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THE INTERNATIONAL BAN ON IVORY SALES AND ITS EFFECTS ON ELEPHANT POACHING IN AFRICA

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The Convention on International Trade in Endangered Species (CITES) secured an agreement in 1989 among its member states to ban the international trade in ivory. This disruption of the international ivory market was intended to reverse a sharp decline in the African elephant population, which resulted from widespread poaching for ivory in the previous decade. The continent's overall population of elephants increased after the ban, but an analysis of elephant population data from 1979 to 2007 found that some of the 37 countries in Africa with elephants continued to lose substantial numbers of them. This pattern is largely explained by the presence of unregulated domestic ivory markets in and near countries with declines in elephant populations.

Keywords: wildlife crime, elephants, ivory, poaching, CITES, situational crime prevention

Introduction

Long past are the days when poaching was a relatively simple matter of commoners hunting venison on Crown lands or taking fish and game from the estates of local landowners (Hay 1977). The taking of 'bush meat' from game parks still supplements the diet of many people in the developing world (Blanc *et al.* 2007; Roe 2008), but, nowadays, poaching consists of a much more diverse set of behaviours than simply hunting for food. It encompasses killing or theft of endangered animals; supplying the market for exotic birds; illegal fishing or over-fishing; organized poaching of abalone and lobsters; illegal harvesting of timber and exotic plants; killing protected wild animals to furnish the ingredients for Asian traditional medicines; and acquiring laboratory animals for Western pharmaceutical companies. In some forms, such as the illegal export of caviar from the Middle East, it supports businesses worth millions of pounds per year, with operations stretching around the world.

This illegal trade in wildlife presents a threat to many rare species and thus to biodiversity and, for that reason, has increasingly attracted the attention of conservation agencies (Rice 2008). During the past 40 years, these agencies have exerted pressure on national governments and international agencies to tighten laws and increase legal penalties for wildlife crimes. Many countries employ forestry and fisheries officers to enforce the laws and have created specialized law enforcement and customs units to arrest traffickers and confiscate the plants and animals they hold. These efforts sometimes lead to violence. For example, national park rangers in some African countries have engaged in armed conflict with poachers, with many killed on either side, in order to protect the animals and safeguard tourism.

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Until the recent emergence of 'green criminology' (Beirne and South 2007; Oldfield 2003; White 2008), much of this activity has gone unexamined by criminologists. In fact, criminology has much to offer the study and prevention of wildlife crime. It can draw on a fund of relevant knowledge about the effectiveness of legal sanctions, deterrence and prevention, and it has a wealth of experience in developing and evaluating solutions to specific forms of crime. The present paper, which examines the effectiveness of the CITES ban on the international trading of ivory, is conceived within the framework of situational crime prevention—an approach that seeks to reduce opportunities for specific forms of crime. First developed to deal with 'street' crimes such as car theft and vandalism (Clarke 1980), it has since been applied to a much wider variety of crimes, including fraud (Levi 2008), child sexual abuse (Wortley and Smallbone 2006) and terrorism (Clarke and Newman 2006). More than 200 evaluations of situational crime prevention projects have been published, many showing large reductions in the specific forms of crimes addressed with only limited displacement (Guerette and Bowers in press).

The wider application of situational prevention has resulted in successive expansions of a classification of opportunity-reducing techniques developed to assist practice and 25 techniques have now been identified (Cornish and Clarke 2003). One of these, 'disrupting markets' for stolen goods, is of particular relevance to the present study because the ban on ivory sales was intended to disrupt the international market for ivory and thereby reduce the rewards of poaching.

In fact, little empirical work on disrupting markets has been undertaken, though Sutton (1998), working within the framework of situational crime prevention, has developed the 'market reduction approach', or MRA. This consists of a methodology for police to disrupt a stolen goods market by analysing the property stolen, the methods of theft and the means of disposal. Armed with this knowledge, police can work with community partners to develop tailored interventions to disrupt the market. One application of the MRA by police in two towns in England sought to reduce 'acquisitive crime', but with mixed results (Hale *et al.* 2004).

This is rather distant from the problem of elephant poaching, but Schneider (2008) has argued that disrupting markets has considerable promise for dealing with the illicit trade in wildlife. To anticipate the results of the present paper, it was found that the CITES action to disrupt the international ivory market was partly successful. The overall number of elephants in the continent increased, but there was considerable variation among the 37 affected countries. Poaching declined sharply in some, but was little changed, or even increased in others. It further found that this variation in the effects of the ban can be partly explained by the differential access of countries to unregulated, domestic markets for ivory.

Before describing the design of the study and the results in more detail, it is necessary to give a brief account of elephant poaching in Africa (including the background to the CITES ban), to provide some information about domestic ivory markets, and to review previous evaluations of the effects of the CITES ban.

Elephant Poaching in Africa

Elephants are found in 37 countries or 'range states' in sub-Saharan Africa. They are a source of bush meat, but their 'white gold' can provide a substantial reward for poachers.

Indeed, it is widely accepted that ivory-driven poaching in the 1970s and 1980s led to a substantial decline in elephant populations. More than 1.3 million elephants roamed Africa in 1979; in 1989, there were approximately 600,000 (van Aarde and Jackson 2006). In Kenya, uncarved ivory was worth $2.50 a pound in 1969, $34 a pound in 1978, and more than $90 a pound in 1989 (Messer 2000). Because bigger tusks meant bigger profits, bull elephants with tusks weighing six or seven times those of females were the usual targets of poaching. This led to skewed sex ratios in some herds, calling into question their long-term survival. It also meant more elephants were killed to meet the weight demands of the international ivory market as the number of bulls declined.

The raw ivory obtained by poachers is sold to wholesalers and craftsmen and is often shipped overseas before being carved into a variety of items such as chopsticks, figurines, piano keys and chess sets. Tourists visiting Africa are also responsible for the continued demand for ivory (Milliken *et al.* 2006).

CITES and the ban on the international trade in ivory

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an agreement between member nations, or parties, to regulate the international trade of wildlife. Currently, there are 173 parties to the Convention who have agreed to help protect more than 30,000 species of plants and animals (CITES, *What is CITES?*, 2008). Parties fulfil their obligations, (1) by passing national legislation that provides the legal framework and funding necessary to implement the Convention's recommendations, (2) by ensuring the appropriate agencies are involved with data collection and law enforcement, and (3) by reporting annually to the CITES Secretariat on measures taken to fulfil international obligations and on the number of specimens traded (Vasquez 2003). The power of CITES rests in its ability to impose restrictive sanctions on the trade of protected species by countries who are not complying with the Convention (Reeve 2006). Essentially, these sanctions can hurt the ability of non-compliant countries to profit from the regulated wildlife market.

Species protected by CITES are listed in one of three appendices, of which only the two most restrictive, Appendices I and II, are relevant here. Appendix I lists species threatened with extinction. Commercial trade in these specimens is strictly prohibited, while other trade—largely in the form of hunting trophies or for scientific and educational purposes—is tightly controlled (Reeve 2006). Appendix II lists species not necessarily threatened with extinction, but in which trade must be controlled in order to ensure their survival (CITES, *How CITES Works*, 2008).

A Conference of the Parties (CoP) held every two to three years discusses and amends the agreement. At every CoP since 1985, elephant conservation has sparked heated debate (Stiles 2004) and, on 17 October 1989, the African elephant was moved from Appendix II to Appendix I. This action meant that poached ivory could no longer be traded in the international market. 'The day before the meeting, a pound of ivory sold for more than one hundred dollars; the day after, a seller would have been lucky to get five dollars' (Leakey and Morell 2001: 118).

Because it is impossible to distinguish poached ivory and ivory purchased from legal sources, the government of Kenya had earlier decided it would no longer sell ivory confiscated from poachers. Continuing to sell this ivory would undermine the effect of the anticipated CITES ban. The decision was announced to the world on 18 July 1989,

when Kenya burned 2,000 confiscated elephant tusks—an event that an estimated 850 million people worldwide learned about from television and newspapers (Leakey and Morell 2001). The point was simple: the African elephant was threatened with extinction because of the ivory trade and it was time to do something about it.

The 'regulated' ivory markets of Africa

Some African countries with strong elephant conservation programmes in place did not support the CITES decision in 1989 to move the African elephant to Appendix I. They argued that a total ban on selling confiscated ivory would hurt their abilities to fund conservation. Consequently, Resolution Conf. 7.9 allowed the elephant populations of certain countries to be given an Appendix II listing at a later date if deemed necessary (Kiyono 2002). In fact, at the 10th CoP in 1997, Botswana, Namibia and Zimbabwe were allowed to transfer their elephant populations from Appendix I to Appendix II under a series of restrictions and precautionary measures, and were permitted an experimental sale of 50 tonnes of raw ivory to Japanese traders (Stiles 2004).

Many African countries opposed this sale because they believed it would provide a loophole for poached ivory to enter the international market once again. Despite this, the 12th CoP, in 2002, gave conditional approval to Botswana, Namibia and South Africa to sell 60 tonnes of stockpiled ivory (Stiles 2004). The conditions were that an adequate system to monitor poaching be put in place, and that Japan—the only designated buyer—provided assurances that it would control the use of the ivory and prevent its re-export. It was not until the 14th CoP, in 2007, that CITES member countries gave their full support to the auction (*USA Today* 2007).

Since the ban in 1989, four countries in Africa have therefore been given CITES approval to auction their ivory stockpiles. These are considered to be 'regulated' ivory markets of Africa, as distinct from the 'unregulated' markets discussed below.

The 'unregulated' ivory markets of Africa

By definition, CITES does not specifically prohibit trade in ivory within the borders of a country (Courouble *et al.* 2003). Policies and law enforcement practices governing the domestic sale of ivory are determined at a national level. This means that each African country is responsible for the presence or absence of an 'unregulated' market within its borders. These unregulated markets serve international tourists looking for souvenirs and the small numbers of local people wanting ivory for their personal use (Courouble *et al.* 2003; Milliken *et al.* 2006). More problematic is that ivory is purchased in these markets by wholesalers looking for raw ivory for re-sale in other markets throughout Africa and Asia (Courouble *et al.* 2003).

There is no requirement for traders in unregulated markets to register their inventory or provide documentation to prove their ivory is not from poached animals. Consequently, unregulated markets provide poachers and carvers an outlet to sell ivory without international oversight.[1] Indeed, numerous reports have suggested a link between

[1] Buying ivory in unregulated markets is not difficult for tourists or dealers, but exporting it requires some measure of deception. For example, one Angolan shop owner said 'he could get an official stamp to allow the export of carved ivory, but not for raw ivory. Raw ivory, however, could be exported through the port by putting it into a container for shipping' (Milliken *et al.* 2006: 16). Carved ivory is also painted to resemble wood, making detection of the illicit product more difficult for Customs officials (Courouble *et al.* 2003).

Africa's unregulated ivory markets and elephant poaching (Courouble *et al.* 2003; Martin and Milliken 2005; Milliken *et al.* 2006). Hunter *et al.* (2004) determined these markets were consuming more ivory per annum than the unregulated markets in Asia. By their estimate, the ivory of 4,000 elephants per year was needed to meet the demand of both markets and might sometimes even reach 12,000 elephants in any given year.

Unregulated markets in Africa can also endanger elephant populations of neighbouring countries because weak border controls enable poachers from neighbouring countries to sell their ivory in the unregulated market. The market's demand may also require the importation of ivory as local sources dry up, and bordering countries will generally provide a more accessible (and thus cheaper) source of ivory than more distant ones. Finally, elephants often cross international boundaries in search of food and water as the seasons change. If they cross into a country with a domestic market, they may increase their risks of being killed.

In summary, regulated and unregulated ivory markets play two distinct roles in elephant conservation. Regulated markets reward countries for their continued protection of an endangered species by funding conservation efforts and giving countries a reason to enforce the international embargo. They can therefore be expected to have a positive effect on the elephant population of Africa. Unregulated markets have the opposite effect because they increase poaching incentives as well as the ability to trade ivory on a domestic and international level. The inability of CITES to control domestic markets must therefore be considered when examining the effectiveness of the 1989 ban.

Previous Evaluations of the Effectiveness of the CITES Ban

The effectiveness of the CITES ban would best be determined by comparing levels of poaching pre and post ban, measured by the number of carcasses found without tusks. Unfortunately, such data are not available for any African country (Stiles 2004)[2] and researchers have therefore pursued a number of alternative evaluative strategies: economic modelling of the ban's likely effects, analyses of ivory seizures, observational studies of ivory markets, detailed case studies of particular countries and longitudinal analyses of elephant population data.

The economic studies have pursued a variety of approaches to overcome the lack of data. Bulte and van Kooten (1999*a*) used illegal poaching (the number of animals killed), enforcement effort (US$/km^2 and scouts/km^2) and legal culling as hypothetical variables for determining whether the ban would increase or decrease the number of elephants. Using Zambian data, they concluded that the ban was helping to conserve elephants, but that for many countries, current elephant populations are higher than economically optimal. In a second paper, they concluded that banning the trade in ivory has halted the 'toboggan ride to zero' (Bulte and van Kooten 1999*b*: 179), but that the international ban was unnecessary in countries with adequate law enforcement. Burton (1999) correlated anti-poaching activities in Zimbabwe (defined as the budget per km^2 and the number of scouts per km^2) with carcasses found and concluded that

[2] Poaching data are available in a few countries for certain parks or reserves, but they cannot legitimately be extrapolated to the national level or combined with data from other countries because they would undercount the real rate of poaching in countries with few preserves and small enforcement budgets (Dublin *et al.* 1995).

there was no change with the ban in place. Khanna and Harford (1996) concluded from their economic analysis that, because the costs of enforcing the ban are incurred at a national level, this has a negative effect on countries without regulated markets, as they have no ivory-linked source of income for conservation. Heltberg (2001) argued that while the ban prevents confiscated ivory entering the market, this might not reduce the value of ivory because poachers might obtain higher prices on the black market. On the other hand, he argued that the ban could be effective because it had a large moral demand-reducing effect.

These economic studies permit no firm conclusions about the effectiveness of the CITES ban, but they usefully draw attention to the variety of its possible effects, which need to be weighed when considering future bans (see the Conclusions below).

A second approach to evaluating the effectiveness of the ban has used ivory seizure data collated by the Elephant Trade Information System (ETIS) to examine whether ivory markets have been reduced. All the reports indicate the international ivory market is still active and is even growing in certain countries (Dublin *et al.* 1995; CITES 2002; 2004*a*; Williamson 2004; Milliken *et al.* 2007; Born Free Foundation 2007). In another approach to studying ivory markets, researchers have posed as buyers to collect data from markets on the number of outlets selling ivory, the number of carvers employed, the price of ivory and the number of pieces for sale. In brief, these surveys find that some ivory markets have declined while others are growing (Stiles 2004).

Detailed conservation case studies in Botswana (Barnes 1996) and Zambia (Jachmann 2003) have concluded that the effects of the CITES ban vary, depending on conservation policies, pressures of human population and enforcement resources. Finally, in his longitudinal analysis of elephant population data, Stiles (2004) found that elephant numbers decreased during the post-ban years in Central and West Africa, but they increased in Southern and Eastern Africa. He concluded that countries that continued to lose elephants were those with domestic ivory markets.

Overall, it is apparent that previous attempts to assess the effectiveness of the CITES ban have yielded few firm conclusions. Largely on the basis of theoretical arguments, some have concluded that the ban was successful. Others found that the ban was detrimental to countries that depended on ivory sales to fund elephant conservation; that it had little effect on a poacher's decision to hunt; and that it successfully reduced ivory markets in some places but not everywhere. In perhaps the most empirically well grounded study, Stiles (2004) concluded that the ban had positive effects on the elephant population in some regions of Africa, but not in others and that this seemed to be related to access to domestic ivory markets. In the study reported below, we build upon his methodology to investigate in more detail his 'market' explanation for the varied effects of the ban.

Research Design

Following Stiles (2004), this study uses changes in elephant population data to examine the effectiveness of the CITES ban; unlike Stiles (2004), however, changes in elephant populations are examined at the national level, not just by the regions of Africa. This permits a more detailed analysis of where the elephant is being exploited and where it is being protected and of the reasons for this. The study focuses primarily on the relationship between ivory markets and local elephant populations, but the analysis also sought to take account of the effect of civil war and corruption.

The analysis was undertaken in three stages. First, country-level changes in elephant populations between 1979 and 1989 were calculated in order to determine which countries suffered most from poaching in pre-ban years. In the second stage, the changes in elephant populations were calculated during the post-ban years (1989–2007) in order to see which countries benefited most and least from the ban. In the third stage, post-ban losses were systematically compared with the presence of a regulated or an unregulated market, the number of bordering unregulated markets, the degree of corruption and whether the country was involved in a civil war.

Variables and Data

Elephant population

The elephant population data used in this study were for two periods: pre-ban (1979 and 1989) and post-ban (1989 and 2007). Although the pre- and post-ban data were reported in different publications, the numbers all came from the African Elephant Database, which is said to be 'the most comprehensive database on the conservation status of any single species of mammal in the wild' (Blanc *et al.* 2007). Data for the pre-ban years, 1979 and 1989, were taken from van Aarde and Jackson (2006) and the post-ban data were obtained from the African Elephant Status Report (Blanc *et al.* 2007). The fact that the pre- and post-ban data come from the same database increases the reliability of the analysis reported below.

The African Elephant Database has four classifications of elephant populations: definite, probable, possible and speculative. The techniques used for determining the number of elephants in each category range from counting the actual number of elephants in a park (definite) to using dung counts and mathematical formulas to estimate the number of elephants in a given area. Because many countries, especially those with forest elephants, have few, if any, 'definite' elephants, it is usual when studying changes in elephant populations to sum all four categories (Stiles 2004). This was done for the present analysis. Because it compares changes over extended periods of time, it may avoid the problem of misreading short period variations that are affected by the use of revised estimation techniques (Blanc *et al.* 2007). The data obtained for 1979 and 1989 were reported in round numbers, while those for 2007 were more exact (see Appendix 1), which reflects the increasing refinement in estimation techniques.

Ivory markets

Regulated markets were identified from Annex 7 of the Monitoring the Illegal Killing of Elephants (MIKE) Status Report (CITES 2004*b*). All four of the regulated markets are located in the southern region of Africa. Unregulated markets were identified using a TRAFFIC briefing document that described the ivory markets found in every African country (Milliken 2004). Ten of the 37 countries with elephants have unregulated markets (see Appendix 2). The highest concentration of unregulated markets is found in the Central African region, where four of the seven countries have unregulated markets. In addition, the markets of Nigeria and Sudan border this region. In the three other regions of Africa, less than one quarter of the countries have an unregulated ivory market.

The numbers of bordering countries with unregulated or regulated markets were recorded for each country (the large, unregulated market in Egypt was included for this portion of the analysis, even though it has no elephants). Seven of the 28 countries included in the analysis border a regulated market; 25 border at least one unregulated.

Civil wars and corruption

A nation engaged in civil war may lack the will or ability to undertake anti-poaching efforts or to enforce CITES recommendations. This means more elephants could be lost to poaching for ivory or bush meat or to human–elephant conflict as refugees migrate. Countries engaged in a civil war at any time between 1989 and 2007 were identified from Wikipedia's (2008) 'List of Conflicts in Africa' (see Appendix 3). After much searching, this was determined to be the most comprehensive and up-to-date source of conflict information.

Corrupt governments enable poachers and traders to move ivory across international borders under diplomatic cover or by using bribes and fake documentation. Corruption can also result in the improper use of money earmarked for elephant conservation. Each country's corruption score was obtained from the 2007 Transparency International Corruption Perceptions Index (Transparency International 2008). The Index is based on opinion surveys given to 14 experts who rate the levels of corruption in 180 nations. The 2007 scores for the 37 African countries in this study (see Appendix 3) ranged from 1.4 to 5.4 (1 indicates the highest level of corruption).

Findings

Pre-ban population changes

Figure 1 presents the pre-ban change in the elephant populations of 35 countries with elephants.[3] These data have been arranged in numerical order, with the greatest losses on the left and the greatest gains on the right. (See Appendix 1 for data label information.)

Figure 1 shows that while poaching may have been occurring throughout Africa, the elephant population of every country was not declining before the ban. The data range between a loss of nearly 300,000 animals in the DRC and a gain of 62,000 in Gabon. Fifteen countries saw no change in their local populations, which means that only 20 countries in Africa saw a decline in their elephant population in the decade before the ban. Four countries—Gabon (35), Congo (34), Botswana (33) and Zimbabwe (32)—contributed an additional 165,000 elephants to the continent total in just ten years.

Elephant losses were highly skewed. Only 12 of the 20 countries lost more than 1,000 elephants in the ten-year span, with combined losses of more than 900,000 elephants. Including the eight countries that lost fewer than 1,000 animals, the continent of Africa actually lost nearly 1 million elephants in the 1980s. The DRC (1), Tanzania (2), Sudan (3) and Zambia (4) were the hardest hit, with each country losing more than 100,000 elephants.

[3] Eritrea and Guinea Bissau were also excluded because data were not available for 1979.

Post-ban population changes

Figure 2 shows the changes in Africa's elephant populations for the post-ban period for 36 of the 37 elephant range states.[4] The data again take the shape of a sigmoidal or s-shaped curve, with some countries having gained elephants while the population of others continued to decline. The range for this dataset extends between a loss of just over 60,000 elephants (DRC) and a gain of nearly 125,000 animals (Botswana).

Three conclusions can be drawn from the data in Figure 2. First, it appears the ban helped to increase the overall number of elephants in Africa by about 140,000 between 1989 and 2007. Eighteen countries had increases in their populations post ban, one-third of which added more than 10,000 animals each. Two of the countries, Kenya (5) and Tanzania (2), are particularly important, as they suffered greatly from poaching in pre-ban years. Second, the ban has been effective at slowing the off-take of elephants from some countries that have continued to lose them. Thus, the loss of 60,000 elephants in the DRC (1) between 1989 and 2007 was one-fifth of the number of elephants lost in the DRC during the pre-ban period. Third, the international ban has not yet benefited every African country. As in the pre-ban years, a few countries are accounting for much of the total loss on the continent. In fact, since 1989, nearly 180,000 elephants were lost in 17 countries with declining populations; 110,000 of these were lost in the DRC (1) and Congo (34) combined. The other three countries accounting for a large proportion of elephant losses are the Central African Republic (6), Zambia (4) and Angola (21).

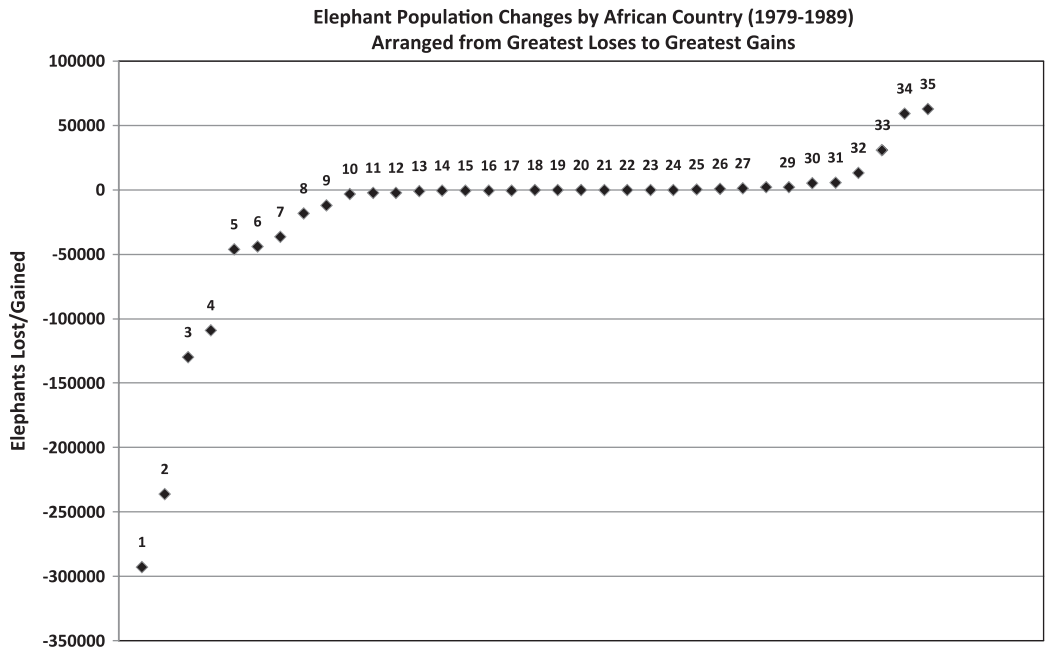

Fig. 1 Elephant Population Changes by African Country (1979–1989) Arranged from Greatest Loses to Greatest Gains

[4] Eritrea was excluded because of insufficient data.

Much like the unregulated ivory markets, elephant loss was concentrated in Central Africa. This region lost more than 130,000 elephants in the post-ban years. Only two of the seven countries saw population increases, which amounted to a total of about 4,000 elephants. The following sections will argue this is the result of the continued presence of unregulated ivory markets within and near these countries.

Post-ban population changes and ivory markets

In this third stage of the analysis, post-ban population gains or losses were examined in terms of the following 'market' variables: the presence/absence of a regulated market; the presence/absence of an unregulated market; and the number of bordering unregulated markets. In addition, the changes were examined in relation to corruption scores and whether or not the country was involved in a civil war.

Eight countries with an absolute change of less than 100 in elephant numbers in post-ban years were excluded from this stage of analysis because this number of elephants was considered too small to reliably indicate any change.[5] All eight countries had small elephant populations in 1989; only one had more than 300 elephants and five had 100 or less. This differs from the 28 countries included in the analysis, of which 25 had a population greater than 1,000 in 1989.

Changes in elephant populations for the 28 countries were converted from raw numbers to percentages (these ranged from –99 to +282 per cent). This resulted in a

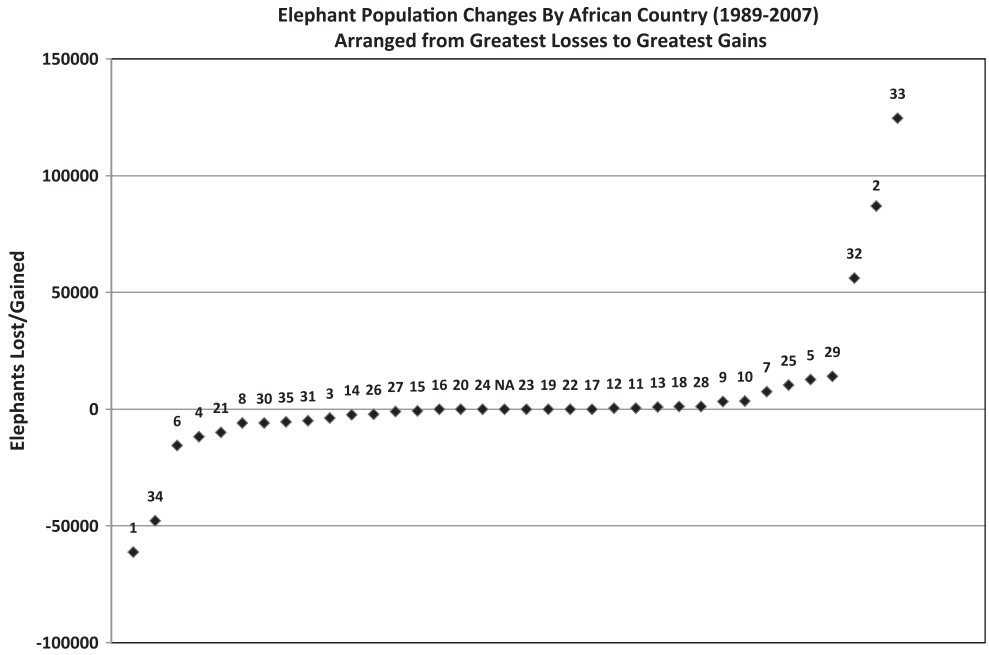

Fig. 2 Elephant Population Changes By African Country (1989–2007) Arranged from Greatest Losses to Greatest Gains

[5] Eritrea was also removed from the analysis because population counts were not available for 1989.

normal distribution that met the assumptions of the statistical procedures used. Independent *t*-tests were used to examine the significance of the effect of each independent variable and Cohen's *d* was calculated to compare the size of the effects.[6] Unavoidable limitations of these analyses were the small sample size and, sometimes, the uneven split of countries on the dependent variable. In these circumstances, two-tailed tests of significance were employed throughout, even though, in most cases, the directions of the differences were consistent with expectations.

Regulated markets

Four countries with regulated markets saw larger increases in their elephant populations than the 24 without. The average increase in countries with a regulated market was 195 per cent (SD = 80) compared to a decrease of 3 per cent (SD = 85) in those without one. This result reinforces the CITES decision to allow regulated trade in these countries, as they are adequately protecting their elephants. Countries that border nations with regulated markets also benefited (N = 7, M = 101 per cent, SD = 134) compared to those that did not (N = 21, M = 0 per cent, SD = 89, $p < 0.05$).

Unregulated markets

Unregulated markets had the opposite effect on elephant populations. Countries with unregulated markets (N = 9) averaged a 58 per cent decline (SD = 41) in their population, while those without one (N = 19) saw a 65 per cent increase (SD = 109, $p < 0.01$). With the exception of Mozambique, every country with an unregulated market saw a decline in their elephant populations from 1989 to 2007.

Bordering one or two unregulated markets was not significantly related to a change in the population. Bordering three or more of these markets nearly reached significance ($p = 0.056$) and suggests this trait could have an adverse effect on elephant populations. Of the six nations bordering three or more unregulated markets, only one, Chad, increased its elephant population post ban. The other five countries lost a total of 134,363 elephants between 1989 and 2007. This accounts for 75 per cent of the elephant decline on the continent since 1989. Chad differs from these five countries because it is the only one without an unregulated market, which may explain why its elephant population has not suffered as much as the others. Despite the reality of Chad's increased elephant population, the nation has been identified as a hotspot for ivory poaching (CITES 2004*b*). Thus, it appears unregulated markets are endangering the elephants of not only nations that harbour them, but those that are surrounded by them as well.

Civil wars and corruption

On average, countries that experienced a civil war during the post-ban period saw a 31 per cent decrease in their elephant population (N = 11, SD = 90) compared to a 62 per cent increase in peaceful nations (N = 17, SD = 106, $p < 0.05$). These data confirm the hypothesis that civil wars have a negative effect on elephant conservation.

The effect of corruption was examined by using different cut-off points for the Corruption Perception Index score. No country in the analysis had a score lower than 1

[6] A regression model was not used in this analysis because of the small number of cases.

so the first cut-off used was 2.5, which divided the countries into nearly equal groups. The *t*-test did not reach significance at this cut-off. When the cut-off was 3, the 22 countries with a score below this had an average loss of 3 per cent (SD = 90) while the six countries with a higher score had an average increase of 131 per cent (SD = 114, $p < 0.01$). When 4 was used as a cut-off, the results were also significant ($p < 0.001$). Countries above the cut-off saw an average increase of 217 per cent (N = 3, SD = 81), while those below the cut-off saw an increase of 3 per cent (N = 25, SD = 87). These results suggest corruption is indeed a threat to the African elephant and that greater levels of corruption are associated with greater elephant losses.

Combined effects of unregulated ivory markets, civil war and corruption

In examining combined effects, countries obtained a score of 1 for each of the following conditions: presence of an unregulated market, bordering three or more unregulated markets, involved in a civil war and a corruption score less than 3.0. When countries with none of these conditions were compared to those with at least one, a significant difference in the elephant population change was found. Countries with a score of 0 saw increases of 131 per cent (N = 6, SD = 114) while those with a score of 1–4 saw a decrease of 3 per cent (N = 22, SD = 90, $p < 0.01$). Using different cut-off points, the results continue to show the adverse effects of unregulated markets, civil war and corruption. When 2 was the cut-off point, the 28 range states were evenly split between the two groups. Here, the results indicate countries with a score of 0–2 had an 88 per cent increase in their populations (N = 14, SD = 98), while those with a score of 3 or 4 suffered a 37 per cent decline (N = 14, SD = 81, $p < 0.01$). Only three countries reached a score of 4; the population declines in these nations ranged from 68 to 93 per cent. It appears the explanatory variables are not only significant by themselves, but have a combined effect on elephant numbers.

Effect size of the independent variables

In order to determine which independent variable most affects elephant populations, Cohen's *d* was calculated. In Table 1, negative *d* values indicate the variable has an adverse effect on elephant populations. As might be expected, the two variables associated with increases in a country's elephant population were the presence of a regulated market and bordering a regulated market, of which the former had a larger

Table 1 *The effect size of variables on post-ban changes in elephant populations*

Independent variable	Cohen's d
Positive effects	
Presence of a regulated ivory market	+2.4
Bordering a regulated ivory market	+0.9
Negative effects	
Presence of an unregulated ivory market	–1.5
High levels of corruption	–1.3
Civil conflict	–0.9
Bordering three or more unregulated markets	–0.9*

* *t*-test was not significant ($p = 0.056$).

effect. Of the three variables associated with declines in elephants, the presence of an unregulated market was the most important. High levels of corruption had the second largest effect, followed by civil conflicts. The effect of bordering three or more unregulated markets was also calculated and it was found that this variable has the same effect size as civil conflicts. These results suggest the regulated sale of ivory can benefit conservation, as claimed by the countries with these markets; perhaps more important, the results also suggest that action to close unregulated ivory markets in Africa is needed to protect the elephant.

Summary of Findings and Limitations

The study's most important finding, consistent with some previous studies, is that the ban has successfully reversed the precipitous decline in the continent's elephant population, which is now slowly recovering. A second important finding is that changes in the elephant populations of the 37 sub-Saharan African countries show considerable variation. Though the continent as a whole lost nearly one million elephants in the ten years before the ban, 13 countries actually saw an increase in their populations. In fact, the majority of elephant losses were concentrated in a few countries, as was also the case with population growth.

After the ban, the same general pattern was seen with skewed numbers on both sides of the sigmoidal curve. This shows the ban has been unable to protect all of Africa's elephants from the ivory trade, despite its universal application. This fact is explained by two important findings: (1) countries with unregulated markets were more likely to lose elephants during the post-ban period and (2) 75 per cent of total elephant losses came from five countries, all of which bordered three or more unregulated ivory markets. It appears poaching incentives are greatest in countries with access to multiple unregulated markets.

Lastly, corruption and civil war were also related to declines in local elephant populations. This might partly be the result of marauding armies shooting elephants for meat and it might be easier to poach ivory under conditions of civil war and corruption. However, without the unregulated markets and the access to them, poachers could not sell the ivory at a price that would justify the risk and effort of obtaining it.

Before exploring the wider issues raised by these findings, two important limitations of the study should be noted. The first is that the elephant population estimates used are subject to the criticism that declines in population do not necessarily mean that elephants are being poached. Thus, habitat loss and human–elephant conflict can result in population declines and new estimation techniques can produce lower counts. However, these elephant population estimates are widely used in developing policy and CITES used them in 1989 to move the African elephant to Appendix I. Moreover, the fact that the present analysis shows both rapid elephant loss and unregulated markets are concentrated in Central African countries brings credibility to the argument that the population declines in this region are linked to poaching for ivory.

The second important limitation is that in keeping with the study's focus on ivory markets, the analysis did not attempt to examine all other possible explanations for the post-ban variations in elephant populations. It did include an examination of corruption and civil wars, which are widely assumed to facilitate poaching, but this was done only to deal with the most obvious factors that might confound the analysis of markets. To have

undertaken a wider analysis of other possible alternative explanations for post-ban variations would have demanded more resources than were available for the present work.

Conclusions

The results of this study indicate that the CITES ban on the international trade in ivory has succeeded in reversing the decline in the African elephant population. However, the ban has not benefited every country alike, some of which have continued to lose elephants. Poachers in these countries have greater access to 'unregulated' domestic markets for ivory, perhaps facilitated by corruption and civil war. These findings call for coordinated action to govern the domestic sale of ivory. The existence of unregulated markets has left open a loophole for poachers, traders and carvers that they continue to exploit. There is an urgent need to close unregulated markets or bring them under greater control, both of which present a considerable political challenge. If they are to be closed, all those in neighbouring countries should be closed at the same time, otherwise the poached ivory will continue to be transported to where it can easily be sold.

These prescriptions are consistent with findings from a large and detailed study of the impact on poaching of the international ban on the trade in endangered birds (Cantu Guzman 2007). This found that the international trade in Mexican parrots rapidly declined following enactment of various prohibitions in the late 1980s/early 1990s on the export of Mexican birds and their import into the United States, including the US Wild Bird Conservation Act 1992. Despite this, the actual poaching of parrots seemed to have been largely unaffected because parrots are prized as pets in Mexico. Consequently, poachers (a mixed group of rural dwellers and licensed trappers) could continue to sell the birds (perhaps at lower prices) to casual buyers and local markets. In other words, the international restrictions on trade did halt the export of poached birds, but did little to stop the poaching itself. This would only be surprising if each step in the international trade in parrots was being masterminded by organized criminals. In fact, organized criminals might only have played a part later in the process—purchasing illegally taken parrots from local markets and sending them out of the country to overseas buyers. Many local poachers might have been entirely unaware of the international ban or its intended effects and might have continued to take parrots as long as they could be sold.

It is impossible to know whether a similar story could be told about the effect of the CITES ban on the ivory poachers because there is no systematic information available about who they are or how they operate. This is an important gap in knowledge that criminologists could help to fill, such as by interviewing apprehended poachers or by mapping the distribution of elephant carcasses to obtain insight into the likely origins of the poachers, whether local or from bordering countries. It could also be important to study how 'unregulated' markets are policed or how easily ivory, once sold, can be transported from the market to ports and trade routes. Once identified, these patterns provide the raw data needed for detailed thinking about appropriate policing or situational prevention initiatives to disrupt the markets.

In fact, this information would assist not only market disruption, but also other possible situational interventions that seek to reduce the rewards of crime, increase its

risks and difficulties, and remove excuses, provocations and temptations (Cornish and Clarke 2003). Lemieux (in press) has identified a number of possible measures to prevent elephant poaching, which fall under these categories, including: the closure of logging roads; the use of pilot-less drones, gun shot detectors and concealed metal detectors in trails (for detecting guns); DNA coding of ivory; and the provision of technology to customs officials that would help them to identify ivory. In choosing among these measures, however, it would be necessary to have detailed information about: who the poachers are and where they come from; whether they seek meat, ivory or both; how they find the elephants; how they evade detection; how they transport the tusks; who they sell them to and where, how much they are paid; how the ivory is sold on and whether it is exported; etc.

In addition to these details about *modus operandi*, more needs to be known about the conditions that facilitate poaching, including such factors as complicity by local park rangers or officials, support by local populations, inadequacy of resources for enforcement, convenient transportation routes, lack of other means of earning money, etc. Obtaining this information in developing countries that lack trained researchers and administrative and scientific record-keeping systems would be a considerable challenge, but many examples exist (some have been mentioned above) of sophisticated studies of elephants undertaken by those with economic or conservation backgrounds using methods that sometimes differ little from those used in criminology.

Disrupting markets or other opportunity-reducing approaches will only succeed if the people of the countries concerned see their elephants as a resource worth protecting. At present, many see elephants not in these terms, but as a source of meat. Many local people are also angered by elephant crop raiding and they chafe at the restrictions on grazing or farming resulting from protections afforded the animals. The need to counter these views and to find ways to exploit the resource potential of elephants is made in several of the economic studies of the CITES ban reviewed above. For example, Barnes (1996: 227) argues that 'most of the elephant range will be occupied by expanding human and livestock populations unless wildlife, dominated by elephant, can contribute use values in excess of those livestock'.

In fact, the primary economic value of elephants, apart from ivory sales, comes from tourism, which can bring considerable sustainable income to an African country. Unfortunately, local people do not always directly benefit from this income, at least in terms that they can perceive and understand. There are many reasons for this. Government income from taxes on tourism might be used to fund a broad range of government programmes, rather than be used to support tourism by improving local roads and services. Some of this government income, in some countries, will also be lost to corruption. Profit made by tour operators will often end up overseas, in the countries where they are based. While tour operators might employ local people to service their game lodges, much of this work requires skills or sophistication that that local people do not possess. This means that those employed by the tour operators are often from outside the local area. For the local population, the perceivable benefits of tourism might therefore come mostly from the sale of carvings and artwork and from small sums handed out by the visitors.

Indeed, it is possible to make the argument that eco-tourism brings the most direct benefits to a handful of wealthy people from the developed world and some indirect

benefits to the world at large through the maintenance of bio-diversity. These benefits are subsidized by poor people in the destination countries whose livelihoods are constrained through controls on farming, grazing and the taking of bush meat, and whose crops are sometime destroyed by the animals tourists come to see. It is not simply enough, therefore, to promote tourism to African countries, desirable as this may be. Ways must also be found of bringing some tangible benefits of tourism to local people. This is a topic that goes well beyond the scope of the present discussion, which is concerned with situational measures to prevent poaching. But, in closing, we should mention ways in which situational measures could help to reduce crop destruction. Omondi *et al.* (2004) have discussed some ways to reduce this problem, including planting barriers of plants that elephants find noxious (such as Mauritius thorn), training farming communities in the use of thunder flashes to scare off marauding animals and creating local sanctuaries for elephants that are managed by local communities who might, as a result, benefit from tourism. Just as with poaching, however, more needs to be learned about crop raiding if it is to be brought under control. This means that if the support of local populations for conservation is to be enlisted, the field of wildlife crime should perhaps be as much concerned with ways to control the 'delinquent' behaviour of wild animals as with controlling those who prey upon them.

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Appendix 1: Elephant Population Data for 37 Sub-Saharan African Countries

	Country	Elephant population (1979)	Elephant population (1989)	Elephant population (2007)	Population change (1979–89)	Population change (1989–2007)
1	DRC	377,700	85,000	23,714	–292,700	–61,286
2	Tanzania	316,300	80,000	167,003	–236,300	87,003
3	Sudan	134,000	4,000	300	–130,000	–3,700
4	Zambia	150,000	41,000	29,231	–109,000	–11,769
5	Kenya	65,000	19,000	31,636	–46,000	12,636
6	CAR	63,000	19,000	3,334	–44,000	–15,686
7	Mozambique	54,800	18,600	26,088	–36,200	7,488
8	Somalia	24,300	6,000	70	–18,300	–5,930
9	Chad	15,000	3,100	6,435	–11,900	3,335
10	Uganda	6,000	3,000	6,559	–3,000	3,559
11	Ghana	3,500	1,100	1,429	–2,400	329
12	Malawi	4,500	2,400	2,727	–2,100	327
14	Cote d'Ivoire	4,000	3,300	965	–700	–2,335
15	Niger	1,500	800	102	–700	–698
16	Senegal	1,000	600	654	–400	–40
17	Mali	450	50	10	–400	54
18	Liberia	900	650	1,676	–250	1,026
19	Rwanda	150	70	117	–80	47
20	Sierra Leone	300	250	215	–50	–35
21	Angola	12,400	12,400	2,530	0	–9,870
22	Guinea	300	300	350	0	50
23	Swaziland	0	18	31	18	13
24	Togo	80	100	65	20	–35
25	South Africa	7,800	8,200	18,507	400	1,037
26	Nigeria	2,300	3,100	828	800	–2,272
27	Benin	900	2,100	1,223	1,200	–877
28	Burk. Faso	1,700	3,900	4,994	2,200	1,094
29	Namibia	2,700	5,000	19,103	2,300	14,103
30	Cameroon	16,200	21,200	15,387	5,000	–5,813
31	Ethiopia	900	6,650	1,760	5,750	–4,890
32	Zimbabwe	30,000	43,000	99,107	13,000	56,107
33	Botswana	20,000	51,000	175,487	31,000	124,487
34	Congo	10,800	70,000	22,102	59,200	–47,898
35	Gabon	13,400	76,000	70,637	62,600	–5,363
NA	Guinea Bissau	No data	20	20	No data	0
NA	Eritrea	No data	No data	104	No data	No data

Appendix 2: Ivory Market Data for 37 Sub-Saharan African Countries

	Country	Regulated ivory market?	Unregulated ivory market?	Bordering regulated markets	Bordering unregulated markets
1	DRC	No	Yes	0	3
2	Tanzania	No	No	0	2
3	Sudan	No	Yes	0	4
4	Zambia	No	No	3	2
5	Kenya	No	No	0	2
6	CAR	No	Yes	0	4
7	Mozambique	No	Yes	2	0
8	Somalia	No	No	0	1
9	Chad	No	No	0	4
10	Uganda	No	No	0	2
11	Ghana	No	No	0	1
12	Malawi	No	No	0	1
13	Eq. Guinea	No	No	0	1
14	Cote d'Ivoire	No	Yes	0	0
15	Niger	No	No	0	2
16	Senegal	No	Yes	0	2
17	Mali	No	No	0	0
18	Liberia	No	No	0	1
19	Rwanda	No	No	0	1
20	Sierra Leone	No	No	0	0
21	Angola	No	No	1	1
22	Guinea	No	No	0	2
23	Swaziland	No	No	1	1
24	Togo	No	No	0	0
25	South Africa	Yes	No	3	1
26	Nigeria	No	Yes	0	1
27	Benin	No	No	0	1
28	Burk. Faso	No	No	0	1
29	Namibia	Yes	No	3	0
30	Cameroon	No	Yes	0	3
31	Ethiopia	No	Yes	0	1
32	Zimbabwe	Yes	No	3	1
33	Botswana	Yes	No	3	0
34	Congo	No	Yes	0	3
35	Gabon	No	No	0	2
NA	Guinea Bissau	No	No	0	1
NA	Eritrea	No	No	0	2

Appendix 3: Civil Conflict and Corruption Data for 36 Sub-Saharan African Countries

	Country	Civil Conflict (1989–2007)	CPI score (2007)		Country	Civil conflict (1989–2007)	CPI score (2007)
1	DRC	Yes	1.9	20	Sierra Leone	Yes	2.1
2	Tanzania	No	3.2	21	Angola	Yes	2.2
3	Sudan	Yes	1.8	22	Guinea	No	1.9
4	Zambia	No	2.6	23	Swaziland	No	3.3
5	Kenya	No	2.1	24	Togo	No	2.3
6	CAR	No	2.0	25	South Africa	No	5.1
7	Mozambique	Yes	2.8	26	Nigeria	No	2.2
8	Somalia	Yes	1.4	27	Benin	No	2.7
9	Chad	Yes	1.8	28	Burk. Faso	No	2.9
10	Uganda	No	2.8	29	Namibia	No	4.5
11	Ghana	No	3.7	30	Cameroon	No	2.4
12	Malawi	No	2.7	31	Ethiopia	Yes	2.4
13	Eq. Guinea	No	1.9	32	Zimbabwe	No	2.1
14	Cote d'Ivoire	Yes	2.1	33	Botswana	No	5.4
15	Niger	Yes	2.6	34	Congo	Yes	2.1
16	Senegal	Yes	2.7	35	Gabon	No	3.3
17	Mali	Yes	3.6	NA	Guinea Bissau	Yes	2.2
18	Liberia	Yes	2.1	NA	Eritrea	No	2.8
19	Rwanda	Yes	2.8				