Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 6, No. 4, p. 177-196, 2015
http://www.innspub.net

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RESEARCH PAPER
OPEN ACCESS

The role of incentive mechanisms in wildlife management: A case study of Moyowosi Game Reserve and Serengeti National park, Tanzania

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Article published on April 21, 2015

Key words: Wildlife management, African elephant, incentive mechanism, market failure.

Abstract

This study aims to determine the efforts devoted in managing wildlife in national parks and game reserves in Tanzania. Specifically, the study focused on evaluating the population and poaching trends of African elephants (Loxodonta africana) in these protected areas that follow under two different management regimes. Furthermore the study identified sources of market failure and suggested economic incentive mechanisms that will improve conservation status of wildlife in Tanzania. Data from secondary sources were analyzed using Mann-Whitney U test in comparing the rate of population increases and poaching per annum for the two protected areas. The results showed that Serengeti National park has a significant higher rate of population increase of 15% than Moyowosi game reserve that has 9% only. Furthermore the study revealed that, Moyowosi game reserve has a significant high rate of poaching than Serengeti National park. Finally, due to having two different bodies that manage these protected areas, government market failure was identified in Moyowosi game reserve than Serengeti national park. Therefore the study suggests some incentives mechanisms that will help to improve the conservation status of African elephants in Moyowosi game reserve. These are decentralizing management of wildlife revenues to the specific game reserve that will increase benefit sharing schemes, review of wildlife hunting policy to make sure that concession hunting blocks are only given to the companies that abide with all three main aspects of being actively involved in anti poaching, community development, wildlife research and monitoring.

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Introduction

Tanzania, located in East Africa bordering the Indian Ocean between Kenya and Mozambique with coordinates of 6°°S , 35°°E, has a total landmass of 945,090 km² of which approximately 37.8% is devoted to protected areas. Of these protected areas, 26% is only for wildlife. The National wildlife policy of (1998) categorizes protected areas into seven groups namely National Park (NP), Ngorongoro Conservation Authority (NCA), Game Reserves, Game Controlled Areas, Marine Parks, Forest Reserves and Wildlife Management Areas (WMA) (map 1).

The African elephant (*Loxodonta africana*) is the primary wildlife species in Tanzania. It is the biggest terrestrial mammal in Tanzania and they are migratory mammals found within and outside the protected areas (Hall- Martin 1992). Tanzania has the highest number of elephants in the Eastern Africa region approximately to be about 108,816, TAWIRI, (2009). It is the second to Botswana that support the largest number of African elephant on the African continent AECG (2007). The African elephants play a vital role both in ecology and the economy Barnes *et al.* (1999) and Cumming et al. (1990). From an ecological perspective, Western (1989) argued that due to its large size and feeding behavior, the African elephants have a significant impacts on vegetation structures as well as in the food web ecosystem of other living organisms.

Several researches have been undertaken regarding African elephants population trends in Tanzania. For example, Douglass- Hamilton (1987) the research on African elephant's population trends and their causes. However, he says little or no regarding to the role of incentive mechanisms in improving the conservation status of African elephants in Tanzania. Dublin and Douglass-Hamilton (1987) they wrote on the status and trends of African elephants in the Serengeti-Mara ecosystem. They wrote little about incentive mechanisms and the conservation of African elephants in Tanzania. Moreover, the research of Galanti, Preton, Martinoli, Wanters and Tosi (2006) regarding the space and habitat use of the African elephant in the Tarangire-Manyara ecosystem, Tanzania. The research little reported about the role of incentive mechanisms towards the improvements of conservation status of African elephants specifically by comparing between national parks and game reserve in Tanzania.

The aim of this study was to evaluate the population and poaching trends of African elephants from 1980s using data from a wide range of reliable sources. Specifically, the study focused on the following aspects namely, evaluate the relationship of African elephants poaching trends between Serengeti national park and Moyowosi game reserve, establishment of a base line of conservation of African elephants by allowing policy makers to apply possible better decisions and incentive mechanisms for the benefit of the community and the ecosystem in general and creating and understanding of the population and poaching trends for the purpose of designing better wildlife conservation policies. For the future, the study holds lots of very useful to the management of all wildlife-protected areas in Tanzania. This research will support the managers of the wildlife- protected areas to lobby the government and its policy makers to ensure equal distribution of tangible benefits gained from the elephants to the local communities that live around the wildlife areas.

Material and methods

Study area

Serengeti National Park

The park was established in 1951 as Serengeti National Park being the first national park in Tanzania (URT 1998). Located in the Northern part of Tanzania and lies between Longitude of 34° and 36° and Latitude 3° 30' with an area of about 14,763km² (Leader-Williams 1996). Listed under UNESCO as a World Heritage Site and Biosphere reserve and designated in category II of protected areas by IUCN due to its national and international importance of biodiversity and endemism. Lamprey *et al.* (1967) argued that the first documented African elephants in

Serengeti National Park were in 1955 after the absence for about 40 years within the park, which was the immigration of African elephants from near areas like Maswa district and South-west Kenya following sport hunting and intensive cultivation and deforestation that destroyed their habitats. Following an enactment of the area as a national park in 1959 there was an intensive protection hence many animal species including elephants found a better place to stay and the population was increasing continuously unlike to other bordering areas like Mara in Kenya which were experiencing rapid deforestation (Leader-Williams 1996, Lamprey *et al.* 1967 and Watson *et al.* 1969).

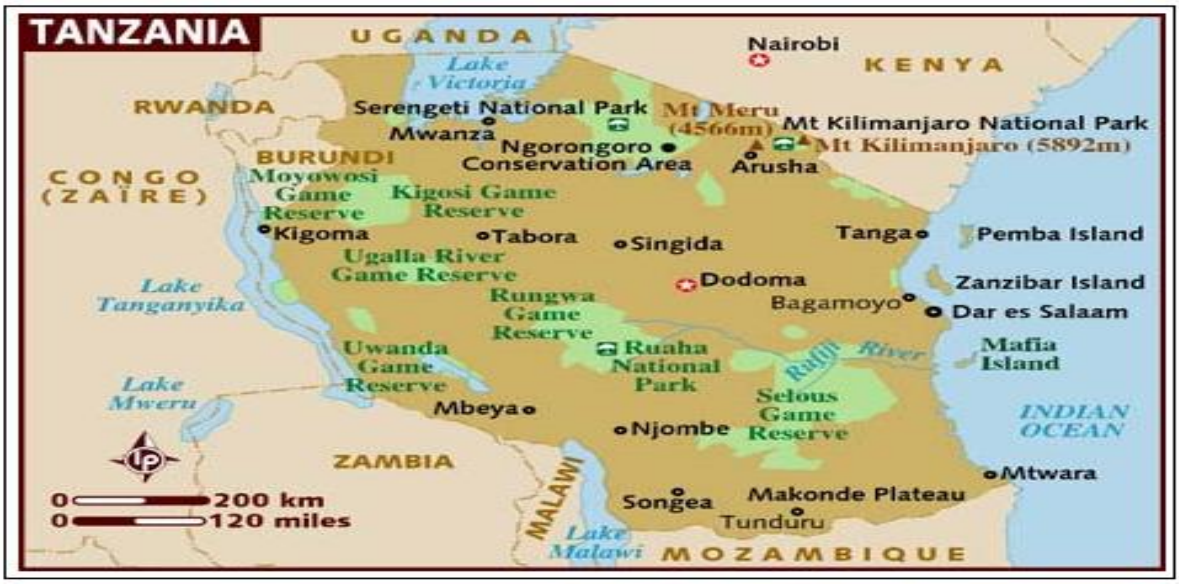

Fig 1. Tanzania Protected Areas (National Parks and Game Reserves).
Source: United Republic of Tanzania, 2012.

The park is managed by a parastatal organization known as Tanzania National Parks Authority (TANAPA) that was created in 1959 to oversee the conservation initiatives of all fifteen national (URT 1998). TANAPA is fully financed itself without government subsidies, no hunting and offering a full protection of fauna and flora. Revenues received from tourists are being used on fauna and flora protection, maintenance and administrative activities of the park ecosystem. Serengeti National Park (SNP) is among of the protected areas in Tanzania that support a potential population size of African elephants (Loxodonta africana) (Strier 1990). The population has been increasing since 1962 with a population number of 529 up to about 2,870 elephants in 2009 (TAWIRI 2010). However the park has been experiencing difficult seasons following a massive poaching of elephant during the mid 1970s up to late 1980s which was fueled by the increases of ivory prices resulted in a population decline up to 500 elephants (Blanc *et al.* 2007 and TAWIRI 2010).

Moyowosi game reserve

Moyowosi game reserve gazette in 1981, located in northwestern Tanzania, has an area of about 6000 km2 and forming the combination of Uvinza open area and Makere forest reserve that together form an area of approximately 3.1 million hectares see map 3 (John *et al.* 2013). It is within the Malagarasi – Moyowosi wetland forming the excellent large and east African flood plain ecosystem that is the first RAMSAR site of International importance in Tanzania (John *et al.*2013). Habitat of the area varies from large swamps to open floodplain and miombo forest, which is the dominant vegetation in this area and supporting a potential number of African elephants. The management depends on a 100% government subsidy whereby all revenues collected

from trophy hunting safaris are collected by the government central treasury account and are reallocated for other activities like agriculture and health services.

Data collection was undertaken through the use of two approaches namely; literature survey and study of elephants in the field.

Sampling of data was undertaken by obtaining research data from the two selected protected areas that are in different management regimes. In order to make the study significant and to give correct results a sample of 1000 elephants were taken from each case study and compared in an area of 10,000ha to get the rate of poaching and the significant % populations increase respectively.

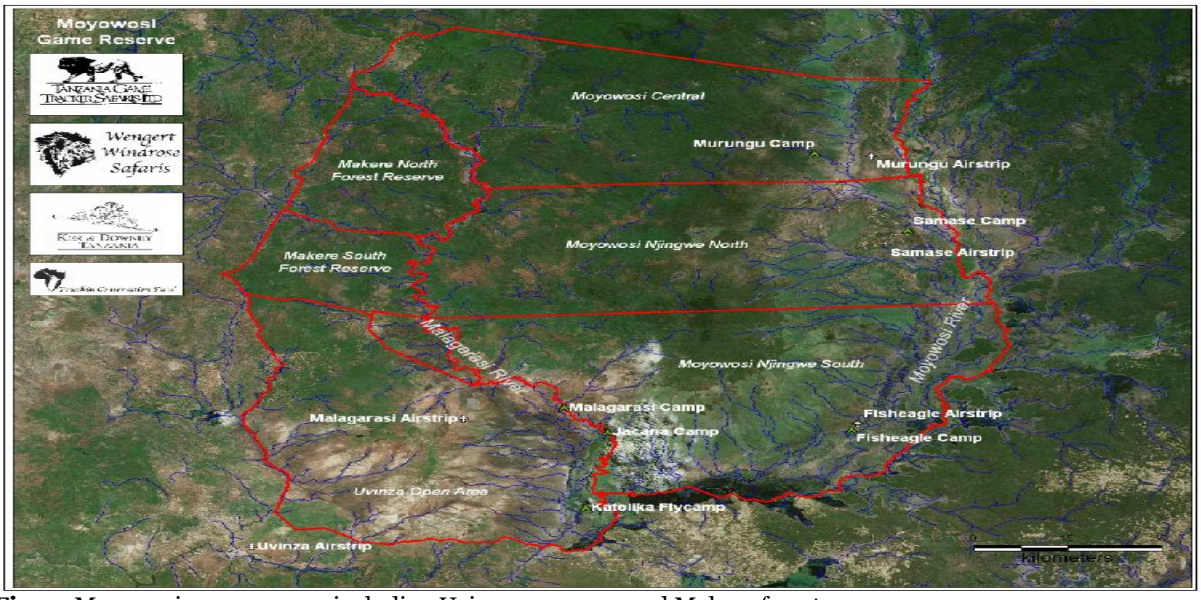

Fig. 2. Moyowosi game reserve including Uvinza open area and Makere forest reserve.
Source: Friedkin Conservation Fund (FCF), GIS & Research department, 2012.

Data collection was undertaken through the use of two approaches namely; literature survey and study of elephants in the field.

Collection of data for this study was obtained from secondary sources such as , intensive review of publications and reports from both local authorities as well as National and International reports including; TANAPA, Ministry of Natural Resources and Tourism, TAWIRI, WD, AESR, AESG, IUCN/SSC, UNEP and UNESCO.

Research hypothesis

During investigating annual population trends and the rate of poaching in both two case of study, the research hypothesis were stated as H_1- "Serengeti national park have high percentage annual rate of increase of elephant population than Moyowosi game reserve in an area of 10,000ha"

H_o- "Both Serengeti and Moyowosi have the same percentage annual rate of increase of elephant population in an area of 10,000ha" H_2- Moyowosi game reserve has high annual rate of poaching than Serengeti national park with a sample of 1000 elephants" H_o- "Both have the same annual rate of poaching with a sample of 1000 elephants"

Research questions

What is the current status of the African elephant population in Tanzania?

What is the percentage annual rate of increase of elephant population and rate of poaching in Serengeti national park and Moyowosi game reserve?

Table 1. Total number of African elephant estimates in East Africa – 2006.

Country	Surveyed range area (Km²)	No. Of Elephants estimated
Eritrea	5,293	96
Ethiopia	38,365	634
Kenya	107,113	23,353
Rwanda	1,014	34
Somalia	4,526	0
Sudan	318,239	20
Tanzania	390,366	108,816

Source: African Elephant Status Report, 2007.

Despite the recovery of African elephants in Tanzania, the increase in population is inconsistent across the country. It is declining in many protected areas and is either increasing or maintaining a healthy rate in other areas TAWIRI, (2010) and Blanc et al. (2007).

Table 2. Population size of African elephants in Serengeti National Park by zones: survey from 1986 – 2009 by Tanzania research Institute –TAWIRI.

a. Northern zone

	1986	1992	1994	1998	2000	2003	2006	2008	2009
Lamai	0	13	2	168	140	50	272	30	176
Mara-Tabora	0	0	0	0	0	0	12	22	274
Nyamalumbwa	56	38	232	122	296	186	34	123	154
Lobo-Tabora	19	19	119	130	0	289	184	1003	1003
Tagora-Lobo	491	491	195	134	66	24	80	578	126
Total	566	561	548	554	502	549	582	1,756	1,733

b. Central zone

Block/year	1986	1992	1994	1998	2000	2003	2006	2008	2009
Banagi-Ikoma	6	3	0	143	371	169	422	393	253
Glumechen	144	140	90	788	175	211	53	201	262
Musabi	28	0	25	287	36	0	95	293	194
Total	178	143	215	1,218	582	380	570	887	709

c. Western zone

Block/year	1986	1992	1994	1998	2000	2003	2006	2008	2009
Western corridor	0	0	0	25	159	26	178	286	10
Dutwa	0	0	0	0	66	0	66	55	39
Sub total	0	0	0	25	222	26	244	341	49

d. Plains and Southern zone

Block/year	1986	1992	1994	1998	2000	2003	2006	2008	2009
Simiyu-makao	0	0	0	0	0	0	0	49	379
Plains	0	0	0	12	0	141	0	117	0
Sub total	0	0	0	12	0	141	0	166	379

Sources: Tanzania Wildlife Research Institute, 2010.

What are the factors that affect directly or indirectly its population?

What are the sources of market failure that have impacted the elephant's population?

What incentive mechanisms available that could be implemented to improve the African elephant conservation status.

Literature review

Status of African elephants population in Tanzania

According to the African elephant population count survey undertaken across Tanzania by TAWIRI in

2009 there were approximately 109,052 elephants. This shows an annual population increase of about 3.3% since the 1980s when the population was estimated to be 55,000 elephants. This count followed a period of intensive poaching as a result of the demands of the ivory trade TAWIRI,(2010), Barnes et al. (1999), Blanc et al. (1995), 1998, 2002 and 2007). Tanzania is the only country in Eastern Africa to have a high number of African elephants and second to Botswana on the African continent that has a total number of African elephants of approximately 133,829 (Blanc et al. 2007) (table 1).

Table 3. Number of elephant counted in Moyowosi game reserve from 1994 – 2006.

Year	Area surveyed km²	# Of elephants counted	Source
1994	21,869	1,583	TWCM 1995
1998	21,870	2,262	TWCM 1998
2000	21,870	2,861	TAWIRI 2000
2006	20,262	3,657	TAWIRI 2007

Source: Friedkin Conservation Fund, 2008.

Table 4. Human population growth trends of Tanzania.

Year	2007	2008	2009	2010	2011	2012
Population(Millions)	38.7	40.2	43.7	45.0	46.2	47.7
Growth Rate (%)	2.6	2.3	2.3	3.0	2.9	3.0

Source: Population Reference Bureau. (http://www.prb.org).

In Tanzania, African elephants are mainly distributed in the southern, western and northern areas (TAWIRI, 2010) and their population movements are determined by the availability of food, water, sex, age as well as social behavior (Grainger et al., 2005, Sukumar, 2003 and Thoules, 1995). It has also been observed that the majority of African elephants are found outside the protected areas especially during the dry season when they go out searching for water and food (Jackson and Erasmus 2004).

Table 5. Number of elephant killed in Serengeti national park 2002-2008.

Year	Elephant killed
2002/2003	1
2003/2004	0
2004/2005	0
2005/2006	1
2006/2007	2
2007/2008	0
Total	4

African elephants distribution in Tanzania

The distribution of the African elephant within an ecosystem depends entirely upon the availability of food. This is supported by several research studies undertaken Laws (1970), Laws & Parker (1968) and Dublin et al. (1990) who have argued that the population of African elephant tends to be large where there is food. This is primarily due to the fact that African elephants are entirely herbivores: non-selective on their forage, feeding on fruits, leaves, shrubs, roots, seeds, shoots barks and stalks. Season changes play a significant role in driving the movement of elephants. During the dry season elephant tent to move long distances even outside the

protected areas searching for water and food where as during the wet season they tend to be concentrated within a protected area (Hamilton 1972, Barnes 1983, Pringle 2008).

African elephants are broadly scattered over a total area of approximately 49 percent of the entire landmass of Tanzania (Blanc et al. 2007). According to Said et al. (1995), elephants in Tanzania are found in 31 out of the 34 Game Reserves, Ngorongoro Conservation Area, 12 out of 14 National Parks, game controlled areas, forest reserves and open village lands. The major populations of elephants are concentrated in the south and western part of the country (Blanc et al. 2003, 2005 & 2007, TWCM 1995, 1997 & TAWIRI 2007).

Table 6. Number of elephant killed illegal Moyowosi game reserve 2007 – 2013.

Year	No. Of elephant killed illegal
2007	24
2008	9
2009	0
2010	6
2011	56
2012	0
2013	1
Total	96

Source: Friedkin Conservation Fund-FCF.

Table 7. Estimates of the number of African elephant Population in African countries that conduct trophy hunting.

Country	Number of elephants
Botswana	133,829
Tanzania	108,816
Zimbabwe	84,416
South Africa	17,847
Zambia	16,562
Mozambique	14,079
Namibia	12,531
Cameroon	179

Source: African elephants status Report, 2007.

Also available in http://www.african- elephants.org/aed/aed/index.html

There has been a rapid decline of African elephants population in Cameroon from 2,006 counted in 2002 up to 179 counted in 2006.

Being broadly locating the elephants across the country Mduma and Sinclair (2003) categorized the habitat range of elephants into seven ecosystems located in Ugalla – Katavi, Selous, Great Ruaha - Ruangwa, Tarangire – Manyara, Serengeti – Mara, Selous – Niassa and Mt. Kilimanjaro – Amboseli. These ecosystems allow elephants to move from one protected area to the other through the corridors.

Apart from food availability, their social structure also determines their daily movements hence dictating the population distribution of African elephants (Vance et al. 2009). A family group that comprises several females and immature males individuals dominates

the social behavior and structure of African elephants. It is estimated a family group comprises between 1 to 20 elephants in one family group and as a male reaches maturity they normally leave the group and form the bachelor group (Douglas- Hamilton 1972).

Table 8. Number of Quotas together with number of Elephants hunted in 2007.

Country	Quotas	Specimen (Number of elephant hunted)
Botswana	600	300
Tanzania	400	200
Zimbabwe	1000	500
South Africa	200	100
Zambia	40	20
Mozambique	80	40
Namibia	180	90
Cameroon	160	80

Source: CITES 2007.

Elephant – habitat interaction

The relationship between African elephants and their environment is a very important aspect in evaluating population trends in an ecosystem. TWCM (1994) and Dublin et al. (1990) the population of African elephant tends to be large in a habitat that has a potential availability of food and water. Due to having large feeding capacity, elephant has a large ability to convert forest or woodland into grassland (Pringle 2008). Furthermore Wright & Jones (2006) argued that the African elephant is one of the key wildlife species in an ecosystem with a big influence on altering the habitat.

Table 9. Number of Quotas together with number of Elephants hunted in 2012 for countries that conduct elephant hunting in Africa.

Country	Number of tusks	Quotas (Number of elephant hunted)
Botswana	800	400
Tanzania	400	200
Zimbabwe	1000	500
South Africa	300	150
Zambia	160	80
Mozambique	200	100
Namibia	180	90
Cameroon	160	80

Source: CITES 2012.

http://www.cites.orh/common/quotas/2012/Export Quotas 2012.pdf.

Moreover there is a big interaction between an increase in the elephant population within a specific habitat and an increase of the rate of habitat degradation. Hamilton (1972) argued that the impact of African elephants within the habitat seems to be a very common aspect in most of the protected areas especially in protected areas with large numbers of elephants. Despite of the known negative impact of African elephant in converting forest/ woodland into grassland, this effect seems to favor the large population of small animals who entirely depend on open grassland. Dublin et al. (1990) argued that the

overpopulation of African elephants which tends to change the habitat into open grassland also help the survival of small animals like lizard and invertebrates.

Current population of African elephants in the two case studies

Factors affecting the survival of African elephants in Tanzania: Market failure

There are several inter-related factors that influence the decreasing population rate of African elephant (*Loxodonta africana*) in Tanzania. TAWIRI (2010) described these factors as human population growth and type of protected area (Forest or Savannah). In this regard, CITES (2012) argued that the level of protection of an area and human accessibility to an area (for example through roads, logging or mining) are also factors to consider. Blanc et al. (2003, 2005 & 2007) stated that corruption, educational awareness and political instability of a many African countries affect the population of African elephants. Despite the range of factors presented by these, this study only considers three main factors: human population growth, illegal hunting (poaching), and legal trophy hunting of African elephants.

Table 10. Tanzanian number of Quotas, according to year and estimated population size.

Year	Quotas	Number of elephants
1998	50	67,416
2000	50	
2001	50	
2002	50	92,453
2003	100	
2004	100	
2005	100	
2006	100	108,816
2007	200	
2008	200	
2009	200	109,051
2010	200	
2011	200	
2012	220	

Sources: CITES 2012 and African elephants status report.

The table gives the relationships between the number of elephant surveyed and the number of allowed quotas the country allowed to hunt from CITES.

Human population growth

Tanzania is estimated to have a total population of about 47million people with a population growth rate of 3% per annum (PRB, 2012) table 3. The rapid population expansion has resulted in increased economic activities resulting in the depletion of natural resources (Blanc *et al.* 2007 and UN 1993). Kurji (1977) argued that rapid human population growth creates a competition in the utilization of the natural resources between human and the wildlife thereby creating conflict.

Approximately 80% of Tanzanian depends upon subsistence farming that is accompanied by clearing of forests (DANIDA 1989). URT (2013) state that 80 % of the forest areas in Tanzania are categorized as general village land, which also support a potential number of wildlife species. It is clear then, that the rapid expansion of the human population, which has led to increased agriculture and settlement, can have an enormous impact upon the habitats of the elephants and their consequent survival.

Poaching of African elephants (Loxodonta africana) in Tanzania

After the 1980s a population count of African elephants (Loxodonta africana) revealed a stark decline in their numbers attributed primarily to illegal hunting (Douglas- Hamilton 2000). The poaching trend of African elephants in Tanzania

differs from one protected area to the other due to the different level of management refer table 5 and 6).

Matured elephant bulls are the first victims of being poached because they have a large tusk (Douglas-Hamilton 1987). As the numbers of large bulls dwindle, poachers are forced to kill more elephants with smaller tusks in order to maintain their profit levels (Messer 2000). The high demand for ivory evidenced by the increasing market prices, simultaneously contributed to the large-scale slaughter of African elephants in Tanzania. The availability of sophisticated weapons used in neighboring countries embroiled in civil wars has increased, resulting in a high level of poaching in protected areas (Douglas- Hamilton 2000). Tanzania has been a member of CITES since 1980 and has included, African elephants in appendix I of CITES species management category. Given that control is restricted by the boundaries of each signatory to the contract, unregulated markets in the neighboring countries of Tanzania such as Burundi and Rwanda, continues to provide opportunities for poachers to continue their trade proposition supported by Courouble et al. (2003). The increase of ivory prices in Asian countries reflecting high demand since the late of 1980s has fueled the continued poaching of the African elephant (Douglas-Hamilton 2000 and CITES 2012). Under economic aspect the poachers have to increase their supply of ivory into the market to meet the demand and achieved by the poaching of more elephants (Robinson 2012) as represented in figure below.

Table 11. Comparison of African elephants population and poaching trends in the two case studies (Descriptive statistical).

	N	Minimum	Maximum	Mean	Std. Deviation
Pop_Moyo	3	4.64	13.24	9.5336	4.42337
Pop_SNP	3	4.19	33.88	15.7313	15.90917
Poac_Moyo	7	.00	12.77	3.3327	4.76301
Poac_SNP	6	.00	1.43	.5102	.60599
Valid N (list wise)	3				

N.B:

Pop_Moyo- elephant population for Moyowosi, Pop_SNP-elephant population of Serengeti National Park, Poac – represents poaching for Moyowosi and Serengeti.

The table 11 shows that the mean % increase of population per year per 10,000 hectares, Serengeti national park has significantly higher population rate of increase of 15% than Moyowosi having 9%.

African elephant trophy hunting

Tanzania is one of eight countries in Africa that permit African elephant (Loxodonta africana) trophy hunting (CITES 2012). The Tanzania National Wildlife Policy of 1998 stated that the spot hunting of elephant limits trophy hunting in the game reserves, game controlled areas, wildlife management areas and open areas. The national wildlife policy also states that the trophy hunting of any kind of wildlife species is not permitted in the National parks, which are only designated for photographic tourism. However all of the National Parks are surrounded by protected areas where trophy hunting is allowed. As such, elephants in national parks are in fact being targeted for trophy hunting as they move or migrate through all the areas.

According to the CITIES (2012), trophy hunting of African elephants (Loxodonta africana) is only permitted in eight countries across the African continent including Tanzania. Six years earlier, Gabon was also part of this contingent of countries that permitted trophy hunting (CITES 2012) but has since outlawed the practice. The justification provided by the remaining eight countries is that trophy hunting is sustainable with the population of the

elephants (refer table 6). These countries can increase their hunting quotas year by year in order to increase the revenues gained from trophy hunting (Table 7). Tanzania is the only country in the eastern Africa regional that deals with the sport hunting of wildlife including the African elephants (TWP 1998). However an examination of the literature reveals that there is very little understanding of whether trophy hunting of an African elephants affects its population status, indeed some literature (Basson et al. (1991), Martin, (2005) and Pilgram & Western (1986a) questioned the sustainability of elephant trophy hunting.

Also available in elephants.org/aed/aed/index.html http://www.african

There has been a rapid decline of African elephants population in Cameroon from 2,006 counted in 2002 up to 179 counted in 2006.

The table gives the relationships between the number of elephant surveyed and the number of allowed quotas the country allowed to hunt from CITES.

Economic perspective of elephant conservation

Under ecological and environmental economics studies several sources of environmental problems have been identified. However most of them point out that there are three causes of environmental problems namely; market failure, policy failure, and institutional failure, that are closely related (Commons 1968, Field 2005, Ostrom 2003, Fischer et al. 2011 and Elizabeth et al. 2013). Bromley (1999) pointed out that because most of the protected areas are public assets, then market failure is likely to occur.

The concept of market failure is an important question and key word in this study. However the concept here is focusing on how the government has failed to manage the habitat and the potential population of African elephants (Loxodonta africana) in Tanzania hence resulting upon decline of the population (TAWIRI, 2007). According to the National Wildlife Policy (1998) all wildlife-protected areas are designed public goods. Furthermore, as such majority of Tanzanians believe that they are not solely responsible for the conservation of resources within the wildlife-protected areas (Maduhu, 1999). This perception has lead to over exploitation of the natural resources including the African elephants.

The common property right as stated by Hardin (1968) is the right to use the resources in such as a way that the use by one person does not affect or exclude the use of another and it is the causes of externalities. More concern in this particular case as highlighted by McCay & Acheson (1995), the common property system considers social equity a priority over the sustainability of the resource itself.

The nature and level of protection of these wildlife-protected areas motivates poaching of the African elephants (*Loxodonta africana*) in Tanzania. With reference to figure 2, because protected areas are government owned, poachers are killing the elephants at Q2 without paying the cost of killing at price P2, it is able to free ride into the protected areas. As a result they increase their Marginal Private Benefits (MPB) without considering the Marginal Social Costs (MSC) of taking off the elephants (Robinson, 2012).

Incentive can be viewed as a catalyst of motivating people to engage, or stopping people from engaging in a certain action. It is a service to induce or motivate or a bonus for high production (Elizabeth et al.2013). In attempting to motivate or prohibiting people from engaging with a certain action, policy makers have to formulate or modify a specific incentive that can help to achieve the implementation of the policy as argued by Robinson (2012) .The design of the policy, policy makers apply three basic mechanisms namely facilitative, induce, and compel change or a combination of the three. URT (1998) states that about 25 percent of the total wildlife revenue from the respective hunting block goes directly to the respective district as a community support. When the

money received by the district, the distribution is politically decided whereby the ward chancellors vote for that. It has been observed that the fund can be distributed to a village that is even not close to the wildlife areas or the money can be used for administrative purposes in the district (Personal observation and communication).

Data analysis

Research data were entered into Microsoft Excel, Word (Microsoft 2011) and Statistical Package for Social Science (SPSS) for statistical analysis of elephant abundance and distribution in each protected area. During data analysis using SPSS, Mann- Whitney U test for descriptive statistics was used in comparing the significant population changes and the significant rate of poaching in each case per year. Literature quantified the rate of elephant population and poaching increase or decrease.

Results and discussion

Five findings emerged during the study. (1) Serengeti national park has a significant increment of number of elephants when comparing to the total area of each protected area refer (table 11), (2) the distribution of elephant within protected area differs from one zone to another and from season to season, (3) the rate of elephant poaching in Moyowosi game reserve is significant high than in Serengeti national park (4) The viable number of elephant obtained depends on the type of method used for counting and the season of the year (5) Market failure is identified in Moyowosi game reserve more than Serengeti national park.

Table 12. Hypothesis test for the elephant population in two case studies.

Hypothesis Test Summary				
	Nill Hypothesis	Test	Sig.	Decision
1	The distribution of Population is the same across categories of Group	Independent Samples Mann Whitney U Test	.000	Reject the null hypothesis

Asymptotic significances are displayed. The significance level is .05.

Elephant population number in Serengeti National Park

Serengeti National Park has a significant annual increase in number of elephant population having an annual average increase of 15.73 that is about 15 percent per year (table 11 and 12). The results reject the null hypothesis and argue, "Serengeti national park has a significant increase of population number of elephant compared to Moyowosi". The findings is also supported by previously research done by Blanc et al. 2007), TAWIRI (2007) and Said et al. (1995) both have argued that Serengeti National Park has a potential increment in number of elephants due to good management of the park.

Table 13. Comparison regard to the rate of poaching for the two case studies.

Hypothesis Test Summary				
	Nill Hypothesis	Test	Sig.	Decision
1	The distribution of Poaching is the same across categories of Group	Independent Samples Mann Whitney U Test	.000	Reject the null hypothesis

Asymptotic significances are displayed. The significance level is .05.

The results from table 2 shows that the African elephant populations total count from 1986 – 2009 in four zones are increasing and evenly distributed. Availability of forage and many water sources the makes northern zone the most favorable area for elephants in the park (TAWIRI 2010). The elephants

are increasing in numbers whereby in 1986 were 566 and in 2009 were 1,733 elephants. More elephants were found in Lobo – Tabora block and Mara- Tabora block support a small number of elephant.

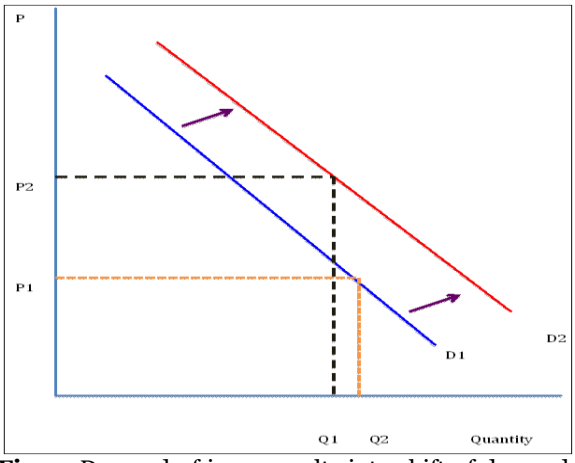

Fig. 1. Demand of ivory results into shift of demand curve from D1 to D2 and rise of price from P1 to P2.

Central zone supported a total number of elephants of about 4,882. Western zone from 1986 to 2009 supported a total number of 907. The southern and plains zone support very low number of elephants of about 698, Simiyu-makao support 428 and plains 270 elephants. The general increase or decrease of population size is because of the movement of elephants searching for forage and water especially during the dry season and moving to the areas that was not covered during the total count of elephants (TAWIRI 2010).

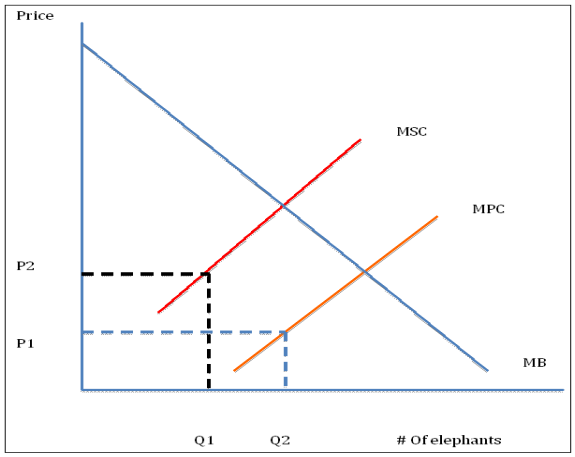

Fig. 2. Level of poaching that has lead into overexploitation (Negative externalities).

Moyowosi game reserve

Population estimates in Moyowosi game reserve 1994- 2006.

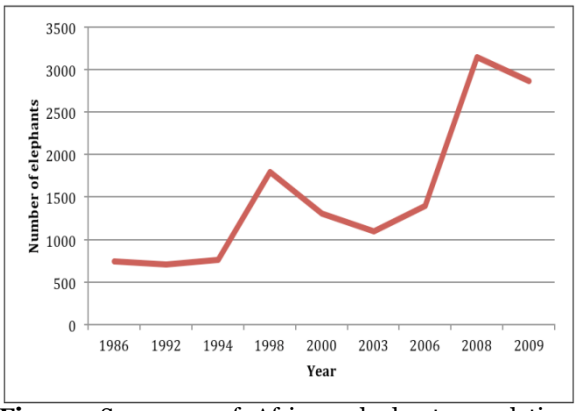

Fig. 4. Summary of African elephant population trend in Serengeti National Park 1986 – 2009.

From the results presented in table 11 shows that Moyowosi game reserve has an average annual percent of population increase of 9.53 that is about 9% increase per year. Therefore the null hypothesis is rejected and the study argue that Moyowosi have a low average mean of population increase per year (table 12). However even if while the annual increase seems to be low during comparison with Serengeti national park, the population of elephants in Moyowosi seems to be increasing as argued by TAWIRI (2007 and 2010) that, there is an increase in number of elephant whereby in 1994 and 2006 about 1,583 and 3,657 were counted respectively. The increase in 2007 is due to the fact that the large area surveyed in 2006 was done outside the game reserve (TAWIRI 2007). Dublin et al. (1990), Barnes (1983), Jackson and Erasmus (2004) have argued that large numbers of African elephants are found outside the protected areas. Hence it is very obvious in regard to Moyowosi game reserve population survey.

Based on the sample of 1000 elephants from each case of study, the results rejects the null hypothesis (table 13) this means that Moyowosi game reserve have a high rate of poaching having annual average rate of about 3.3% compared to Serengeti having about 0.5% only.

The poaching rate of African elephants in Moyowosi game reserve is very high while comparing to

Serengeti National Park. From 2007 up to 2013 about 96 elephants were killed illegally in Moyowosi game reserve, making an average of 13.7 elephant to be killed every year (refer figure 6). Where as in Serengeti National Park from 2002 – 2008 about 4 elephants were killed and making about 0.7 elephant killed every year (figure 5).

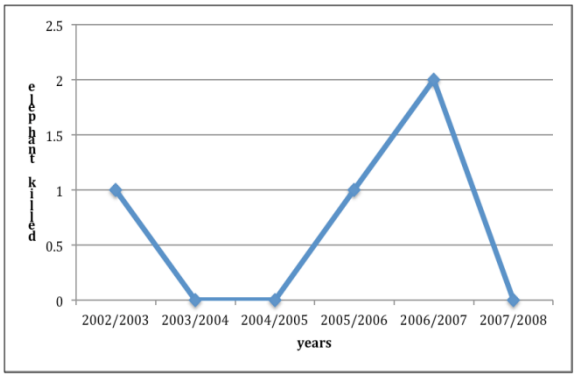

Fig. 5. Number of African elephant killed in Serengeti National Park 2002- 2008.

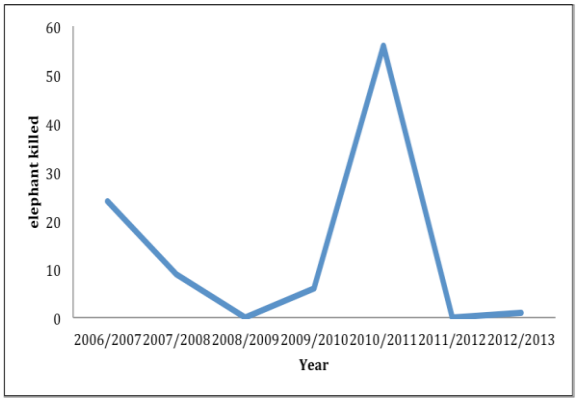

Fig. 6. Number of African elephants killed by poacher in Moyowosi game reserve 2007 – 2013.

Although the population number in both shows constant increase of elephants, the high poaching rate in Moyowosi game reserves is affecting the population. The difference in the rate of poaching justifies the market failure of the government in managing game reserves as also argued by Blanc et al. (2007). The total dependence of subsidy from the government in managing Moyowosi game reserve results high rate of poaching (TAWIRI 2010). Example in 2012 results shows that there was no elephant killed but it is because the whole year they didn't have enough funds to undertake anti poaching activities (figure 6). In Serengeti national park the protection of elephant is good because 100 percent of the tourist fees received is used back for protection and management activities within the park and not like in game reserve where it is taken by the government to the central treasure.

Conclusion

In conclusion, findings show that the number of elephant is increasing in both case studies. The analysis of the relationship between the total areas and the number of elephants of each case study, findings shows that Serengeti have significant increase of elephant population per year. My findings relate to the findings of TAWIRI (2010) that Serengeti has population annual growth rate of 5%. The rate of poaching per year per 1000 elephants is high in Moyowosi game reserve than in Serengeti national park. Poaching, human population increases that are accompanied by encroachment for agriculture and unplanned settlement and insufficient and poor allocated financial incentives for conservation are among of the factors identified that affect elephant's population. The study argues that the high increase in number of elephants and low rate of poaching in Serengeti national park is because of availability of management fund due to centralized collection of fund.

The findings identified that the exactly number of elephant counted depends on the size area covered and the method used in counting animal (total counts or systematic reconnaissance flight survey). Total count method seems to give the reliable population number of elephants than systematic reconnaissance flight survey method (TAWIRI 2010). With example of Moyowosi game reserve whereby in 2000 counted 2,861 and in 2006 counted 3,657 African elephants, which was the result of covering a big area in counting (TAWIRI 2010). Therefore there is an urgent need for the government to design policies for creating incentives to the local communities and the management of the reserve so as to improve the management of elephants.

This study will stimulate future research in the following issues.

Research on the willingness to accept for the local communities not to cultivate the land that is closed to the game reserves and national park so as to maintain the elephant corridor.

Study of the population size of all villages that surrounds protected areas and the rate of encroachment particularly for agriculture and settlement.

Designing policy that will help the uses revenue from wildlife by the game reserves for wildlife protection and community based development projects as conservation.

Stop legal elephant trophy hunting that are offered by CITES because it is difficult for the consumers to differentiate between legal and illegal ivory in the market, hence will be easy to trace.

In reducing/ stopping the supply of ivory two things has to be done (1) to go to the consumers to educate them by graphically presenting how elephants are being slaughtered and its effect and show the possible substitute of ivory (2) Joint national agreement between Tanzania and most consumer's country like China to ban the ivory trade.

More capacity building/awareness with regards to wildlife management for all stakeholders including local communities on land use plans.

Motivate management partnerships between different stakeholders and government sectors like agriculture and mining that affects directly elephant habitat management.

Acknowledgement

My profound gratitude goes to Dr. Jackie Robinson from the school of economics, University of Queensland, Dr. Paul Dargusch and Sebastian Thomas from the school of Geography, Planning and Environmental Management, University of Queensland for spending many hours with me during the whole period of this study. I do appreciate the support of fund for this work research from Friedkin Conservation Fund, Tanzania. Also my sincerely thanks goes to Mr. Keith Roberts and Elliot Kinsey from the Friedkin Conservation Fund, Tanzania for great support during data collection and organizing my work. They also make me well motivated, inspiring and keeping me on track. I also thank Joyce Poole from the Elephant voice, Nairobi Kenya for helping a lot during data collection. Finally I would like to give my thanks to Mr. Emmanuel Dawson Kaaya and Rehema Kaitira, ecologists, Serengeti National Park for tireless help during the whole process of data collection and assisting me to proofread my work.

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