

Privilege Cheteni (South Africa)

An analysis of antipoaching techniques in Africa: a case of rhino poaching

Abstract

In the last decade the African continent has been facing a number of incidences on rhino poaching and we may be heading to rhino extinction. A number of strategies have been tried and tested to protect the rhinos in Africa. However, rhinos killed by poaching are ever increasing. Based on previous strategies to protect rhinos very little has been achieved in combating rhino poaching. This study employed an exploratory research approach whereby literature search and case analysis are used to draw conclusions on the effectiveness of the current poaching techniques. This study investigates whether the current conservation methods are still useful in addressing poaching. Literature reveals that most methods have failed to protect rhinos. Therefore, forensic tests, shoot to kill policy and new strategies maybe the only way to avoid rhino extinction.

Keywords: rhinos, poaching, strategies, conservation.

JEL classification: Q01, Q50, Q56, Q57.

Introduction

Human continuous destruction of the environment, diseases and food security are the real threats to the existence of the mammals in Africa. The black rhinoceros (*Diceros Bicornis*) and the white rhinoceros (*Ceratotherium simum*) have been the victims of human calculated environment destruction. The numbers of African rhinos have decreased during the past 20 years at an alarming rate due to poaching. A rhino horn is fetching about US \$60000-80000 on the black market according to the Convention on International Trade in Endangered Species (CITES) statistics for 2012. The most notable decrease is the Black rhinoceros that have been classified as endangered species because of its dwindling population. The Convention on International Trade in Endangered Species CITES (1977) classified trade in rhino horn as illegal. This ban has achieved limited impact in curbing poaching around the African continent due to the lucrative black market in the Far East Asia. The rhino horn is high in keratin which is used as a medicine in the Far East Asia and as a trophy in Yemen (Sas-Rolfes, 2012).

Black rhinos are projected to be numbered at about 4840 while the white rhinos are pegged at 20150 (www.iucnredlist.org). The intensity of poaching is a serious setback to all the efforts that have been directed by conservationists in trying to replenish the rhino population in Africa. Of particular concern is the intensity of rhino poaching in Southern Africa that threatens to undo all the efforts that have been made to avoid the extinction of rhinos. South Africa and Zimbabwe are countries that are most likely to destroy conservations efforts because of rampant poaching considering that South Africa alone has more than 93% of the white rhino population in Af-

rica (www.gov.za). The rhino population expansion is attributed to the success of conservation methods that have been implemented since 1970s when poaching was at its maximum (Emslie and Brooks, 1999).

Conservationist benefit in the upkeep of rhinos through tourism, hunting and live sales (Child, 2012). However, the costs of keeping rhinos have increased due to poaching and this has made rhinos a liability. Some of the conservationists are believed to be in dilemma if whether they should keep rhinos or sell them to the rhino market because the costs of maintaining them are high (Child, 2012). This crisis is intensified by poachers who are armed and dangerous, and who would kill to escape from authorities. Therefore, Africa is now at the same place as America was during the period of 1900 to 1933 when the Bison mammal was hunted to extinction. Wildlife was nationalized in the line of this threat as it was believed that it was overutilized (Guthrie, 1990). Conservation of rhinos poses a greater challenge considering that the needs of wildlife are so much incompatible with human activities. Sukumar (1991) asserts that large mammals are a potential threat to agriculture and human life and their survival outside conservation is often low. Further, Leader-Williams et al. (1990) deduces that survival of species whose body parts are of commercial value is problematic. These factors highlight the complex nature of rhinos survival in any environment. Although extensive academic research has explored the causes of poaching, ways of conservation and biodiversity preservation (Barnes & Jones, 2009; Barnard, 1998; Leader-Williams, 1990; Miliken et al., 1993, Western, 1987) limited research has investigated the effectiveness of conservation methods (Child, 2012; Kahler, 2010; Nelson, 2006).

The increase in poaching conveys a need for research that goes beyond just identifying conservation methods, but weigh in different methods and

their effectiveness. This need is illustrated by few studies assessing why poaching is on the increase yet the methods are believed to be working (Child, 2012). This highlights a major gap in environmental research which needs to be filled with new ideas in trying to curb poaching.

The purpose of this study is to answer the questions: “If the Rhino horn trade was banned in 1977 then why are rhinos still threatened in the 21 century?”. “Does this mean it is high time new approaches to poaching are devised?” This paper serves to analyze the current conservation methods that are relevant to the protection of rhinos or are fuelling poaching in the African context using empirical literature from different scholars. As well as evaluate previous conservation methods taken to curb poaching. A review of literature to address where poaching started in Africa is discussed. This is followed by an analysis of conservation methods that have been used in trying to curb poaching in Africa. Lastly, a conclusion is given on what is best for African conservation at this point in time.

1. History background of poaching in Africa

In 1970s the Black rhinoceros population decreased from 6500 to less than 1500 in 1980s (Emslie & Brooks, 1999). The decline was so huge to an extent that Parker and Martin (1979) pointed it to poaching for horns. The most notable decrease were in Kenya in the Maasai area. In a quest to stop poaching the Kenyan government attempted to turn the Maasai settlement lands into an area exclusive to wildlife and tourism (Western and Grimsdell, 1979). However, this was viewed by the Maasai people as a direct confrontation and they speared rhinos. The rhino spearing was only done as a response to the government action of taking their land (Western, 1973). Consequently, the government stance of conversion of land for commercial gain made rhino horns profitable, thereby attracting poachers outside Kenya (Martins, 1980). In a quest to squash poaching the Kenyan government implemented anti poaching methods. However, the rhinos continued to decline because most rhinos were killed outside tourist viewing areas and mostly speared (Western, 1982).

In 1977 the decline of rhinos ended and the reversal was attributed to that Maasai people were officially excluded from national park and could not bring in their livestock (Western, 1982). On the other hand, Western and Henry (1979) asserts that in 1977 the Maasai people were given financial returns from the national park and therefore were sympathetic to wildlife. Moreover, the authors point out that financial returns were the major incentive that led to a

decline in poaching than excluding them from the national park. A study by Leader-Williams et al. (1990), noted that the decline of rhinos were mainly caused by problems originating outside the protected areas, such as the increasing price of the horn in the international markets and a decline in economic opportunities for local people living in those protected areas. The study holds that law enforcement is very effective in protecting rhinos in small areas and population. However, in situations where the rhino population is large it is less effective.

Due to poaching in 1977 CITES classified the black rhino under Appendix I¹ which marked the ban on trade of horn species and products. TSas-Rolfe (2000) insists that the ban from CITES was not successful in reducing demand for the rhino horn even though some countries in Africa recorded noticeable growth in the species. In early 1990s rhinos that survived were primarily in heavy fortified reserves, Leader-Williams (1990) projected that the cost of upkeep of the rhinos was US \$200 kilometer square per year with the majority of 77% rhinos of the continental population in South Africa, Zimbabwe and Namibia. At the CITES conference in 1994 it was estimated that South Africa and Namibia contain about 70% of the 3600 black rhinos remaining in Africa, therefore making these nations the vanguard in the recovery of these rhinos.

Conservation methods. Although many governments in Africa have tried different strategies to reduce poaching it seems the battle is long lost to a certain extent. A number of methods that involve huge investments have been tried and tested with minimum success.

Dehorning. In early 1990s in Zimbabwe white rhinos were dehorned in Hwange national park. Dehorning and translocation of rhinos from vulnerable areas reduced poaching of black and white rhinos in Zimbabwe (Duffy, 2000). However, a lax in security led poachers killing all the horned and dehorned rhinos. This perhaps shows that dehorning without adequate security produces the same result (Lindsay and Taylor, 2011). Similarly, in Namibia it was practiced from 1989 to 1995 then it was stopped. The dehorning of rhinos, improvements in security and antipoaching measures contributed to the reduction in poaching and no rhino was poached in that period (Lindsay & Taylor, 2011). Du Toit (2011) alleges that dehorned rhinos have a 29.1% more chance of surviving poaching than horned rhinos.

¹ Appendix I lists species that are the most endangered among CITES-listed animals and plants and are threatened with extinction and CITES prohibits international trade in specimens of these species except when the purpose of the import is not commercial.

Kock and Atkinson (1993), challenge this view and insist that dehorning of rhinos is a costly exercise that is dependent on a number of factors such as rhino population density, area size, vegetation and terrain and other relevant factors. In Zimbabwe the costs of dehorning ranged from US\$500 where rhinos occurred at high densities and small areas to US\$5000 per animal where rhinos are widely spaced and dispersed in large areas (Atkinson, 1993). Whereas, in Namibia it was estimated to have costed about US\$1400/Rhino to US\$1500 to dehorn (Morkel & Geldenhuys, 1993). However, dehorning continues to play a pivotal role in the protection of rhinos.

Community based conservation. A community based wildlife management (CWM) usually includes indigenous people as participants in wildlife activities (Songorwa, 2000). This method involves including communities affected by poaching by making them a part of the solution. However, governments are reluctant to fully adopt CWM for the fear that it may jeopardize the tourism industry (Songorwa, 2005). Goldstein (2005) maintains that there have been constant struggles to maintain a healthy relationship with neighborhoods living close to protected areas. These struggles are escalated by the spread of diseases by human intrusion and livestock to wildlife. Daszak et al. (2000) state that *filarioid* a worm that causes serious wounds to wildlife animals by exposing them to secondary diseases is usually transmitted through human and livestock movements. Therefore, diseases lead to wildlife losses and increase costs for conservation, as more medication is needed for the animals. This was noted in Kenya in 2011 when 4 black and 5 white rhinos were treated of filariosis lesions at the Meru National Park by the Kenya Wildlife Services.

Uniqueness of policies. The wildlife management policies of South Africa and Namibia were effective in protecting the rhino populations because of promoting locally managed commercial use of wildlife and adopting wildlife as a form of private land use (Child, 2004). Jones (2001) notes that Namibia granted private landholders the right to manage and utilize wildlife in their land subject to restrictions as a measure of protecting wildlife. However, in Zimbabwe a change of wildlife policy in 1993 led to budget cuts for national parks and in that period poachers ran riot and as little as 6 white rhinos were known to have survived in 1993 (Berger, 1997).

Shoot to kill policy. Cumming et al. (1990) state that conservation efforts in African rhinos have focused on military style antipoaching protection. It is noted that such methods are very costly in areas with low densities of rhinos (Martin, 1993). In 1980s the Zimbabwe government authorized the shoot to kill policy

as a strategy of reducing poaching and it was met with criticism (Duffy, 2000). In that period between 1984 to 1993 park rangers killed more than 170 poachers, then a Protection of Wildlife Act was passed in 1989. This act was meant to protect game wardens that feared being charged with murder, this Act meant they could be absolved of any course of action done in good faith (Duffy, 2000). Hence, the Act boosted moral around anti poaching units and led to more poachers being killed than rhinos in 1990 (Duffy, 2000). The Act was said to be violating human rights as suspected poachers were not given a right to appeal and denied basic process. Even under these circumstances the policy received monetary support from Non Governmental Organizations such as World Wildlife Fund that donated a helicopter for the poaching activities and later withdrew it after it was used to kill a poacher (Duffy, 2010). However, the policy reduced poaching at a faster pace than any other method as poachers feared for their lives when caught poaching.

Penalties for poaching. Penalties in the form of fines, prison sentences or a combination of both have received little success in protecting rhinos in Africa. For example, poachers caught in South Africa are charged a penalty of more than ZAR 40000 (US\$4400) yet a single horn cost more than US\$20000 in black market. Theoretically, as much as it must reduce a rational poacher's incentive to poach, it also gives more courage for poachers. Leader-Williams and Milner-Gulland (1993) argue that since a penalty does not constitute monetary fines alone, administering a penalty with a mix of a fine and prison sentence has a different effect on a poacher's behavior. However, Clarke et al. (1993) looked into a penalty structure that constitutes fines only and pointed out that while higher fines might have a deterrent effect to poachers, it does not stop poaching because poachers make their decisions about whether to poach based on marginal benefits or marginal fines. Hence, high fines might induce poachers to poach so as to offset the fines in the event of capture. Leader-Williams and Milner Gulland (1993) contend that if the prison sentence is less severe than the fine many poachers would simply choose prison which increases expenses to the state. Alternatively middle man would buy out poachers they hired if the fine is less severe. However, most African countries are practicing penalties and it seems they are not contributing much to the reduction of poaching due to the marginal benefit achieved when poaching.

A number of studies have concluded that stricter wildlife protection laws are not sufficient in reducing poaching without effective enforcements. Studies by Martin (1998, 2001) and Yonzon (2002) report that increase in law enforcement and increased patrols

reduce poaching significant in the long run and a lack of these increase poaching twofold. However, as much as this may be close to reality only a few studies have tried to measure the adjustment of poachers in line of effective protection mechanism. Studies done in Nepal by Gurung and Guragain (2000) underline that the ineffectiveness of antipoaching enforcement is affected by the adaptation of poachers to those enforcements. Furthermore, it notes that as poachers become familiar with the enforcements, poachers can increase their poaching success. However, Adhikari (2002) posits that a change in enforcement halted poaching for many years in Nepal. Therefore it is necessary to revise antipoaching enforcements each year.

2. Methodology

The analysis employed exploratory research in order to gain insights on why rhino poaching is intensifying yet protection measures are being revised each year. The exploratory research was based on literature search whereby newspapers, magazines, academic literature, published statistics from research firms and government agencies were used. This allows focus on complexity in the study with a holistic analysis (Merriam, 2009). The main advantages of this approach is that it enables a holistic perspective to the phenomenon under study. Also, the study uses the researcher as the primary instrument for data collection and analysis, and the study is primary concerned with the process rather than outcomes. Furthermore, the study broadened to case analysis whereby selected examples of phenomenon of interest were used to draw conclusions. Stake (1994) described three types of case studies as *intrinsic* (exploring to get a better understanding), *instrumental* (examining to provide information) and *collective* (joining a number of cases to inquire on a phenomenon). This approach meets the needs of initial exploration (Creswell, 2007). Hence, this study served both intrinsic and instrumental purposes. One of the study goal was to develop an understanding of methods used for poaching. This study used triangulation in situations where it was hard to draw conclusions on certain phenomenon. However, the study is not expected to provide answers to the problems affecting poaching. Nevertheless, it is expected to provide rich, meaningful information and definitive explanations to why poaching is still a challenge to the African continent. It should be noted that rhino statistics and positions

are usually hidden from the public domain in order to avoid poachers from accessing such information for their benefit, hence, it is not possible to access rhino statistics and positions.

3. Effectiveness of conservation methods

Using a modelling poaching technique in the Luangwa Valley (Zambia) with respect to financial gains, detection and penalties, Milner-Gulland and Leader-Williams (1992) report that a penalty that varies with output is more effective than a fixed one. It is further noted that the detection rate was a deterrent to poachers compared to the penalty. The study alleges that differing incentive structures attract local poachers and dealers to poaching. Any policy that involves curbing poaching might not stop a syndicate employed by the dealer. Although modelling does not address a number of issues like intensity of poaching measures in curbing poaching it gives an idea of how complex is the poaching market.

Bulte and VaKooten (1999) analyzed the effects of the ivory trade ban on poaching and elephant stocks. Bulte and VaKooten (1999) study gives an idea of how the rhino market may respond to certain measures trying to curb poaching. The authors argue that banning trade may increase or decrease elephant stocks depending on the discount rate and probability of testing. The study unanimously highlights that ivory ban is more effective in conserving African elephants than allowing open trade. This study gives a picture that can be expected in the rhino markets if rhino horns are permitted to be traded in an open market. However, the fact that the study is done on a macro level using data of Zambian elephants, it cannot conclusively give the whole picture in the African context because markets differ within each nation.

A report by the Species Survival Commission (SSC) in 2009 presented statistics (see Table 1) on rhino poaching in Africa. It is projected that between the years of 2006 to 2009 a minimum of 470 rhinos were poached in seven nations, 69% were shot with the remainder being killed by spears and other methods. These ranged from using veterinary immobilizing drugs, poison and cross bow. Further, the report states that since 2006 poaching has shifted from Eastern Africa to Southern Africa. According to the SSC report 96% of detected rhinos deaths in Africa occurred in Zimbabwe and South Africa.

Table 1. Rhinos killed illegal in period of 2006-2009

Country	All rhinoceros 2006-2009				Total
	Illegal killing				
	Shot	Snared	Speared, tabbed, poisoned	Unknown but presumed poached	
Botswana	0	0	0	0	0
DR Congo	0	0	0	1	1

Table 1 (cont.). Rhinos killed illegal in period of 2006-2009

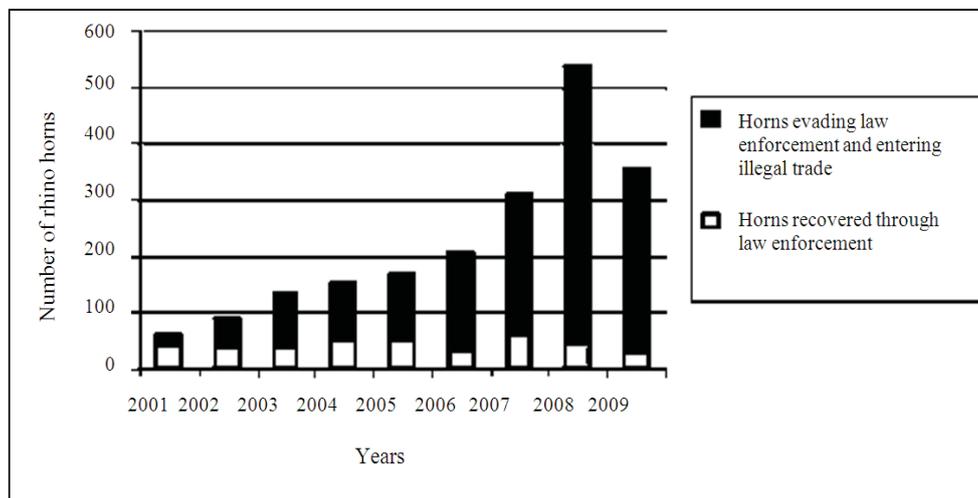
Country	All rhinoceros 2006-2009				Total
	Illegal killing				
	Shot	Snared	Speared, tabbed, poisoned	Unknown but presumed poached	
Kenya	16	1	0	0	17
Malawi	0	0	0	0	0
Mozambique	5	0	0	0	5
Namibia	0	0	0	0	0
South Africa	152	2	1	55	210
Swaziland	0	0	0	0	0
Tanzania	0	0	0	1	1
Uganda	0	0	0	0	0
Zambia	1	0	0	0	1
Zimbabwe	149	6	4	76	235
Grand total	323	9	5	133	470

Source: CITES (2009).

One of the complex natures of poaching is the development of serious tactics by poachers. According to Rademeyer (2012) poaching syndicates are multinational and are known to be involved in high risk criminal activities such as diamond smuggling, drugs, vehicle theft and armed robberies. This structure of organized crime involves some government officials and business leaders who according to TRAFFIC (2012) are connected to poaching activities. Miliken and Shaw (2012) claim that conservation staff are also involved in the poaching business. A Vietnam embassy personnel was arrested with rhino horns and diamonds, under interrogation this personnel admitted that he used a diplomatic bag to move the rhino horns

to Vietnam (TRAFFIC, 2012). The use of diplomatic immunity avoided prosecution (Rademeyer, 2012).

Figure 1 shows the number of rhino horns that evaded law and enforcements in period of 2001-2009 to illegal markets. The increasing numbers of horns that evaded law highlighted the ineffectiveness of current enforcement reforms. According to Figure 1 there was a steady increase in horns evading law enforcements from as little as 20 horns in 2001 to 500 horns in 2008. CITES (2013) warns that rhino poaching is no longer an environmental crime, but constitutes of highly organized crime that threatens national security.



Source: CITES 2009.

Fig. 1. Estimated Rhinos horn recovered or lost to illegal trade in Africa 2006-2009

4. Recommendations

Legalize or not. According to CITES only South Africa is allowed to export white rhino horn. CITES regulations allow trading of white rhino in South Africa and Swaziland for exclusive purposes of

international trade and hunters' trophy. However, it was discovered that at least 15 rhinos are shot in true trophy hunts and more than 200 are shot by pseudo trophy hunts where the hunt is only for horns to be sold in Asian markets (Burgess, 2012). Legalization has drawn more criticism from a num-

ber of Non Governmental Organizations, that see this as a reversal of all years in curbing poaching. Rademeyer (2012) insists that legalizing trading of rhino horns may not achieve any of its goals because rhino horns are price inelastic. Therefore, it would motivate more poachers or criminals to make big money. However, resource economists argue that the legal trade would make the horns available in the market, thereby reducing prices in the black market. Heinstein (2012) argues that while poachers have a US\$400000 incentive to kill a rhino, conservationist do not have a US\$400000 to save one. The issue of legalization is a complex one due to the reason that the rhino market is not known. What if it is legalized and in the long run it is discovered that the market is very larger than was assumed? This would mean all the efforts done in protecting rhinos would be a waste, hence, legalization is one of the trickiest routes to take currently. Heinstein (2012) concludes that new methods are needed to save rhinos from extinction.

Forensic technology trials. South Africa has already rolled out a forensic project that would help in combating wildlife crimes (CITES, 2013). The use of seized wildlife products to crime scenes and implicated criminals would help in the prosecution of offenders. Therefore, the new Rhino DNA Index system allows individual rhinos to be identified from blood, horn, tissue etc. The use of DNA samples in illegal trade is said to be effective in South Africa and recently a Kenyan investigation was assisted by DNA analysis. Kenya, Swaziland, Namibia, Botswana and Zimbabwe have submitted their samples to be included in the database (CITES, 2013). Furthermore, conservation officers have been trained in handling of DNA samples that could be used in court. Hence, the new technology is worth trying because it can be used in the prosecution of criminals.

Using radio tags/collars. The use of radio tags or collars have been witnessed in a number of species ranging from fish to reptiles, as well as, large mammals like bears and wilddogs (Mills and Gorman, 1997; Jepsen et al., 2001). This method has been with limited success in rhinos according to a study by Linklater (2003). A number of disadvantages has been recorded with the use of radio tags. These problems range from false transmission, ineffective designs of collars such that Rhinos injure themselves (Dinerstein et al., 2001). Apart from these, the attachment of the radio tags is a harmful process on its own that can lead to fertility problems and death. Moreover, the tranquilisation technique is said to have serious complications to rhinos (Linklater, 2006). Therefore, all these problems make the method a risky option in protecting rhinos.

Penalty increases. Increasing severity of penalties is one of the suggested methods by Leader-Williams & Milner Gulland (1993). The authors suggest that owing to difficulties of penalties enforcement sentencing dealers as well is the key. A penalty that is not fixed is said to be a deterrent, for instance varying penalty with output (number of horns) is more effective than a fixed penalty. A typical case in Nepal is when wildlife offences were given severe penalties and it deterred poachers (Martin, 1998). Therefore, a blend of harsher payments and penalties are needed in curbing rhino poaching in Africa.

Sustainable approach. The sustainability approach aims to maximize benefits of wildlife to those who live on it (Child, 2012). Four concepts are covered, that is price, subsidiary, proprietorship and adaptive management. Adaptive management covers the learning processes linked to stakeholders and change. Subsidiary describes nested institutions need to build from bottom and price-proprietorship suggests that the wildlife is valuable and if this value accrues to landholders they would guide wildlife as they manage their livestock. This approach is usually successful when proprietorship is strong and prices are high. If the proprietorship is strong and prices are low, open economy exists and wildlife is exploited. According to Child (2012) park agencies have little income to fight poachers and as a result they switch to profit enterprises. Child (2012) suggests devolving of rights to landholders by reducing regulatory restrictions and encouraging rhino trade to drive prices through innovation.

Use of unmanned aerial vehicles (UAVs). Unmanned aerial vehicles also known as drones have been used successfully by the United States army when targeting Al Queda militants in Somalia, Pakistan and Yemen. Drones can be very useful in combating poaching because they have cameras or can take videos of the poachers. This will help in the prosecution of the offenders. Moreover, they can be equipped with missiles that can be launched to targeted poachers without being noticed. They can stay afloat for over 24 hours depending on the model of the drone. However, the only issue is that they are very expensive and need huge investments from the government if ever they can be used as an anti-poaching method.

Conclusion

Rhinos are still threatened in this century because many African governments have little political will in protecting rhinos. Even though the rhino horn trade was banned in 1977 limited success has been achieved with the current protection strategies. Therefore, using Forensic tests, shoot to kill policy and new strategies may be the only way to avoid

rhino extinction. There is an urgent need to implement serious antipoaching strategies that would reduce the poaching rate. The shoot to kill policy that was practiced in Zimbabwe had the fastest results and reduced poaching even though it was later criticized as violating human rights. The same policy can be reintroduced because animals have a right to live and coexist under animal welfare rights. Of all the methods tried up to date it is the only one that can give a clear signal to poachers that rhinos deserve to live. This policy can be used with new strategies like forensic technology and others. Legalization of rhino horn sales would force poachers to kill more rhinos so as to increase the rhino horn stocks. Therefore, this would lead to the extinction

of rhinos by making the rhino horn very expensive in the market. Therefore, it is quite clear that in order to save rhinos from extinction a strong political will and commitment from African governments are the key. Every government should be willing to support every measure that is meant to address poaching. Heavy investments are to be channelled to antipoaching methods in order to stop the poaching appetite. The use of drones as an anti poaching strategy is inevitable because currently it seems as the only method that would not endanger the lives of the rangers or wildlife caregivers. Absence of such a will would imply that the next generation would be learning about extinct rhinos, just as the current generation learned about dinosaurs.

References

1. Adhikari, T.R. (2002). The curse of success, *Habitat Himalaya*, 9 (3).
2. Barnard, P. (1998). *Biological Diversity in Namibia: a Country Study*, Namibian National Biodiversity Task Force, Windhoek.
3. Barnes, J. and Jones, B. (2009). Game ranching in Namibia, In *Evolution and innovation in wildlife conservation*.
4. Burgess, M. (2012). Rhino poaching and East Asian policies: Facts and debates, The Centre for Chinese Studies (CCS) at Stellenbosch University.
5. Child, B. (2012). The sustainable use approach could save South Africa's rhinos, *S Africa Journal of Science*, 108 (7/8), Available at: <http://dx.doi.org/10.4102/sajs.v108i7/8.1338> [Accessed 14 April].
6. Clarke, H.R., Reed, W.J. and Shrestha, M. (1993). Optimal enforcement of poverty rights on developing country forests subject to illegal logging, *Resource and Energy Economics*, 15, pp. 271-293.
7. CITES (2011). Annual Report. London.
8. CITES (2012). Annual Report. London.
9. CITES (2013). Sixteenth meeting of the Conference of the Parties Bangkok (Thailand), March 3-14, 2013.
10. Cumming, D.H., R.F. Du Toit, and Stuart, S.N. (1990). *African elephants and rhinos: status survey and conservation action plan*, IUCN/SSC (African elephant and Rhino Specialist Group), Gland, Switzerland.
11. Daszak, P., Cunningham, A.A. and Hyatt, A.D. (2000). Emerging Infectious Diseases of Wildlife, *Threats to Biodiversity and Human Health Science*, 287, pp. 443-449.
12. Dinerstein, E., Shrestha, S. and Mishra, H. (2001). Capture, Chemical Immobilization, and Radio-Collar Life for Greater One-Horned Rhinoceros, *Journal of Zoology*, 253, pp. 333-345.
13. Duffy, R. (2000). *Killing for Conservation: Wildlife Policy In Zimbabwe*.
14. Duffy, R. (2010). *Nature Crime: How were are getting conservation wrong*.
15. Dunham, K.M. (2005). The re-introduction of rhinos to Gonarezhou National Park, Zimbabwe: a feasibility study – biological aspects and IUCN reintroduction guidelines, SADC Regional Programme for Rhino Conservation Report (Task 3.1-12.1).
16. Du Toit, R. (2011). *Zimbabwe lowveld; dehorning experience*.
17. Emslie, R.H. and Brooks, M. (1999). African Rhino: Status Survey and Conservation Action Plan, IUCN/SSC African Rhino Specialist Group, IUCN, Gland.
18. International Union for Conservation of Nature (2013). Available at: www.iucnredlist.org [Accessed 12 April 2013].
19. Lindsey, P.A. and Taylor, A. (2011). A study on the dehorning of African rhinoceroses as a tool to reduce the risk of poaching, Report prepared by the Endangered Wildlife Trust (EWT) for the South African Department of Environmental Affairs (DEA): 62.
20. Milner-Gulland, N.J., Leader-Williams, N. and Beddington, J.R. (1994). Is Dehorning Africa Rhinos Worthwhile? Accessed online http://www.rhinoresourcecenter.com/pdf_files/117/1175862394.pdf.
21. Milliken, T. and Shaw, J. (2012). The South Africa – Viet Nam Rhino horn Trade Nexus: A deadly combination of institutional lapses, corrupt wildlife industry professionals and Asian crime syndicates, TRAFFIC, Johannesburg, South Africa.
22. Gurung, O. and Guragain, G. (2000). *An assessment of anti poaching operations in Royal Chitwan and Royal Bardia National Parks in Nepal*, Kathmandu: WWF Nepal Program.
23. Guthrie, R.D. (1990). *Frozen Fauna of the Mammoth Steppe: The Story of Blue Babe*, The University of Chicago Press, Chicago.
24. Heinstejn, P. (2012). Can rhino horn trade be legalised? *Business Report*.
25. Jepsen, N., Lewis, L.E., Schreck, C.B. and Siddens, B. (2001). The Physiological Response of Chinook Salmon Smolts to Two Methods of Radio-Tagging, *Transactions of the American Fisheries Society*, 130, pp. 495-500.

26. Jones, B.T.B. (2001). The evolution of a community based approach to wildlife management at Kunene, Namibia.
27. Kahler, J.S. (2010). *Local perceptions of risk and vulnerability associated with human wildlife conflicts in Namibian conservancies*, ProQuest Publishers.
28. Kock, M.D. and Atkinson, M. (1993). *Report on dehorning of black and white rhinoceros in Zimbabwe*, Harare, Department of National Parks and Wildlife Management.
29. Leader-Williams, N. (1992). *The world trade in rhino horn: a review*, Traffic International, Cambridge, United Kingdom.
30. Leader-Williams, N. and Albon, S.D. (1988). Allocation of resources for conservation, *Nature*, 336, pp. 533-535.
31. Leader-Williams, N. and Milner-Gulland, E.J.(1993). Policies for Enforcement of Wildlife Laws: The balance between detection and penalties in Luangwa Valley, Zambia, *Conservation Biology*, 7 (3), pp. 611-617.
32. Linklater, W.L. (2003). Science and management in a conservation crisis: a case study with rhinoceros, *Conservation Biology*, 17, pp. 968-975
33. Martin, E.B. (1980). Selling rhinos to extinction, *Oryx*, 15, pp. 322-323.
34. Martin, R.B. (1993). Rhino population dynamics, illegal hunting and law enforcement in the lower Zambezi Valley, Zimbabwe, pp. 10-31.
35. Milliken, T., Nowell, K. and Thomson, J.B.(1993). The decline of the black rhinoceros in Zimbabwe: Implications for future rhino conservancies, Cambridge: TRAFFIC International.
36. Milliken, T., Emslie, R.H. and Talukdar, B. (2009). African and Asian Rhinoceroses – Status, Conservation and Trade A report from the IUCN Species Survival Commission (IUCN/SSC) African and Asian Rhino Specialist Groups and TRAFFIC to the CITES Secretariat pursuant to Resolution Conf. 9.14 (Rev. CoP14) and Decision 14.89.
37. Milledge, S. (2004). *Rhino horn Stockpile management: Minimum standards and best practices from East and Southern Africa*.
38. Milliken, T. & Shaw, J. (2012). The South Africa – Viet Nam Nexus.
39. Mills, M.G.L. and Gorman, M.L. (1997). Factors Affecting the Density and Distribution of Wild Dogs in the Kruger National Park, *Conservation Biology*, 11, pp. 1397-1406
40. Morkel, P. and Geldenhuys, L.J. (1993). Dehorning of black rhinoceros in Namibia, pp. 350-353. Proceeding of an international conference, *SanDieg USA Zoological Society*, pp. 1-5.
41. Nelson, F. (2006). Black Rhinoceros Conservation and Trophy Hunting in Southern Africa: Implications of Recent Policy Changes, *Endangered Species*.
42. Parker, I.S.C. and Martin, E.B. (1979). Trade in African rhino horn, *Oryx*, 15, pp. 131-158.
43. Rachlow, J.L. and Berger, J. (1997). 'Conservation Implications of Patterns of Horn Regeneration in Dehorned White Rhino', *Conservation Biology*, 11 (1), pp. 84-91. Available: <http://onlinelibrary.wiley.com/doi/10.1046/j.1523-1739.1997.95523.x/pdf> [Accessed 7 April 2013].
44. Rademeyer, J. (2012). Killing for profit: exposing the illegal rhino horn trade, Cape Town, Zebra Press, pp. 1-11, pp. 1-332.
45. Songorwa, A.N., Buhrs, T. and Hughey, K.F.D. (2000). Community-based wildlife management in Africa: A critical assessment of the literature, *Natural Resources Journal*, 40 (3), pp. 603-643.
46. South Africa Government. Available at: www.gov.za [Accessed 12 April 2013].
47. TSas-Rolfes, M. (2012). The Rhino Poaching Crisis: A Market Analysis Conservation Economist (Independent). Available at: <http://www.rhino-economics.com/>.
48. TRAFFIC (2012). Annual Report. Johannesburg.
49. Yonzon, P. (2002). The wounds of neglect, *Habitat Himalaya*, 9 (1).
50. Western, D. (1987). Africa's elephants and rhinos flagships in crisis, *Trends in Ecology and Evolution*, 2 (11), pp. 343-346.
51. Western, D. (1982). Patterns of depletion in a Kenya black rhino population and the conservation implications, *Biology Conservation*, 24, pp. 147-156.
52. Western, D. and Grimsdell, J.J.R. (1979). *Measuring the distribution of animals in relation to their environment*, Nairobi, African Wildlife Leadership Foundation, Handbook No. 2.
53. Western, D. and Henry, W. (1979). Economics and conservation in Third World National Parks, *BioScience*, 29, pp. 414-418.