Trafficking Save the Last Titan? Animal Law. Vol. 20:27.

ANPN. 2013. Wildlife and poaching assessment in northeast Gabonpreliminary results. ANPN, WCS, WWF. 23. Available: http://awsassets.panda.org/downloads/preliminary_results_of_minkebe_pilot_study.pdf. Accessed 2013 Feb 20.

anonymous. 1994. Firing Line. Pages 3-10. The Weekly Review.

Anstey, S. 1993. Angola: Elephants, People and Conservation, a Preliminary Assessment of the Status and Conservation of Elephants in Angola. IUCN Regional Office for Southern Africa, Harare.

Barnes, R. F. W. 1999. Is there a future for elephants in West Africa. Mammal Review 29:175-199.

Barnes, R.F.W., Barnes, K.L., Alers, M.P.T. & Blom, A. 1991. Man determines the distribution of elephants in the rainforests in northeastern Gabon. Afr. J. Ecol. 29, 54–63.

Barnes, R. F. W., A. Blom, and M. P. T. Alers. 1995. A review of the status of forest elephants *Loxodonta africana* in central Africa. Biological Conservation 71:125- 132.

Barnes, R.F.W. 1996. The conflict between humans and elephants in the central African forests. Mammal Review, 26, 67-80.

Barnes, R. F. W., K. Beardsley, F. Michelmore, K. L. Barnes, M. Alers, and A. Blom. 1997. Estimating forest elephant numbers with dung counts and a geographic information system. Journal ofWildlife Management 61:1384–1393.

Bates LA, Handford R, Lee PC, Njiraini N, Poole JH, et al. 2010. Why Do African Elephants (*Loxodonta africana*) Simulate Oestrus? An Analysis of Longitudinal Data. PLoS ONE 5(4): e10052. doi:10.1371/journal.pone.0010052

Baxter, P.W.J. & Getz, W.M. (2005). A model-framed evaluation of elephant effects on tree and fire dynamics in African Savannas. Ecol. Appl. 15, 1131–1341.

BBC. 2015. Central African Republic profile – Overview. Country Profiles. Available at: http://www.bbc.com/news/world-africa-13150040

Bell, R. H. V. 1981. An outline of a management plan for Kasungu National Park, Malawi. Academic Press, New York, New York, USA.

Bell, R. H. V. 1984. The man-animal interface: An assessment of crop damage and wildlife control. Pages 387-416 in R. H. V. Bell and E. McShane-Caluzi, eds. Conservation and Wildlife Management in Africa. U.S. Peace Corps Office of Training and Program Support, Malawi.

Bennett, E.L. 2014. Legal Ivory Trade in a Corrupt World and its Impact on African Elephant Populations. Conservation Biology, Volume 00, No. 0, 1–7.

Beyers RL, Hart JA, Sinclair ARE, Grossmann F, Klinkenberg B, et al. 2011. Resource Wars and Conflict Ivory: The Impact of Civil Conflict on Elephants in the Democratic Republic of Congo - The Case of the Okapi Reserve. PLoS ONE 6(11): e27129. doi:10.1371/journal.pone.0027129

Blake, S. 2002. The Ecology of Forest Elephant Distribution and its Implications for Conservation. Ph.D. thesis. University of Edinburgh.

Blake, S. 2005. Long term system for monitoring the illegal killing of elephants (MIKE) – Central African Forests: Final Report on Population Surveys (2003-2004). March 2005.

Blake, S., Bouché´, P., Rasmussen, H., Orlando, A. and Douglas-Hamilton, I. 2003. Range Behaviour, Population Status and Recent History of Desert Elephants of Mali. Kenya: Save the Elephants.

Blake S, Strindberg S, Boudjan P, Makombo C, Bila-Isia I, et al. 2007. Forest elephant crisis in the Congo Basin. PLoS Biol 5(4): e111. doi:10.1371/journal.pbio.0050111

Blake S, Deem SL, Strindberg S, Maisels F, Momont L, et al. 2008. Roadless Wilderness Area Determines Forest Elephant Movements in the Congo Basin. PLoS ONE 3(10): e3546. doi:10.1371/journal.pone.0003546

Blake, S., S.L. Deem, E. Mossimbo, F. Maisels, and P. Walsh. 2009. Forest Elephants: Tree Planters of the Congo. Biotropica, 10.1111/j.1744-7429.2009.00512.x

Blanc, J. 2008. Loxodonta africana. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 30 January 2015.

Blanc, J.J., Barnes, R.F.W., Craig, G.C., Dublin, H.T., Thouless, C.R., Douglas-Hamilton, I. and Hart, J.A. 2007. African Elephant Status Report 2007: an update from the African Elephant Database. Occasional Paper Series of the IUCN Species Survival Commission, No. 33. IUCN/SSC African Elephant Specialist Group. IUCN, Gland, Switzerland. Vi + 276 pp.

Booth, V. and K.M. Dunham. 2014. Elephant poaching in Niassa Reserve, Mozambique: population impact revealed by combined survey trends for live elephants and carcasses. Oryx. doi:10.1017/S0030605314000568

Bouché´ P, Douglas-Hamilton I, Wittemyer G, Nianogo AJ, Doucet J-L, et al. 2011. Will Elephants Soon Disappear from West African Savannahs? PLoS ONE 6(6): e20619. doi:10.1371/journal.pone.0020619

Bouché, P., R.N.M. Mange, F. Tankalet, F. Zowoya, P. Lejeune, C. Vermeulen. 2012. Game over! Wildlife collapse in northern Central African Republic. Environ Monit Assess, 184:7001–7011

Bradshaw, G. A., A. N. Schore, J. L. Brown, J. H. Poole, and C. J. Moss. 2005. Elephant breakdown. Social trauma: early trauma and social disruption can affect the physiology, behaviour and culture of animals and humans over generations. Nature 433:807–807.

Brewer, R. 1994. The Science of Ecology, Second Edition. Saunders College Publishing, Orlando Florida, USA. 773 pp.

Breytenbach, J. 2001. The Plunderers. Covos Day Books, Johannesburg, South Africa.

Burn, R.W., Underwood, F.M., Blanc, J., 2011. Global trends and factors associated with the illegal killing of elephants: a hierarchical Bayesian analysis of carcass encounter data. Plos One 6, e24165.

Carroll, R. W. 1988. Elephants of the Dzangha-Sangha dense forests of south-western Central African Republic. Pachyderm 10:12-15.

Caulderwood, K. 2014. “Like Cocaine Minus the Risk, Rhino Horn Trade Explodes in Africa” International Business Times, April 9, 2014. Accessed May 13, 2015. < http://www.ibtimes.com/cocaine-minus-risk-rhino-horn-trade-explodes-africa-1569192>

CITES. 2014. Press Release: “Elephant poaching rates virtually unchanged in 2014”. Available: http://cites.org/eng/mike_figures2014

CITES, IUCN/SSC African Elephant Specialist Group, TRAFFIC International. 2013. Status of African elephant populations and levels of illegal killing and the illegal trade in ivory: A report to the African Elephant Summit, December 2013.

Chamaillé-Jammes, S., Valeix, M., Fritz, H., 2007. Managing heterogeneity in elephant distribution: interactions between elephant population density and surface-water availability. J. Appl. Ecol. 44, 625–633.

Chardonnet, Ph, & Boulet, H. 2008. Des éléphants dans la tourmente. République Centrafricaine, 2007. Bois et Forêts des Tropiques, 295, 91–96.

Chase, M.J. 2013. Status of wildlife populations and land degradation in Botswana's forest reserves and Chobe District. Published by Forest Conservation Botswana, Elephants Without Borders, and Zoological Society of San Diego.

Chase, M.J. and C.R. Griffin. 2009. Elephants caught in the middle: impacts of war, fences and people on elephant distribution and abundance in the Caprivi Strip, Namibia. African Journal of Ecology. 47:223-233.

Chase, M.J. and C.R. Griffin. 2011. Elephants of south-east Angola in war and peace: their decline, re-colonization and recent status. African Journal of Ecology. 49: 353-361.

Chiyo, P. I., E. P. Cochrane, L. Naughton, and G. I. Basuta. 2005. Temporal patterns of crop raiding by elephants: a response to changes in forage quality or crop availability? African Journal of Ecology 43:48–55.

Chiyo, P.I., J.W. Wilson, E.A. Archie, J.A. Hollister-Smith, P.C. Lee, J.H. Poole, C.J. Moss, and S.C. Alberts. 2011. Association patterns of African elephants in all-male groups: the role of age and genetic relatedness. Animal Behaviour. 81, 1093-1099

Chiyo, P.I., J.W. Wilson, E.A. Archie, P.C. Lee, C.J. Moss, and S.C. Alberts. 2014. The influence of forage, protected areas, and mating prospects on grouping patterns of male elephants. Behavioral Ecology, 25(6), 1494–1504. doi:10.1093/beheco/aru152

Christy, B. 2012. "Ivory Worship" National Geographic Magazine, October, 2012. Accessed May 13, 2015. < http://ngm.nationalgeographic.com/2012/10/ivory/christy-text>

Cobb S. 1976. The distribution and abundance of the large herbivore community of Tsavo National Park. PhD thesis. University of Oxford, Oxford.

Cock, J. and Mckenzie, P. 1998. From Defense to Development, Redirecting Military Resources in South Africa. The Group for Environmental Monitoring, Cape Town, South Africa.

Comstock, K.E., N. Georgiadis, J. Pecon-Slattery, A.L. Roca, E.A. Ostrander, S.J. O'Brien, and S.K. Wasser. 2002. Patterns of molecular genetic variation among African elephant populations. Molecular Ecology (2002) 11, 2489-2498

Connor, R. C., Smolker, R. A., & Richards, A. F. 1992. Two levels of alliance formation among male bottlenose dolphins (Tursiops sp.). Proceedings of the National Academy of Sciences of the USA, 89, 987–990.

Courouble, M., Hurst, F. and Milliken, T. (2003). More Ivory than Elephants: Domestic Ivory Markets in Three West African Countries. TRAFFIC Online Report Series No. 8. TRAFFIC International, Cambridge, UK.

Cushman, S.A., M. Chase, and C. Griffin. 2010. Mapping Landscape Resistance to Identify Corridors and Barriers for Elephant Movement in Southern Africa. Chapter 19. In S.A. Cushman and F. Huettmann (Ed.), Spatial Complexity, Informatics, and Wildlife Conservation, (pp. 349-367).

Danquah, E. and S.K. Oppong. 2014. Survey of Forest Elephants *Loxodonta cyclotis* (Matschie, 1900) (Mammalia: Proboscidea: Elephantidae) in the Bia Conservation Area, Ghana. Journal of Threatened Taxa 6(11): 6399–6405; http://dx.doi.org/10.11609/JoTT.o3722.6399-405

Dapash, M.O., 2002. Coexisting in Kenya: the human–elephant conflict. Anim. Welf.Inst. Q. 51 (1).

Dawson TP, Jackson ST, House JI, Prentice IC, Mace GM. 2011. Beyond Predictions: Biodiversity Conservation in a Changing Climate. Science: 332, 53.

de Boer, W.F., F. van Langevelde, H.H.T. Prins, P.C. de Ruiter, J. Blanc, M.J.P. Vis, K.J. Gaston, I. Douglas-Hamilton. 2013. Understanding spatial differences in African elephant densities and occurrence, a continent-wide analysis. Biological Conservation 159: 468-476.

de Merode E., Smith K.H., Homewood K., Pettifor R., Rowcliffe M., et al. 2007. The impact of armed conflict on protected-area efficacy in Central Africa. Biology Letters 3(3): 299–301.

Dell'Amore, C. 2014. "Beloved African Elephant Killed for Ivory—"Monumental" Loss" National Geographic, June 16, 2014. Accessed May 13, 2015. < http://news.nationalgeographic.com/news/2014/06/140616-elephants-tusker-satao-poachers-killed-animals-africa-science/>

Dickman, A.J., Macdonald, E.A. and Macdonald, D.W. 2011. A review of financial instruments to pay for predator conservation and encourage human– carnivore coexistence. PNAS 108 (34):13937–13944.

Doak, N. 2014. Polishing off the Ivory Trade: Surveys of Thailand's Ivory Market. TRAFFIC International, Cambridge, UK.

Dobson, A., and J. H. Poole. 1998. Conspecific aggregation and conservation biology. Pages 193–208 in T. Caro, editor. Behavioural ecology and conservation biology. Oxford University Press, Oxford, United Kingdom.

Dougherty, N. 1994 Nigeria's elephants: characterizing pachyderm problems in West Africa. Swara 17(2): 25-27.

Douglas, L.R. and K. Alie. 2014. High-value natural resources: Linking wildlife conservation to international conflict, insecurity, and development concerns. Biological Conservation 171: 270-277.

Douglas-Hamilton, I. 1972. On the ecology and behaviour of the African elephant. Oxford: University of Oxford.

Douglas-Hamilton, 1. 1979a. The African Elephant Action Plan. Typescript report for the IUCN/WWF/NYZS Elephant Survey and Conservation Programme.

Douglas-Hamilton, I. 1987. African elephants: population trends and their causes. Journal of Cambridge.

Douglas-Hamilton, I. 1988. African elephant database project: phase two, December. United Nations Environment Program, Nairobi.

Douglas-Hamilton, I., S. Bhalla, G. Wittemyer, F. Vollrath. 2006. Behavioural reactions of elephants towards a dying and deceased matriarch. Applied Animal Behavior Science. doi:10.1016/j.applanim.2006.04.014

Douglas-Hamilton, I., F. Maisels, et al. 2012. Comments on the Report "Decision-making mechanisms (DMM) and necessary conditions for a future trade in African elephant ivory" Consultancy document for the CITES Secretariat (no 2011/046).

de Silva, S. and G. Wittemyer. 2012. A Comparison of Social Organization in Asian Elephants and African Savannah Elephants. Int. J. Primatol. 33:1125-1141.

Draulans, D. and E. Van Krunkelsven. 2002. The impact of war on forest areas in the Democratic Republic of Congo. Oryx, Vol. 36 No. 1.

Dublin, H.T., Milliken, T. & Barnes, R.F.W. 1995. Four years after the CITES ban: illegal killing of elephants, ivory trade and stockpiles. Published on behalf of IUCN/TRAFFIC/WWF by the Chicago Zoological Society, Chicago.

Dudley, J.P., Ginsberg, J.R., Plumptre, A.J., Hart, J.A. & Campos, L.C. 2002. Conservation and conflict: effects of war and civil strife on wildlife and habitats. Conserv. Biol. 16, 319–329.

Eggert, L.S., C.A. Rasner, and D.S. Woodruff. 2002. The evolution and phylogeography of the African elephant inferred from mitochondrial DNA sequence and nuclear microsatellite markers. Proc. R. Soc. Lond. B. 269, 1993–2006

Eggert, L.S., R. Buji, M.E. Lee, P. Campbell, F. Dallmeier, R.C. Fleischer, A. Alonso, and J.E. Maldonado. 2013. Using Genetic Profiles of African Forest Elephants to Infer Population Structure, Movements, and Habitat Use in a Conservation and Development Landscape in Gabon. Conservation Biology, Volume 00, No. 0, 1–12.

Eltringham, S.K. 1990. Wildlife carrying capacities in relation to human settlement. Koedoe 33, 87–97.

Fa, J. E., S. F. Ryan, and D. J. Bell. 2005. Hunting vulnerability, ecological characteristics and harvest rates of bushmeat species in afrotropical forests. Biological Conservation 121:167–176.

Fears, D. 2014. "Overwhelmed U.S. port inspectors unable to keep up with illegal wildlife trade" The Washington Post, October 17, 2014. Accessed May 14, 2015. <http://www.washingtonpost.com/national/health-science/overwhelmed-us-port-inspectors-unable-to-keep-up-with-illegal-wildlife-trade/2014/10/17/2fc72086-fe42-11e3-b1f4-8e77c632c07b_story.html>

Ferguson, K. and M. Chase. 2010. Elephants and fencing conflicts in the GLTFCA and KAZATFCA. In: Ferguson, K. and Hanks, J. Editors, Fencing Impacts: A review of the environmental, social and economic impacts of game and veterinary fencing in Africa with particular reference to the Great Limpopo and Kavango-Zambezi Transfrontier Conservation Areas (pp 173-180).

Field, C. R., and I. C. Ross. 1976. The savanna ecology of the Kidepo Valley National Park II. Feeding ecology of the elephant and giraffe. East African Wildlife Journal 14:1-15.

Fischer F. 2005. Elephant in Cote d'Ivoire- a warning for West African Conservation. Pachyderm 38: 64–75.

Flint, J. 2009. Beyond 'Janjaweed': Understanding the militias of Darfur, Switzerland: Small Arms Survey.

France-Presse, A. 2015. "Poachers slaughter 30 elephants in DR Congo" The Jakarta Post, March 23, 2015. Accessed May 13, 2015. <http://www.thejakartapost.com/news/2015/03/23/poachers-slaughter-30-elephants-dr-congo.html>

Frankfurt Zoological Society (FZS). 2015. Press Release: FZS commits to support Tanzania in intensifying anti-poaching efforts as Great Elephant Census reveals rapidly declining elephant population" June 1, 2015. Accessed June 2, 2015. <https://fzs.org/en/news/great-elephant-census/>

Fund for Peace. 2013. Fragile States Index 2013. Available at: http://foreignpolicy.com/fragile-states-2014/#rankings

Geist, V. 1988. How Markets in Wildlife Meat and Parts, and the Sale of Hunting Privileges, Jeopardize Wildlife Conservation. Conservation Biology, Vol. 2, No. 1 (Mar., 1988), pp. 15-26.

Gessner, J., R. Buchwald, and G. Wittemyer. 2014. Assessing species occurrence and species specific use patterns of bais (forest clearings) in Central Africa with camera traps. African Journal of Ecology, 52: 59-68.

Gettleman, J. 2012. "Elephants dying in epic frenzy as ivory fuels wars and profits." New York Times. 03 September 2012. New York, New York.

Ginsberg, J. R., and E. J. Milner-Gulland. 1994. Sex-biased harvesting and population dynamics in ungulates: implications for conservation and sustainable use. Conservation Biology 8:157–166.

Goldenberg, S.Z., S. de Silva, H.B. Rasmussen, I. Douglas-Hamilton, and G. Wittemyer. 2014. Controlling for behavioural state reveals social dynamics among male African elephants, *Loxodonta africana*. Animal Behavior. 95:111-119.

Graham, M., 2006. Coexistence in a Land Use Mosaic? Land Use, Risk and Elephant Ecology in Laikipia District, Kenya. University of Cambridge (Ph.D. thesis).

Graham, M.D., I. Douglas-Hamilton, W.M. Adams, and P.C. Lee. 2009. The movement of African elephants in a human-dominated land-use mosaic. Animal Conservation, 12: 445-459.

Green. 2014. "Uganda probes theft of ivory stockpile, suspends wildlife agency staff" Rueters, November 18, 2014. Accessed May 13, 2015. < http://www.reuters.com/article/2014/11/18/us-uganda-wildlife-idUSKCN0J219S20141118>

Groves, C. P. 2000 What are the elephants of west Africa? Elephant 2, 7–8.

Grubb, P., Groves, C.P., Dudley, J.P. and Shoshani, J. 2000. Living African elephants belong to two species: *Loxodonta africana* (Blumenbach, 1797) and *Loxodonta cyclotis* (Matschie, 1900). Elephant 2(4): 1-4.

Hamilton, M. J., Milne, B. T., Walker, R. S., Burger, O., & Brown, J. H. 2007. The complex structure of hunter–gatherer social networks. Proceedings of the Royal Society B, Biological Sciences, 274, 2195–2202.

Hance, J. 2014. "Grenades, helicopters, and scooping out brains: poachers decimate elephant population in park" Mongabay, June 15, 2014. Accessed May 13, 2015. < http://news.mongabay.com/2014/0615-hance-garamba-elephant-poaching.html>

Hanson, T., Brooks, T.M., Da Fonseca, G.A.B., Hoffman, M., Lamoreux, J.F., Machlis, G., Mittermeier, C.G., Mittermeier, R.A. & Pilgrim, J.D. 2009. Warfare in biodiversity hotspots. Conserv. Biol. 23, 578–587.

Happold, D.C.D. 1995. The interactions between humans and mammals in Africa in relation to conservation: a review. Biodiv. Conserv. 4, 395–414.

Hart, J et al. Inventory and Monitoring report No 7, Nov 2007, Wildlife Conservation Society, DRC).

Hedges, S. and D. Gunaryadi. 2009. Reducing human–elephant conflict: do chillies help deter elephants from entering crop fields? Oryx, 44(1), 139-146.

Hegner, R. E., Emlen, S. T., & Demong, N. J. (1982). Spatial-organization of the white-fronted bee-eater. Nature, 298, 264–266.

Helldén, U. and C. Tottrup. 2008. Regional desertification: A global synthesis. Global and Planetary Change 64: 169-176.

Hema, E.M., Barnes, R.F.W. and Guenda W. 2011. Distribution of savannah elephants (*Loxodonta africana africana* Blumenback 1797) within Nazinga game ranch, Southern Burkina Faso. African Journal of Ecology, 49:2, pp. 141-149.

Hicks, C. 2013. "86 elephants killed in Chad poaching massacre" The Guardian, March 19, 2013. Accessed May 13, 2015. < http://www.theguardian.com/environment/2013/mar/19/86-elephants-chad-poaching-massacre>

Hoare, R. 1995. Options for the control of elephants in conflict with people. Pachyderm 19:54 63.

Hoare, R. 1999. Determinants of human–elephant conflict in a land-use mosaic. J. Appl. Ecol. 36, 689–700.

Hoare, R.E. 2001. Management implications of new research on problem elephants. Pachyderm 30:44–48.

Hoare, R. 2003. Fencing and other barriers against problem elephants. AfESG Technical Brief Series. <www.iucn.org/afesg>

Hoare, R. 2012. Lessons from 15 years of human–elephant conflict mitigation: Management considerations involving biological, physical and governance issues in Africa. Pachyderm No. 51 January–June 2012.

Hoare, R.E., du Toit, J.T., 1999. Coexistence between people and elephants in African savannahs. Conserv. Biol. 13, 639–663.

Hollister-Smith, J.A., J.H. Poole, E.A. Archie, E.A. Vance, N.J. Georgiadis, C.J. Moss, and S. C. Alberts. 2007. Age, musth and paternity success in wild male African elephants, *Loxodonta africana*. Animal Behaviour 74:287–296.

Huey RB, Kearney MR, Krockenberger A, JaM Holtum, Jess M, Williams SE. 2012. Predicting organismal vulnerability to climate warming: roles of behaviour, physiology and adaptation. Philosophical Transactions of the Royal Society B: Biological Sciences, 367, 1665–1679.

International Crisis Group (ICG). 2010. Dangerous little stones: Diamonds in the Central African Republic. Africa Report No. 167, 16 December 2010. Available at http://www.crisisgroup.org/~/media/Files/africa/central-africa/central-africanrepublic/167%20Dangerous%20Little%20Stones%20-%20Diamonds%20in%20the%20Central%20African%20Republic.ashx

International Fund for Animal Welfare (IFAW). 2014. Bidding Against Survival: the elephant poaching crisis and the role of auctions in the U.S. ivory market.

International Fund for Animal Welfare (IFAW), Humane Society of the United States (HSUS), Humane Society International (HSI), and the Fund for Animals. 2015. Petition to Uplist African Elephants to Endangered under the United States Endangered Species Act. Submitted February 11, 2015.

IPCC. 2014. Climate Change 2014: Synthesis Report. An Assessment of the Intergovernmental Panel on Climate Change. Available at www.ipcc.ch.

Ishida Y, Oleksyk TK, Georgiadis NJ, David VA, Zhao K, et al. 2011. Reconciling Apparent Conflicts between Mitochondrial and Nuclear Phylogenies in African Elephants. PLoS ONE 6(6): e20642. doi:10.1371/journal.pone.0020642

Jenkins, R.W.G. 2002. An Overview of the Fundamental Principles of CITES as a Mechanism for Regulating Trade in Listed Species. Presentation for CITES.

Johnson, M.B., S.L. Clifford, B. Goossens, S. Nyakaana, B. Curran, L.J.T. White, E.J. Wickings, and M.W. Bruford. 2007. Complex phylogeographic history of central African forest elephants and its implications for taxonomy. BMC Evolutionary Biology, 7:244.

Jori, F., D. Brahmbhatt, G.T. Fosgate, P.N. Thompson, C. Budke, M.P. Ward, K. Ferguson, and B. Gummow. 2011. A questionnaire-based evaluation of the veterinary cordon fence separating wildlife and livestock along the boundary of the Kruger National Park, South Africa. Preventative Veterinary Medicine, doi:10.1016/j.prevetmed.2011.03.015

Kangwana, K. 1995. Human-elephant conflict: the challenge ahead. Pachyderm 19:11-14.

Kangwana, K., 1996. Studying Elephants. AWF Technical Handbook Series No. 7.African Wildlife Foundation, Nairobi, Kenya.

Karimi, R.R., 2009. An Assessment of Perceived Crop Damage in a Tanzanian Village Impacted by Human–Elephant Conflict and an Investigation of Deterrent Properties of African Elephant (*Loxodonta africana*) Exudates Using Bioassays.Georgia Southern University (M.Sc. thesis).

Kawai, M., Ohsawa, H., Mori, U., & Dunbar, R. 1983. Social organization of gelada baboons: social units and definitions. Primates, 24, 13–24.

Kideghesho, J.R., Røskaft, E., Kaltenborn, B.P., 2007. Factors influencing conservation attitudes of local people in Western Serengeti, Tanzania. Biodivers. Conserv. 6, 2213–2230.

Kikoti, A., 2009. Seasonal Home Range Sizes, Transboundary Movements and Conservation of Elephants in Northern Tanzania. University of Massachusetts, USA(Ph.D. thesis).

Kikoti, A.P., Griffin, C.R., Pamphil, L., 2010. Elephant use and conflict leads to Tanzania first wildlife conservation corridor. Pachyderm 48, 57–66.

King, L.E., I. Douglas-Hamilton, and F. Vollrath. 2012. Beehive fences as effective deterrents for crop-raiding elephants: field trials in northern Kenya. African Journal of Ecology, pp. 1-9.

Kingdon J. 1979. East African mammals: an atlas of evolution in Africa. Volume III Part B (Large mammals). London: Academic Press. 436 p.

Kioko, J., P. Muruthi, P. Omondo, and P.I. Chiyo. 2008. The performance of electric fences as elephant barriers in Amboseli, Kenya. South African Journal of Wildlife Research 38(1): 52–58.

Kothari, A. 1996. Toward joint management of India's protected areas. Workshop on Collaborative Management for Conservation, IUCN World Conservation Congress, Montreal.

Kuhl, A., N. Balinova, E. Bykova, Y. N. Arylov, A. Esipov, A. A. Lushchekina, and E. J. Milner-Gulland. 2009. The role of saiga poaching in rural communities: linkages between attitudes, socioeconomic circumstances and behaviour. Biological Conservation 142:1442–1449.

Kumleben, M.E. (1996) Commission of Inquiry into the Alleged Smuggling of and Illegal Trade in Ivory and Rhinoceros Horn in South Africa. Report of the Chairman M.E. Kumleben. Report to the State President of the Republic of South Africa, Truth and Reconciliation Commission, Durban, South Africa.

Lahm, S. A. 1994. The impact of elephants on agriculture in Gabon. Pages 90. WWF Programme pour le Gabon, B.P. 9144, Libreville, Gabon.

Lahm, S. A. 1996. A nationwide survey of crop-raiding by elephants and other species in Gabon. Pachyderm 21:69-77.

Lamarque, F., Anderson, J., Fergusson, R., Lagrange, M., Osei-Owusu, Y., Bakker, L., 2009. Human–Wildlife Conflict in Africa: An Overview of Causes, Consequences and Management Strategies. FAO Forestry Paper no.157, Rome.

Laporte NT, Stabach JA, Grosch R, Lin TS, Goetz SJ 2007. Expansion of industrial logging in Central Africa. Science 316: 1451–1451.

Latham, B. 2015. "The Number of Elephants in Parts of Zimbabwe Is Plunging" Bloomberg, Feb. 18, 2015. Accessed June 2, 2015. < http://www.bloomberg.com/news/articles/2015-02-18/zimbabwe-elephant-population-dwindles-amid-threat-from-poachers>

Laurence, W.F., B.M. Croes, L. Tchignoumba, S.A. Lahm, A. Alonso, M.E. Lee, P. Campbell, and C. Ondzeano. 2005. Impacts of Roads and Hunting on Central African Rainforest Mammals. Conservation Biology Volume 20, No. 4, 1251–1261.

Laws, R. M. 1969. Aspects of reproduction in the African elephant, Loxodonta africana. J. Reprod. Fertil. 6, 193–217.

Laws, R.M., Parker, I.S.C., Johnstone, R.C.B., 1975. Elephants and Their Habitats: The Ecology of Elephants in North Bunyoro, Uganda. Clarendon Press, Oxford, 366 pp.

Leblan, V. 2014. The Impact of West African Trade on the Distribution of Chimpanzee and Elephant Populations (Guinea, Guinea-Bissau, Senegal, 19th–20th Century). Human Ecology 42: 455-465.

Lee, P. C. 1987. Allomothering among African elephants. Animal Behavior, 35, 278–291.

Lee, P.C. and M.D. Graham. 2006. African elephants *Loxodonta africana* and human–elephant interactions: implications for conservation. Int. Zoo Yb. 40: 9-19.

Lee, P.C. and C.J. Moss. 2014. African Elephant Play, Competence, and Social Complexity. Animal Behavior and Cognition. 1(2):144-156.

Leggett, K.E.A. 2006. Home range and seasonal movement of elephants in the Kunene Region, northwestern Namibia. Afr. Zool. 41, 17–36.

Lei R, Brenneman RA, Louis EE. 2008. Genetic diversity in the North American captive African elephant collection. Journal of Zoology 275: 252–267.

Lemieux, A.M. and R.V. Clarke. 2009. The international ban on ivory sales and its effects on elephant poaching in Africa. Brit. J. Criminol. 49, 451-471.

Leong, K.M., A. Ortolani, L.H. Graham, and A. Savage. 2003. The use of low-frequency vocalizations in African elephant (*Loxodonta africana*) reproductive strategies. Hormones and Behavior 43: 433–443.

Lewis, D.M. 1987. Fruiting patterns, seed germination and distribution of Sclerocarya caffra in an elephant-inhabited woodland. Biotropica 19, 50–56.

Loarie, S.R., van Aarde, R.J., Pimm, S.L., 2009. Fences and artificial water affect African savannah elephant movement patterns. Biol. Conserv. 142, 3086–3098.

Lotter, W. and K. Clark. 2014. Community involvement and joint operations aid effective anti-poaching in Tanzania. Parks, Vol. 20.1.

Loveridge, A. J., Hunt, J. E., Murindagomo, F., and Macdonald, D. W. (2006). Influence of drought on predation of elephant (*Loxodonta africana*) calves by lions (*Panthera leo*) in an African wooded savannah. J. Zool. ,Lond. 270: 523-530.

Mackenzie, C.A., Ahabyona, P., 2012. Elephants in the garden: financial and social costs of crop raiding. Ecol. Econ. 75, 72–82.

Maglio, VJ. 1973. Origin and evolution of the Elephantidae. Trans Am Phil Soc Philad, New Series 63: 1–149.

Maisels F, Strindberg S, Blake S, Wittemyer G, Hart J, et al. 2013. Devastating Decline of Forest Elephants in Central Africa. PLoS ONE 8(3): e59469. doi:10.1371/journal.pone.0059469

Mariki, S.B., H. Svarstad, and T.A. Benjaminsen. 2015. Elephants over the Cliff: Explaining Wildlife Killings in Tanzania. Land Use Policy 44: 19-30.

Martin, R.B. 2005. The influence of veterinary control fence on certain wild large mamal species in the Caprivi strip, Namibia. In: Ososfsky, S.A. (Ed.), Conservation and Develoment Interventions at the Wildlife/Livestock Interface: Implications for Wildlife, Livestock, and Human Health. Occasional Paper IUCN SSC, Gland, Switzerland/Cambridge, UK, pp. 27-39.

Martin, E. and Stiles, D. 2000. The Ivory Markets of Africa. Save the Elephants. London, UK.

Martin, E. and D. Stiles. 2008. Ivory Markets in the USA. Pub. by Care for the Wild International, West Sussex, UK, and Save the Elephants, Nairobi, Kenya.

Mascarenhas, A. 1971. Agricultural vermin in Tanzania. Pages 259-267 in S. H. Ominde, ed. Studies in East African Geography and Development. University of California press, Berkeley.

McCain CM and King SRB. 2014. Body size and activity times mediate mammalian responses to climate change. Global Change Biology, 20: 1760–1769.

McComb, K., G. Shannon, S.M. Durant, K. Sayialel, R. Slotow, J. Poole, and C. Moss. 2011. Leadership in elephants: the adaptive value of age. Proc. R. Soc. B doi:10.1098/rspb.2011.0168

Metzger, K.L., Sinclair, A.R.E., Hilborn, R., Hopcraft, J.G.C., Mduma, S.A.R., 2010. Evaluating the protection of wildlife in parks: the case of African buffalo in Serengeti. Biodivers. Conserv. 19, 3431–3444.

Michelmore, F., K. Beardsley, R.F.W. Barnes, and I. Douglas-Hamilton. 1994. A model illustrating the changes in forest elephant numbers caused by poaching. African Journal of Ecology. Vol. 32, pp. 89-99.

Milliken, T. 2014. Illegal Trade in Ivory and Rhino Horn: an Assessment Report to Improve Law Enforcement Under the Wildlife TRAPS Project. USAID and TRAFFIC.

Milliken, T., Burn, R.W. and Sangalakula, L. (2002). An analysis of the spatial aspects of the elephant product seizure data in ETIS; a report to the 12th meeting of the Conference of the Parties. CoP12 Doc 34.1, Annex 2. CITES Secretariat, Geneva, Switzerland. http://www.cites.org/eng/cop/12/doc/E12-34-1.pdf.

Milliken, T., Pole, A., and Huongo, A. 2006. No Peace for Elephants: Unregulated Domestic Ivory Markets in Angola and Mozambique. TRAFFIC International, Cambridge, UK.

Milner-Gulland, E.J., Bennett, E.L., 2003. Wild meat: the bigger picture. Trends Ecol. Evol. 18, 351–357.

Milner, J. M., E. B. Nilsen, and H. P. Andreassen. 2007. Demographic side effects of selective hunting in ungulates and carnivores. Conservation Biology 21:36–47.

Moss, C.J., 1983. Oestrous behaviour and female choice in the African elephant. Behaviour 86, 167–196.

Moss, C.J., 2001. The demography of an African elephant (*Loxodonta africana*) population in Amboseli, Kenya. J. Zool. Lond. 255, 145–156.

Moss, C. J., & Poole, J. H. 1983. Relationships and social structure of African elephants. In R. A. Hinde (Ed.), Primate social relationships: An integrated approach (pp. 315–325). Oxford: Blackwell.

Muir, R. 2006. Declines in the hippopotamus population of the Virunga National Park. Gorilla J. 33, 9–10.

Naughton-Treves, L. 1997. Farming the forest edge: Vulnerable places and people around Kibale National Park, Uganda. The Geographical Review 87(1): 27-47.

Naughton, L., R. Rose, and A. Treves. 1999. The social dimensions of human-elephant conflict in Africa: A literature review and case studies from Uganda and Cameroon. A Report to the African Elephant Specialist, Human-Elephant Task Conflict Task Force, of IUCN, Glands, Switzerland. December 1999.

Naughton-Treves, L., Treves, A. & Rose, R. (2000) The Social Dimensions of Human-Elephant Conflict in Africa.: A Review of the Literature and Case Studies from Cameroon and Uganda. IUCN African Elephant Specialist Group, Nairobi, Kenya.

Newmark, W.D., Manyanza, D.N., Gamassa, D.M., Sariko, H.I., 1994. The conflict between wildlife and local people living adjacent to protected areas in Tanzania: human density as a predictor. Conserv. Biol. 8, 249–255.

Ngene, S., S. Njumbi, M. Nzisa, K. Kimitei, J. Mukeka, S. Muya, F. Ihwagi, and P. Omondi. 2013. Status and trends of the elephant population in the Tsavo–Mkomazi ecosystem. Pachyderm No. 53, January-June 2013.

Niang, I., O.C. Ruppel, M.A. Abdrabo, A. Essel, C. Lennard, J. Padgham, and P. Urquhart, 2014: Africa. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1199-1265.

Nishihara, T. 2003. Demand for forest elephant ivory in Japan. Pachyderm No. 52 July–December 2012.

Nyirenda, V.R., P.A. Lindsey, E. Phiri, I. Stevenson, C. Chomba, N. Namukonde, W.J. Myburgh, and B.K. Reilly. 2015. Trends in Illegal Killing of African Elephants (*Loxodonta africana*) in the Luangwa and Zambezi Ecosystems of Zambia. Environment and Natural Resources Research; Vol. 5, No. 2.

O'Conell-Rodwell, C., Rodwell, T., Rice, M., Hart, L.A., 2000. Living with modern conservation paradigm: can agricultural communities co-exist with elephants? A five year study in East Caprivi, Namibia. Biol. Conserv. 93,381–391.

Omondi, P. E. Bitok, and J. Kagiri. 2004. Managing human–elephant conflicts: the Kenyan experience. Pachyderm, No. 36, January-June 2004.

Omondi P, Bitok EK, Mukeka J, Mayienda RM, Litoroh M. 2008. Total aerial count of elephants and other large mammal species of Tsavo–Mkomazi ecosystem. Kenya Wildlife Service, Nairobi, Kenya.

Osborn, F.V., 2004. Seasonal variation of feeding patterns and food selection by crop-raiding elephants in Zimbabwe. Afr. J. Ecol. 42, 322–327.

Osborn, F.V., Hill, C.M., 2005. Techniques to reduce crop loss: human and technical dimensions in Africa. In: Woodroffe, R., Thirgood, S., Rabinowitz, A. (Eds.), People and Wildlife: Conflict and Coexistence. Cambridge University Press, pp. 72–85.

Owen-Smith, N. 1998. How high ambient temperature affects the daily activity and foraging time of a subtropical ungulate, the greater kudu (Tragelaphus strepsiceros). Journal of Zoology 246:183-192.

Parker G.E., Osborn, F.V., Hoare R.E. and Niskanen, L.S. (eds.) 2007. Human-Elephant Conflict Mitigation: A Training Course for Community-Based Approaches in Africa. Participant's Manual. Elephant Pepper Development Trust, Livingstone, Zambia and IUCN/SSC AfESG, Nairobi, Kenya.

Parker I.S.C., and A.D. Graham. 1989. Elephant decline: Downwardtrends in African elephant distribution and numbers (part 2). Int J Environ Stud 35: 13–26.

Parmesan C and Yohe G. 2003. A globally coherent fingerprint of climate change impacts across natural systems. Nature, Vol. 421. 2 January 2003. www.nature.com/nature

Perry, J. S. 1953 The reproduction of the African elephant, *Loxodonta africana*. Proc. R. Soc. B 237, 93–153.

Platt, J. 2012. Cameroon elephant massacre shows poaching, ivory trade require an international response. Available: http://blogs.scientificamerican.com/extinction-countdown/2012/03/20/cameroon-elephant-massacre-poachingivory-trade/.

Plumptre, A.J., Bizumuremi, J.B., Uwimana, F. & Ndaruhebeye, J.D. 1997. The effects of the Rwandan civil war on the poaching of ungulates in the Park National des Volcans. Oryx 31, 265–273.

Poole, J.H. 1982. Musth and male-male competition in the African elephant. Ph.D. thesis, University of Cambridge.

Poole, J.H. 1987. Rutting behavior in African elephants: the phenomenon of musth. Behaviour, 102, 283-316.

Poole, J.H. 1989. Mate guarding, reproductive success, and female choice, in African elephants. Animal Behavior, 37, 842-849.

Poole, J. 1996 Coming of age with elephants. London, UK: Hodder and Stoughton.

Power, J. and R.X.S. Compion. 2009. Lion Predation on Elephants in the Savuti, Chobe National Park, Botswana. African Zoology, 44(1): 36-44.

Prins, H. H. T., and J. G. Grootenhuis. 2000. Introduction: the value of priceless wildlife. Pages 1–12 in H. H. T. Prins, J. G. Grootenhuis, and T. T. Dolan, editors. Wildlife conservation by sustainable use. Kluwer Academic Publishers, Dordrecht, The Netherlands.

Pugh, M., and Cooper, N. 2004. War economies in a regional context: Challenges and transformations. London: Lynne Rienner.

Rasmussen, H. B. 2005. Reproductive tactics of male African savannah elephants (*Loxodonta africana*) (Doctoral thesis). Oxford, U.K.: Oxford University.

Reich, P.F., S.T. Numbem, R.A. Almaraz and H. Eswaran. 2001. Land resource stresses and desertification in Africa. In:Bridges, E.M., I.D. Hannam, L.R. Oldeman, F.W.T. Pening de Vries, S.J. Scherr, and S. Sompatpanit (eds.). Responses to Land Degradation. Proc. 2nd. International Conference on Land Degradation and Desertification, Khon Kaen, Thailand. Oxford Press, New Delhi, India. Available at: http://www.nrcs.usda.gov/

Roca A.L., O'Brien S.J. 2005. Genomic inferences from Afrotheria and the evolution of elephants. Curr Opin Genet Dev 15: 652–659.

Roca, A.L., N. Georgiadis, J. Pecon-Slattery, and S.J. O'Brien. 2001. Genetic Evidence for Two Species of Elephant in Africa. SCIENCE, Vol. 293, 24 August 2001.

Roca, A.L., N. Georgiadis, J. Pecon-Slattery, and S.J. O'Brien. 2005. Cytonuclear genomic dissociation in African elephant species. Nature Genetics, Vol. 37. No. 1, pp. 97-100.

Roca, A.L., N. Georgiadis, J. Pecon-Slattery, and S.J. O'Brien. 2007. Cyto-nuclear genomic dissociation and the African elephant species question. Quant. Int., 169-170: 4-16.

Roca, A.L., Y. Ishida, A.L. Brandt, N.R. Benjamin, K. Zhao, and N.J. Georgiadis. 2015. Elephant Natural History: A Genomic Perspective. Annu. Rev. Anim. Biosci. 3:139-67.

Rodwell, T.C., Tagg, J. & Grobler, M. 1994. Wildlife Resources in the Caprivi, Namibia: The Results of an Aerial Census in 1994 in compArison with Past Surveys. Ministry of Environment and Tourism, Windhoek, Namibia.

Roever, C.L., R.J. van Aarde, M.J. Chase. 2013. Incorporating mortality into habitat selection to identify secure and risky habitats for savannah elephants. Biological Conservation, 164: 98-106.

Rohland N, Reich D, Mallick S, Meyer M, Green RE, et al. 2010. Genomic DNA Sequences from Mastodon and Woolly Mammoth Reveal Deep Speciation of Forest and Savanna Elephants. PLoS Biol 8(12): e1000564. doi:10.1371/journal.pbio.1000564

Roth, H.H. and I. Douglas-Hamilton. 1991. Distribution and status of elephants in West Africa. Mammalia, t. 55, No 4.

Russo, C. 2013. "What happened to the elephants of Bouba Ndjida?" Mongabay, March 7, 2013. Accessed May 5, 2012. < http://news.mongabay.com/2013/0307-russo-elephants-bouba-njida.html>

Sachs, J.D., Reid, W.V., 2006. Investment toward sustainable development. Science 312, 1002.

Said, M.Y., Chunge, R.N., Craig, G.C., Thouless, C.R., Barnes, R.F.W. and Dublin, H.T. (1995). African Elephant Database 1995. IUCN, Gland, Switzerland. 225pp.

Sanders WJ, Gheerbrant E, Harris JM, Saegusa H, Delmer C. 2010. Proboscidea. In: Werdelin L, Sanders WJ, eds. Cenozoic mammals of Africa. Berkeley: University of California Press.

Sanjayan, M. 2014. "Mountain Bull, legendary Kenyan elephant, found dead" CBS News, May 16, 2014. Accessed May 13, 2015. < http://www.cbsnews.com/news/mountain-bull-legendary-kenyan-elephant-found-dead/>

Save the Elephants. 2014. "Price of ivory triples in China" The Guardian, July 3, 2014. Accessed May 13, 2015. < http://www.theguardian.com/environment/2014/jul/03/price-ivory-china-triples-elephant>

Selier, S.J., B.R. Page, A.T. Vanak, R. Slotow. 2014. Sustainability of Elephant Hunting Across International Borders in Southern Africa: A Case Study of the Greater Mapungubwe Transfrontier Conservation Area. The Journal of Wildlife Management 78(1): 122-132.

Shambaugh, J., Oglethhorpe, J., Ham, R., 2001. The Trampled Grass: Mitigating the impacts of armed conflict on the environment. Biodiversity Support Program, Washington, DC, USA.

Sitati, N.W., Tchamba, M., 2008. Mitigating Human Elephant Conflict in Central Africa: A Planning Mission Document to Develop a Human–Elephant Conflict Mitigation Strategy. WWF – Central Africa Regional Office (unpublished report).

Sitati, N.W., M.J. Walpole, R.J. Smith, and N. Leader-Williams. 2003. Predicting spatial aspects of human-elephant conflict. Journal of Applied Ecology, 40: 667-677

Sitati, N.W., Walpole, M.J., Smith, R.J., Leader-Williams, N., 2005. Factors affecting susceptibility of farms to crop raiding by African elephants: using a predictive model to mitigate conflict. J. Appl. Ecol. 42, 1175–1182.

Slotow, R., G. van Dyk, J. Poole, B. Page, and A. Klocke. 2000. Older bull elephants control young males. Nature 408:425–426.

Slotow, R., and G. van Dyk. 2001. Role of delinquent young 'orphan' male elephants in high mortality of white rhinoceros in Pilanesburg National Park, South Africa. Koedoe 44:85–94.

Smith, N.S., Buss, I.O., 1973. Reproductive ecology of the female African elephant. J. Wildl. Manage. 37, 524–534.

Sogge, D. 1992. Sustainable Peace: Angola's Recovery. Southern African Research and Documentation Centre, Harare, Zimbabwe.

Soshani, J., W.J. Sanders, and P. Tassy. 2001. Elephants and other Proboscideans: a summary of recent findings and new taxonomic suggestions. The World of Elephants – International Congress, Rome 2001

Southwood, T. 1977. The relevance of population dynamic theory to pest status. Pages 36-54 in J. M. Cherret and G. R. Sagar, eds. Origins of Pest, Parasite, Disease and Weed Problems. Blackwell, Oxford, UK.

Spinage, C.A. 1973. A review of ivory exploitation and elephant population trends in Africa. African Journal of Ecology 11: 281-289.

Stephenson, P. J. 2004. The future for elephants in Africa. In Terrestrial ecoregions of Africa and Madagascar: a conservation assessment: 133–136. Burgess, J. D. A. H., Underwood, N. E., Dinerstein, E., Olson, D., Itoua, I., Schipper, J., Ricketts, T. & Newman K. (Eds). Washington, DC: Island Press.

Stiles, D. 2004. The Ivory Trade and Elephant Conservation. Environmental Conservation, 31: 309 – 21.

Stiles, D. 2015. Elephant ivory trafficking in California, USA. Report for the Natural Resources Defense Council.

Stokes EJ, Strindberg S, Bakabana PC, Elkan PW, Iyenguet FC, et al. (2010) Monitoring Great Ape and Elephant Abundance at Large Spatial Scales: Measuring Effectiveness of a Conservation Landscape. PLoS ONE 5(4): e10294. doi:10.1371/journal.pone.0010294

Sukumar, R. 1993. Minimum viable populations for elephant conservation. Gajah 11: 48-52.

Sutmoller, P., 2002. The fencing issues relative to the control of foot-and-mouth disease. Ann. N.Y. Acad. Sci. 969,191–200.

Sutmoller, P., Thomson, G.R., Hargreaves, S.K., Foggin, C.M., Anderson, E.C., 2000. The foot-and-mouth disease risk posed by African buffalo within wildlife conservancies to the cattle industry of Zimbabwe. Prev. Vet. Med. 44,43–60.

Tanzania Wildlife Research Institute (TAWIRI). 2010. Tanzania Elephant Management Plan 2010-2015. Eds. S.R. Mduma, A.L. Lobora, C. Foley, and T. Jones. Arusha, Tanzania.

Tanzania Wildlife Research Institute (TAWIRI). 2014. Aerial census of large mammals in the Selous-Mikumi Ecosystem, Dry Season 2013: Population Status of African Elephant. Arusha, Tanzania.

Taylor, I. 2003. Conflict in Central Africa: Clandestine networks & regional/global configurations. Review of African Political Economy, 30(95), 45-55. doi 10.1080/03056240308372

The David Sheldrick Wildlife Trust. 2014 Press Release: Tsavo Ecosystem Elephant Count 5th - 10th Feb 2014 - 2/15/2014. Accessed May 12, 2015. < https://www.sheldrickwildlifetrust.org/updates/updates.asp?ID=616>

Thomas CD, Cameron A, Green RE. 2004. Extinction risk from climate change. Nature, 427, 145–148.

Thomson, G.R., 1999. Alternatives for controlling animal diseases resulting from interactions between livestock and wildlife in Southern Africa. S. Afr.J.Sci.95,71–76.

Thornycroft, P. and A. Laing. 2013. "Poachers kill 300 Zimbabwe elephants with cyanide" The Telegraph, October 20, 2013. Accessed May 13, 2015. <http://www.telegraph.co.uk/news/worldnews/africaandindianocean/zimbabwe/10390634/Poachers-kill-300-Zimbabwe-elephants-with-cyanide.html>

Thouless, C.R. 1994. Conflict between humans and elephants on private land in northern Kenya. Oryx, 28, 119-127.

Thouless, C. 1996. Home ranges and social organisation of female elephants in northern Kenya. Afr. J. Ecol. 34, 284–297.

Thuiller W, Lavorel S, Arau´ jo MB. 2005. Niche properties and geographic extent as predictors of species sensitivity to climate change. Global Ecology and Biogeography, 14, 347–357.

Thuiller, W., O. Broennimann, G. Hughes, J. Robert, M. Alkemades, G.F. Midgley, and F. Corsi. 2006. Vulnerability of African mammals to anthropogenic climate change under conservative land transformation assumptions. Global Change Biology, 12, 424–440, doi: 10.1111/j.1365-2486.2006.01115.x

Transparency International. 2014. Corruption Perceptions Index 2014: Results. Available at: http://www.transparency.org/cpi2014/results

UNCED 1992: Report of the United Nations Conference on Environment and Development, Chapter 12: Managing fragile ecosystems: Combating desertification and drought- (Rio de Janeiro, 3–14 June 1992), General A/CONF.151/26 (Vol. II), Chapter 12

Underwood FM, Burn RW, Milliken T. 2013. Dissecting the Illegal Ivory Trade: An Analysis of Ivory Seizures Data. PLoS ONE 8(10): e76539. doi:10.1371/journal.pone.0076539

UNEP, CITES, IUCN, TRAFFIC (2013). Elephants in the Dust – The African Elephant Crisis. A Rapid Response Assessment. United Nations Environment Programme, GRID-Arendal. www.grida.no

United Nations. (UN). 2013. Report of the Secretary-General on the activities of the United Nations Regional Office for Central Africa and on the Lord's Resistance Army affected areas. United Nations Security Council Resolution S/2013/297. Retrieved from: http://www.un.org/en/ga/search/view_doc.asp?symbol=S/2013/297

Uno, K.T., J. Quade, D.C. Fisher, G. WIttemyer, I. Douglas-Hamilton, S. Andanje, P. Omondi, M. Litoroh, and T.E. Cerling. 2013. Bomb-curve radiocarbon measurement of recent biologic tissues and applications to wildlife forensics and stable isotope (paleo)ecology. PNAS, Vol. 110, No. 29, 11736-11741 pp.

U.S. Fish and Wildlife Service (USFWS). 2014. April 4, 2014 Press Release: "Service Suspends Import of Elephant Trophies from Tanzania and Zimbabwe". Available at: http://www.fws.gov/news/ShowNews.cfm?ID=2E6FF2A2-E10F-82BC-DAE08807810E3C6B

Vanclay, J.K., 2001. The effectiveness of parks. Science 293, 1007.

Vigne, L. and E. Martin. 2014. China Faces a Conservation Challenge, the expending elephant and mammoth ivory trade in Beijing and Shanghai. Save the Elephants, PO Box 54667, Nairobi 00200, Kenya, and The Aspinall Foundation, Port Lympne Reserve, Lympne, Nr Hythe, Kent CT21 4PD, UK, 2014.

Virmani, S.M., Katyal, J.C., Eswaran, H. and Abrol, I., eds. 1994. Stressed Agroecosystems and Sustainable Agriculture. New Delhi: Oxford & IBH.

Wall, J., G. Wittemyer, B. Klinkenberg, V. LeMay, and I. Douglas-Hamilton. 2013. Characterizing properties and drivers of long distance movements by elephants (*Loxodonta africana*) in the Gourma, Mali. Biological Conservation, 157: 60-68.

Walpole, M., Karanja, G., Sitati, N., Leader-Williams, N., 2003. Wildlife and People: Conflict and Conservation in Masai Mara, Kenya. IIED Wildlife and DevelopmentSeries no 14

Walpole, M., Linkie, M. (Eds.), 2007. Mitigating Human–Elephant Conflict: Case Studies from Africa and Asia. Fauna and Flora International (FFI), Cambridge, UK.

Warner, M.Z., 2008. Examining Human–Elephant Conflict in Southern Africa: Causes and Options for Coexistence. University of Pennsylvania, (Masters thesis).

Wasser, S.K., W.J. Clark, O. Drori, E.S. Kisamo, C. Mailand, B. Mutayoba, and M. Stephens. 2008. Combating the Illegal Trade in African Elephant Ivory with DNA Forensics. Conservation Biology, Vol. 22, No. 4, 1065-1071.

Wasser, S.K., B. Clark, and C. Laurie. 2009. *The Ivory Trail*. Scientific American, July 2009.

Wasser, S.K., J. Poole, P. Lee, K. Lindsay, A. Dobson, J. Hart, I. Douglas-Hamilton, G. Wittemyer, P. Granli, B. Morgan, J. Gunn, S. Alberts, R. Beyers, P. Chiyo, H. Croze, R. Estes, K. Gobush, P. Joram, A. Kikoti, J. Kingdon, L. King, D. MacDonald, C. Moss, B. Mutayoba, S. Njumbi, P. Omondi, and K. Nowak. 2010. Elephants, Ivory, and Trade. SCIENCE Vol. 327, March 12, 2010.

Webber, C.E., Sereivathana, T., Maltby, M.T. and Lee, P.C. (2011). Elephant crop-raiding and human-elephant conflict in Cambodia: crop selection and seasonal timings of raids. Oryx, 45, pp. 243-251.

Weladji, R.B., Tchamba, M.N. 2003. Conflict between people and protected areas within the Be´noue Wildlife Conservation Area, North Cameroon. Oryx 37 (1),72–79.

Western, D., 1975. Water availability and its influence on the structure and dynamics of a savannah large mammal community. Afr. J. Ecol. 13, 265–286.

Western. 1989. Chairman's Report: Ivory Under Scrutiny. Pachyderm, No. 12.

Western, D., Lindsay, W.K., 1984. Seasonal herd dynamics of a savannah elephant population. Afr. J. Ecol. 22, 229–244.

Western, D. 1997. In the Dust of Kilimanjaro. Island Press, Washington, D.C.

White, N. 2014. "The Political Economy of Ivory as a "Conflict Resource"," Peace and Conflict Studies: Vol. 21: No. 2, Article 6. Available at: http://nsuworks.nova.edu/pcs/vol21/iss2/6

Wildlife Conservation Society (WCS). 2015. Press Release: "Mozambique Releases Elephant Numbers" May 26, 2015. Accessed June 2, 2015. < http://www.wcs.org/news-and-features-main/mozambique-elephant-numbers.aspx>

Wilkie, D. S., J. G. Sidle, and G. C. Boundzanga. 1992. Mechanized logging, market hunting, and a bank loan in Congo. Conservation Biology 6:570–580.

Wilson, D. & Ayerst, P. 1976. White Gold: The Story of African Ivory. Heinemann, London WTO (1998) WTO in Asia and the Pacific. World Tourism Organisation, Madrid.

Wittemyer, G. 2011. Effects of Economic Downturns on Mortality of Wild African Elephants. Conservation Biology. Doi: 10.1111/j.1523-1739.2011.01713.x

Wittemyer, G., I. Douglas-Hamilton, and W.M. Getz. 2005. The socioecology of elephants: analysis of the processes creating multitiered social structures. Animal Behavior. 69, 1357–1371

Wittemyer, G., H.B. Rasmussen, and I. Douglas-Hamilton. 2007b. Ecography 30: 42-50.

Wittemyer, G., P.Elsen, W.T. Bean, A. Coleman O. Burton, J.S. Brashares. 2008. Accelerated Human Population Growth at Protected Area Edges. SCIENCE, Vol. 321. July 4, 2008.

Wittemyer, G., Okello, J. B. A., Rasmussen, H. B., Arctander, P., Nyakaana, S., Douglas Hamilton, I., & Siegismund, H. R. 2009. Where sociality and relatedness diverge: The genetic basis for hierarchical social organization in African elephants. Proceedings of the Royal Society B: Biological Sciences, 276, 3513–3521.

Wittemyer G., Daballen D., Douglas-Hamilton I. 2013. Comparative Demography of an At-Risk African Elephant Population. PLoS ONE 8(1): e53726. doi:10.1371/journal.pone.0053726

Wittemyer, G., J.M. Northrup, J. Blanc, I. Douglas-Hamilton, P. Omondi, and K.P. Burnham. 2014. Illegal killing for ivory drives global decline in African elephants. PNAS. Vol. 111, No. 36, 13117-13121 pp.

World Population Review. 2015. Africa Population 2015. Accessed May 12, 2015. < http://worldpopulationreview.com/continents/africa-population/>

World Tourism Organization (UNWTO). 2014. Towards Measuring the Economic Value of Wildlife Watching Tourism in Africa – Breifeing Paper, UNTWO, Madrid.

WWF, CMS, SSC, and IUCN. 2005. Strategy for the Conservation of West African Elephants, Revised 2005.

Zubair, L., Blumenthal, B., Ndiaye, O., Perera, R., Ward, N., Yahiya, Z., Chandimala, J.,et al., 2005. Evaluation of climate and habitat interactions affecting the conserva-tion and management of Asian Elephants in South-East Sri Lanka. InternationalResearch Institute for Climate and Society, Sri Lanka.