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A Survey on Anti-Poaching Strategies

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Abstract: ***South Africa holds the largest number of the world's rhinoceros population. Over the years this species has suffered so much at the hands of poachers. Based on statistics at least two rhinos are lost to poaching each day. With this rate of poaching activities, Africa's rhino could slide over the blink, into extinction. In this paper we therefore review the various anti-poaching strategies that have been implemented over time bringing to light their shortcomings.***

Keywords: Poaching, Anti-poaching, Rhinoceros, Extinction, Wildlife.

1. Introduction

The rhinoceros is one of the most endangered species in the African continent. Many factors have escalated poaching crimes against this species; among which are the value attached to its horn, thereptical effects believed to be associated with the horn and also its ornamental value in some cultures[1], [2].

Prior to the 1990s, it seems South Africa, Zimbabwe and Namibia managed to escape the rampant waves of poaching which affected the African continent but this joy was short circuited as statistics of rhinos lost through poaching skyrocketed with effect from 2008[3]. South Africa is believed to have 83% and 73% rhino population in Africa's rhinos and world wide wild rhinos respectively. Based on these statistics, it therefore becomes crucial to endeavour in a research meant to protect this precious resource lest it become extinct. Figure 1 shows poaching statistics in South Africa from 2000 to April 2014[1].Based on the intensity of poaching crimes, it is therefore imminent to observe the various methods that have been proposed in a bid to alleviate this problem and save this species.

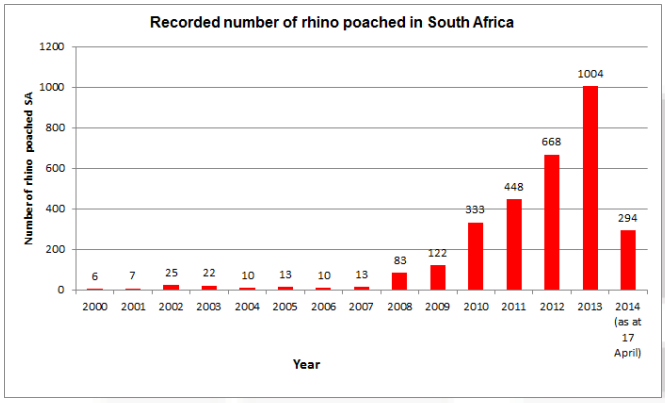

Figure 1: Rhino Poaching Statistics in South Africa[1]

Poaching among other types of illegal trade in wildlife are set to top the agenda at the first ever United Nations Environment Assembly (UNEA) to be held in Nairobi in June. United Nations Environmental Programme (UNEP) Executive Director Archim Steiner, strongly emphasize that the threat it poses is not be underestimated. "We are confronted with a battle we are not winning"[4]. Organized crime syndicates find fewer barriers to their operations in developing countries. They are highly skilled, armed, organisedand sometimes uses night vision goggles and helicopters[5].

The remainder of the article is organized as follows. Section 2 aims to provide a survey on the anti-poaching strategies and technologies. The challenges and potential research directions are discussed in Section 3. Finaly, we conclude and discuss future work in Section 4.

2. Rhino Anti-Poaching Strategies

Over the years, various strategies to mitigate rhino poaching in South Africa have been implemented ranging from patrols and also use of surveillance. It is in this light that we seek to explore some of the strategies that have been implemented so far to mitigate the problem.

2.1 Poisoning

In this measure, a mixture of poison and indelible pink ink is injected in the horn of the live rhino. This is meant to thus render the horn useless. The indelible ink can be identified by scanners thus reducing the chances of the horn being transported via the airport[6],[7]. Although this method is meant to protect the rhino, there are ethical concerns associated with the method since anyone who will use the powdered horn is prone to serious injuries or even death. According to Cathy Dean, the Director of Save the Rhino International poisoning the rhino with the intend of killing or injuring the consumer is as good as attempted murder[7], [8]. This method therefore lacks social acceptance and is a crime to humanity.

2.2 Dehorning the rhino

Based on a research entitled Aerial Surveillance to Tackle Poaching, dehorning the rhinos at Kruger National park alone will cost the nation approximately US$5.8-8.8 million. This cost is only for a one off dehorning: putting into consideration that the horns will grow again, this method becomes so costly to implement [9]. According to statistics, when dehorning was introduced in Zimbabwe, it was seen that there was a 29.1 % chance of survival of dehorned rhinos as compared to horned rhinos.In the 1990s, it was noted in Hwange National Park in Zimbabwe that the dehorned rhinos were poached in exactly 12-18months after

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the dehorning process. It seems dehorning on its own is not an effective method, rather it's just a delaying tactic. Furthermore dehorned rhinos can still be killed either as retaliation from the poachers or even for that short stub which remains after dehorning [10],[11], [12].

2.3 Remotely Piloted Aircraft systems (RPAS)/ Drones

The use of drones requires two basic components which are the airframe and the ground station. Communication is facilitated between the airframe and the station.

The aerial vehicles or drones use cameras and sensors in the gathering of information. RPAS are propelled by a brushless electrical motor using a lithium polymer battery. The plane can operate at three different modes: autopilot, first person view mode and manually (radio control conventional mode/third person mode). An onboard FPV (First Person View) video camera, a GPS data logger with a barometric altitude sensor and an autopilot are equipped in the plane. The autopilot provides flight stabilization and an onboard screen a (OSD). The OSD provides GPS information about the position, speed, course and height of the plane. All this information combined with the video from the FPV camera is sent to the ground station[2].

The ground station contains a monitor, DVD recorder, video recorder and control signals transmitter with its associated antennas. The RPAS can be tracked in real time by using a laptop to program the autopilot, storage of pictures[2]. The deployed of drones in Nepal has proved be an effective anti-poaching measure [5].

This method also has its own limitations. The use of drones may result in problems like mistakenly attack of non-poachers and thus poses issues of human right breaching.

2.4 Anti-Poaching Heat Sensing Planes

Due to the intensity of poaching activities at Kruger National Park in South Africa, in 2012 one of Africa's defense contractor; the Paramount donated a heat sensing plane called the Seeker. In support to the launching of the Seeker, Ivor Ichikowitz, Paramount's executive chairman described the situation as a war, "This is a war. You cannot take a stick to a gunfight." This plane has a quiet engine and has sensors which are used for the detection of animals and humans on the ground so that rangers can detect poaching activities [5], [13], [14].

2.5 Wireless Sensor Network for Tracking and Detection (Sensor Fusion)

Wireless Sensor Networks (WSN) facilitates the random deployment of nodes. Because of the mobility effect, these nodes can self-organize to form a multi-hop network. The use of WSN as an Anti-poaching measure requires the use of the target animal as a Mobile Biological Sensor (MBS). The sensor is attached on the animal in such a manner that the cameras attached to it can send data to the central computer and it should have GPS features to facilitate location detection of the animal.

Data about the movement of animals is collected by access points and is send to a central computer where it is stored in a database. Using artificial intelligent tool a classifier will attempt to determine whether or not there are abnormalities on animal action compared to usual learned behavior. If a sudden panic of animals occurs an abrupt change in the graph of a classifier in the central computer occurs, this shows a potential incident and the system respond by first raising an alarm, secondly displaying the current location using GPS, thirdly the system will try to display what is taking place by processing received image with different techniques such as edge detection, thresholding and filtering to ensure that users are getting a clear image of what is happening. Furthermore a system will send a short message (SMS) to the game rangers through a GSM network to draw their attention on the suspected area[15].

Concerns about this anti-poaching measure include the following: there is a possibility of a false alarm, data gathered during the learning process can be compromised by potential poachers and also the change might be observed after an attack has already occurred.

2.6 DNA Mapping

DNA mapping is used to determine the precise location where the animal was killed. An example of DNA Mapping was used in June 2002 by Singapore officials to trace back a container with 6.5 tons of ivory to Zambia. DNA was collected from elephant dung using a microsatellite and then DNA was extracted from the captured tusks[16].This method can also be implemented as a rhinoceros anti-poaching strategy. This however is a reactive measure as conservation biologist Samuel Waser would put it across, "Seizing the ivory doesn't save the elephants. We need to shut the market down and keep the ivory in Africa." This measure to ban ivory trade implemented by the Convention on Internal Trade in Endangered Species(CITES) in 1989 lasted for a few years since the prices of ivory skyrocketed on the market and smuggling started again [16], [17].

3. Challenges

Based on the survey, we have the following summary and suggestions

3.1 Huge market for wildlife products

There is an ever increase in the demand of wildlife products in Asian countries. China is believed to be the world's largest consumer of wildlife products[18]. These products are used primarily as traditional medicine. Rhino horn is now having a higher street value than cocaine [5].This has fueled illegal poaching activities. Long term solution may lie in measures to reduce the demand of wildlife products through the use of alternative non wildlife products. But more rigorous measures are needed in order to curb illegal trading of wildlife products.

3.2 Detection

Pinpointing the location of poachers proved to be a major problem. It is difficult to know where and when poaching

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activity is taking place. This is due to the fact that poacher do not show any preference for a particular time of the day. One of the most difficult task ranger's face is catching poachers at night. If they are wearing camouflage clothes they may not be detected even by a flying anti-poaching drone. In summer rhinoceros and poachers are more displaced due to the availability of water thus making it more difficult to detect them[2]. Real-time tracking systems which are capable of detecting and classification of multiple targets can help in spotting and monitoring of animals.

3.3 Cost of implementation

The implementation cost of highly effective anti-poaching surveillance and tracking systems like drones is typically high. This is unaffordable in developing countries given the more important priorities such as food, health and education. Conversation comes way down on the list. This results in developing countries resorting to less effective measures of fighting against rampant poaching activities.

3.4 Legal framework

Countries are taking different positions on the control of trade in wildlife products[18]. The varying positions and commitments have opened loopholes for illegal trade in wildlife products. On the other hand very few countries in the world have legal framework for operating unmanned aerial vehicle [2]. Kenya banned the game reserves to use drones to monitor its endangered rhinos deeming them to be a security threat [19]. Measures like this will hamper efforts in preserving endangered species. Countries must take tough measures to save their wildlife heritage.

4. Conclusions and Future Work

Despite the various measures to curb the poaching problem over the years, there is an ever-increase in the killing of rhinos. With the increase in the demand of wildlife products, organized crime syndicate is now involved in illegal trading of wildlife products. We presented various strategies being employed in a move to eradicate rampant poaching activities. Notable challenges hampering efforts in fighting against poaching and illegal trading of wildlife products have been discussed. As future work, we plan to design a self-organizing surveillance system capable of target detection and tracking using low cost unmanned vehicle.

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