What does it take to curtail rhino poaching? Lessons learned from twenty years of experience at Malilangwe Wildlife Reserve, Zimbabwe

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Abstract

A successful, reserve-level, rhino anti-poaching strategy based on seven fundamental pillars of management is described. Of the seven management areas, leadership, intelligence and funding are considered the most important. Limitations of the method are discussed and comparisons made with other strategies. While the approach may not be applicable under all circumstances, the underlying philosophy of striving to get the basics of rhino protection in place before the addition of more technologically advanced security layers, should have universal relevance.

Additional key words: Rhinoceros, recruitment, training, security, community

Résumé

Une stratégie efficace de lutte contre le braconnage des rhinocéros au niveau d'une réserve, basée sur sept piliers fondamentaux de la gestion est décrite ici. Sur les sept zone de gestion, l'aptitude à diriger, l'intelligence et les finances sont considérées comme étant les plus importantes. Les limites des méthodes sont discutées et des comparaisons avec d'autres stratégies ont été faites. Alors que l'approche ne peut pas être appliquée dans toutes les circonstances, la philosophie de lutte pour mettre en place les bases de protection des rhinocéros avant d'inclure le perfectionnement de systèmes de sécurité, devrait avoir une portée universelle.

Mots-clés supplémentaires: Rhinocéros, recrutement, braconnage, sécurité, communauté

Introduction

Various strategies have been implemented to control rhino poaching in Africa, but success curbing the onslaught has been limited (Biggs et al. 2013). Protected areas (PAs), have continued to increase numbers of security personnel, allocated more funds to law enforcement, adopted a militarized style of management, and invested in the welfare and education of surrounding communities (Ferreira and Ouma 2012; Muntifering et al. 2015; Büscher and Ramutsindela 2016). Despite this, rhino poaching has continued (Knight 2018). The above interventions are based on sound reasoning, and all are essential components of the fight against wildlife crime. What then is missing? Over the past decade, management at Malilangwe Wildlife Reserve in south-eastern Zimbabwe (Fig. 1, below) has pondered this question. Analysis of the mechanics of poaching incidents in Zimbabwe has shown that in most cases poachers were assisted by corrupt employees of PAs, and that reserves with high levels of poaching had poor or non-existent intelligence systems. By adopting a leadership style principally aimed at minimizing internal corruption, and focusing on intelligence, as well as five other fundamental

aspects of security management, rhino poaching has been successfully curbed at Malilangwe. Only three rhinos have been illegally killed in 20 years, despite the reserve having one of the highest densities of rhinos in the world.

The purpose of this paper is to share Malilangwe's experience with others. This is done by (1) outlining the poaching threat, (2) describing seven core areas-pillars of management that are believed to be collectively responsible for Malilangwe's success, (3) comparing Malilangwe's strategy with those of other reserves, and (4) highlighting potential limitations of the method.

Poaching Threat

Malilangwe re-introduced rhinos between 1996 and 1998. Pre 2008, poaching was limited to snaring for meat and netting of fish. At this time, the reserve was only partially fenced and, although the scout force was well-organized, it had fewer personnel and was less militarized.

From 2007, southern Africa experienced a sharp increase in rhino poaching (Martin and Vigne 2012; Save the Rhino International 2018), and in September 2008, a gang of five poachers, one being an ex-scout, entered Malilangwe, shot and killed a rhino, and successfully escaped with the horns. In October 2008, a rhino wandered off Malilangwe onto

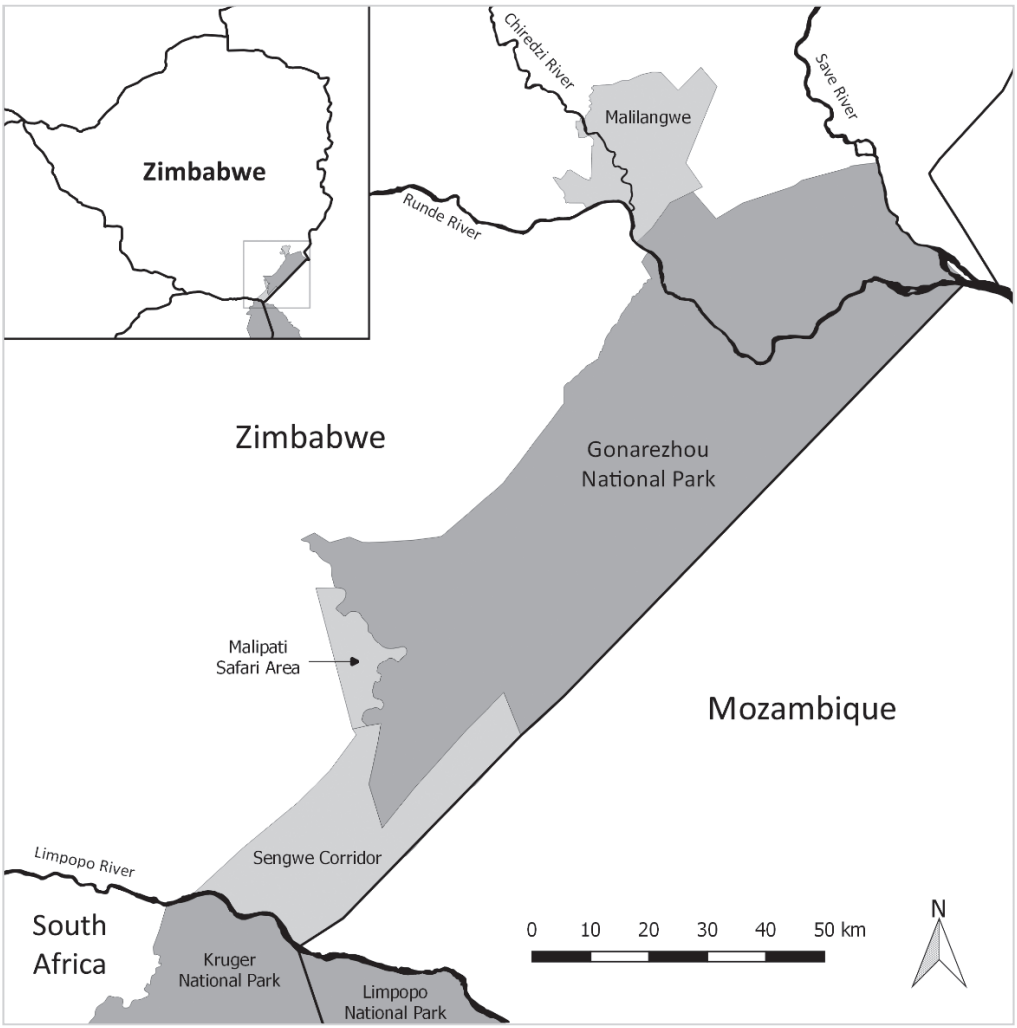


Figure 1. Map showing position of Malilangwe (50,000 ha) and adjoining protected areas.

neighboring Hippo Valley Sugar Estate, where it fell into an irrigation canal and drowned. Before it was located, poachers stole its horns. In February 2009, a pair of poachers entered the reserve with help from a former Malilangwe employee. They shot a rhino, through the spine paralyzing but not killing it. Scouts responded quickly and, hearing a vehicle, the poachers fled. They managed to escape, but without the horns. Tragically the rhino had to be euthanized. These events galvanized Malilangwe's security team into action. They responded swiftly by developing an intelligence network, increasing the number of scouts, improving training and equipment, and re-fencing the entire reserve. This paid off, with 19 subsequent poaching threats being intercepted with the loss of only one rhino. The situation elsewhere in Zimbabwe has not been as promising, with 489 rhinos poached in the last 10 years, and 50 killed in 2018 (Anderson pers. comm. 2018). We believe Malilangwe's success to be the result of focus on seven core management pillars described below.

Core Management Areas

Malilangwe's anti-poaching strategy is underpinned by seven areas of management focus. Each is critical to the proper functioning of the security unit, but we believe leadership, intelligence and funding to be the most important.

Leadership

The degree of deviant behaviour within an organization is often linked to the level of employee satisfaction (Kulas et al. 2007). For example, dissatisfied employees or ex-employees are more likely to steal from their employers than satisfied ones. This is often the case with anti-poaching personnel. When scouts are disgruntled, they frequently resort to poaching themselves or to assisting poachers in return for a cut of the spoils. The temptation to collude with rhino poachers is particularly high because payouts are potentially large due to the exorbitant value of the horn, despite the risks (Biggs et al. 2013).

Access to inside knowledge of security systems appears to be an important determinant of whether poachers will target a reserve. Information given to poachers from insiders greatly reduces the risk of being caught. On the other hand, when inside help is absent, poachers appear to be reluctant to enter. We believe that eradicating collusion between reserve personnel and poachers is fundamental to curbing rhino poaching, and that insufficient attention is given to this element of security management.

The style of leadership has a bearing on the employees' level of satisfaction, (Ugboro and Obeng 2000). Good leaders instill fulfillment and therefore commitment in their subordinates, even when financial remuneration is poor and conditions dangerous. On the other hand, staff can be demoralized by poor leadership, even when financial remuneration is adequate. Experience at Malilangwe has shown leadership style to be a critical determinant of staff loyalty, which, in our opinion, is directly linked to anti-poaching success.

Because it is necessary for the security manager to instill the required level of discipline, train personnel in the use of firearms, strategically plan operations, and apply appropriate tactics, it is preferable that he is military trained. However, it is more important that he is a person of integrity who gains respect by treating all people with appropriate dignity. Ideally he should be genuinely concerned with the wellbeing of his staff and their families, but also demand high standards and adhere to a strict code of conduct. He should create a work environment that is infused with a mixture of empathy, teamwork, camaraderie, accountability and discipline, and encourage responsible personal behaviour beyond the workplace (e.g. education of children, and investment in a family home). Adoption of a responsible attitude often leads to an improvement in quality of life, making staff proud of their achievements and determined to work to the best of their ability. This generates respect for staff amongst their peers, with new recruits striving to emulate the achievements of established employees, which further elevates their status and loyalty.

Intelligence

Intelligence switches anti-poaching activities from reactive to proactive mode. It is better to engage poachers before they make contact with rhinos than trying to apprehend them after a rhino has been killed. Intelligence makes for safer operations, and if successfully acted upon, it increases the reputation

of the security team, which further deters poachers. Anti-poaching is very much a mind game, and when poachers are uncertain about the information security personnel may have, the perceived risk of being caught increases. We believe this to be an important factor in Malilangwe's anti-poaching success.

A medium-sized (50,000 ha) reserve like Malilangwe should have at least one dedicated intelligence operative whose role is to gather information, manage informants, follow up on leads, and liaise with government security authorities. The security manager should be constantly updated on developments and appraised of any new threats. We believe one good intelligence officer to be worth more than ten men on the ground.

Very little passes unnoticed in rural Africa, and information can be traded for the right price. Great personal risk is incurred when informing on friends, neighbors and acquaintances and, in most cases, this is not done for the love of wildlife, but rather for financial reward. Therefore, it is important to pay informants dependably, on time and well. Payment should be for reliable information regardless of whether it leads to success because an operation will often fail for reasons beyond the control of the informer.

Funding

Inadequate funding is arguably the greatest global challenge facing conservation (Waldron et al. 2013). Protection of ecosystems, with all their interconnected elements, comes at significant financial cost. Safeguarding rhinos costs Malilangwe approximately US$750,000 per annum (US$1,500/km^2). This is more than the minimum annual expenditure of US$1,000/km^2 suggested for the protection of rhinos in Africa (Martin and Vigne 2012), on par with the US$1,000-2,000/km^2 spent annually by private sanctuaries in Kenya, and significantly less than the US$5,000-6,000/km^2 spent protecting rhinos in West Bengal, India (Martin and Vigne 2012). The bulk of expenditure at Malilangwe goes to paying salaries, with the remainder being spent on fuel, equipment, rations, vehicles, and training (Table 1). The priority when allocating funds should be the people protecting the wildlife. It is important to remunerate fairly because scouts are potentially the greatest threat to rhinos if they turn to poaching to compensate for a lack of income. However, care needs to be exercised when setting wages. Pay needs to be commensurate with work done, and reflect the dangers of the job, but should be balanced, as overpay can lead to poor behaviour and ill-discipline.

Table 1. Breakdown of annual costs of running Malilangwe's security department. These funds support scouts at a density of 0.1/km^2, an intelligence unit, a quick reaction team, gate security, and a manager.

Cost centre	Cost per annum (US$)	Per cent of total (%)
Salaries	531,000	71
Fuel	45,000	6
Equipment	44,000	6
Rations	40,000	5
Vehicles	35,000	5
Training	30,000	4
Other	25,000	3

While US$750,000 may appear to be an exorbitant sum, it amounts to the value of the horns from only three average sized rhinos. In other words, the cost of security is a small percentage of the black market value of the rhinos under protection. At Malilangwe, scouts also collect biological data, so the US$750,000 also covers the cost of collecting information necessary for monitoring and research. The employment of >80 scouts from neighbouring communities, and the associated benefits to human livelihoods, is further justification for the cost of securing rhinos.

Recruitment

Careful recruitment of the correct personality type for the job is essential because low staff turnover is vitally important for the success of anti-poaching operations. Former employees are potentially the greatest threat because they take with them accumulated knowledge of the reserve's security systems and detailed information on the location of rhinos.

Malilangwe handpicks potential recruits, aged 18 to 25 years, from well-respected families that live within 25 km of the reserve boundary. To avoid nepotism, all established staff are consulted during the recruiting process, and consensus must be reached before a candidate is included. The pool of potential recruits is then filtered over a six month selection course, the

goal being to produce an elite group of loyal, motivated, well-rounded individuals who are physically fit, have high moral standards, and are proud to represent the organization they work for. To achieve this, selection needs to be extraordinarily difficult. Candidates should be challenged physically and mentally beyond what they believe they are capable of withstanding (Fig. 2; see colour plates: page iii).

Over the past 10 years, Malilangwe has run five scout selections. The pool of carefully chosen candidates has ranged between 150 and 180 individuals. In each case, this has been whittled down to a select group of 12 to 15 new recruits. It is important that the security manager is intimately involved in the selection process, and that he struggles alongside his men, because this generates respect and creates the strong bond that results in loyalty. The longer the selection period, the more distilled the final group. Initially Malilangwe ran a three-month selection, but this has been extended to six months, to reveal any undesirable conduct over the longer time-frame. An extended selection also creates a stronger bond among the final recruits.

Training

At Malilangwe the bulk of training takes place during selection. It is important to note that recruits are not trained to become "special forces", but to equip them with basic scouting abilities. In our opinion, honesty, enthusiasm, loyalty and tenacity are more important than high level soldiering skills. In addition to the military drills, recruits (Fig. 3; see colour plates: page iii) are trained how to track, map read and use a GPS; instructed on radio protocol and etiquette; provided with education of fauna and flora; and taught basic first aid. Malilangwe scouts carry out the dual roles of law enforcement and biological monitoring, so recruits are also taught how to report sightings, mortalities, and movements of wildlife into and out of the reserve.

Daily scouting can become monotonous, especially when levels of poaching are low. To break the tedium, scouts at Malilangwe undergo a week of refresher training every three months. This involves:

Early morning physical training sessions, leading up to a fitness test; practical first aid training; weapons handling (time spent on the range increases shooting confidence, which is critically important in a contact situation); tactical training and appraisal of patrol effort. (Scouts carry GPS enabled radios that capture position fixes at regular intervals. Position data are plotted to generate maps of patrol effort, which are then discussed with scouts. It is important that patrols cover the reserve, and that time spent walking along roads is limited); recreational activities such as fishing and movie watching, soccer games against the community and debriefing session to give scouts an opportunity to discuss operational issues, company policies, or any other problems with their managers.

In essence, the refresher week is an important morale-boosting period when scouts, who are normally isolated to outlying pickets, can socialize with different people and connect with senior staff.

Strategic deployment

Malilangwe operates at a scout density of one actively patrolling man per 10 km^2. This matches the recommendation for rhino protection in Africa of one man per 10 km^2 for medium to large reserves (Martin and Vigne 2012). Scouts are housed in nineteen pickets, located at strategic points along the reserve's boundary, and three located within the Reserve (Fig. 4; see colour plates: page iii). An end of year prize is awarded for the best kept camp. Wives and young children are permitted, but they cannot move beyond the confines of the camp. They are transported to and from the picket by an authorized vehicle.

Early every morning (04h30–05h30), scouts are paged on a private radio channel by a senior sergeant and given their patrol instructions for the day. Each picket has a patrol area that is spatially defined by the boundary and internal roads. It is important not to have a routine, so sergeants randomize the daily patrols. Emphasis is not on distance covered, but on patrolling correctly, in accordance with seasonal differences in thickness of vegetation and type of terrain. Daily patrols from the pickets include a section of the boundary fence, such that the entire 120 km perimeter fence is covered on foot each morning. Scouts may also be instructed to man observation points at night instead of returning to their pickets. This is especially important during full moon. The entire reserve is patrolled, ninety-four per cent of sightings result in positive identification of

a rhino (Malilangwe's rhinos are ear notched with uniquely identifiable patterns), so detailed biological information is generated at both the individual rhino and population levels. While detailed monitoring does not protect rhinos from poachers, it does provide a sound basis on which to measure the success of anti-poaching operations. By contrast, when monitoring is poor, it is uncertain whether a missing rhino has been poached or simply not been sighted.

Vehicles patrol the reserve after dark, covering random routes, stopping and listening at intervals. Main roads outside the boundary are also patrolled at night to check for suspicious activity. Boom gates at either end of a public road that runs north-south through the reserve are manned 24 hours. Vehicles travelling along the road are checked for number of occupants and travel time between the gates is recorded. If a vehicle takes too long, a team is sent to investigate.

A quick reaction team (QRT) is based at a picket close to Headquarters. In addition to being tasked with as a rapid reaction force for any incident, the role of the QRT is also to: assist government authorities with off property investigations; locate rhinos that are seen infrequently and visit local communities to forge relationships.

The QRT receive a higher level of firearms instruction than the regular scouts, have more sophisticated equipment, and are paid extra to cover overtime. They work closely with the Security Manager and have the status of an elite unit, with the associated prestige. Extra effort is expected from QRT members, and individuals who fail to meet the high standards are replaced.

Community engagement

Malilangwe has been striving to improve the welfare of its surrounding communities since the formation of the reserve in 1994. Projects have included: development and refurbishment of infrastructure for schools and clinics; drilling of boreholes; establishment of small-scale agricultural enterprises; education on HIV/AIDS; child supplementary feeding; conservation education; and bursaries for tertiary education.

While these programmes have helped to forge a strong relationship between Malilangwe and its neighbors, the long-term employment of over 300 staff from the surrounding communities has, in our opinion, had a greater positive effect. Many have been employed in the reserve for more than a decade and this has dramatically improved their living standards, and those of their extended families. These staff members are Malilangwe's eyes and ears beyond its boundaries and there have been instances when employees have passed on information concerning poachers. However, in many cases, communities have no knowledge of poachers because gangs travel widely, and they are often from other provinces or even countries. Furthermore, it is our observation that immoral elements will always exist in communities regardless of the level of philanthropic input. Given these limitations, investment in neighbouring communities will help to reduce poaching, but not necessarily eliminate it.

Discussion

Malilangwe's anti-poaching strategy is, in many ways, similar to that of other protected areas in Africa, but differences are also apparent. Malilangwe's particular focus on human resource management is unusual in an African conservation setting. Modern businesses increase profits by adopting leadership styles geared towards improving the satisfaction and loyalty of employees (Matzler and Renzl 2006; Lu-Ming and Jui-Yun 2017). This level of management, however, is yet to become widespread in the fight against poaching. We believe the development of a loyal bond between scouts and their leader to be an important factor in rhino protection because loyal employees are less likely to collude with poachers. Loyalty develops over time, when a serving leader sets a high standard, while working side by side with his staff in the field (Jennings and Stahl-Wert 2003). Martin (2004) also reports quality leadership as being the most important factor in curbing rhino poaching in Royal Chitwan National Park, Nepal.

Malilangwe has a strong focus on intelligence. Considerable effort and resources are directed towards acquiring and managing informants, and following up on information. This has paid off, with security being pre-warned of 90 % of threats. This greatly increases the probability of successful arrests. If poaching attempts consistently fail, word gets out that targeting the reserve is not worth the risk. When

faced with the choice of whether to increase the number of scouts on the ground or develop an intelligence unit, we recommend the latter (see Barichievy et al. 2017).

Many conservation organizations hire external consultants for short periods to recruit and train their scouts. Once the work is done, the consultant leaves, and any bond that may have developed during the recruitment process is broken. In contrast, Malilangwe's recruitment and training is done over much longer periods by permanently employed staff. This continuity sets the stage for a long-term relationship (54 % of Malilangwe's scouts have been employed for >10 years, and 13 % for >20 years). Many would consider a six month selection process excessive, but experience at Malilangwe has shown this to be invaluable. Choice of the correct personality type for the job is fundamental, and we believe the meticulous care taken over an extended recruitment to be well worth the extra money and effort. The current method of selection could be improved by running a pre-selection clinic where candidates are told what to expect and preparatory diets and exercise routines are handed out. This would improve efficiency because candidates that arrive for selection unprepared could be quickly identified and dropped.

Increasingly sophisticated technology is being used in the fight against poachers. Drones, camera traps, law enforcement monitoring software, and thermal imaging units that help to detect poachers have been developed (Mulero-Pazmany et al. 2014; Hart et al. 2015; Pimm et al. 2015). While these tools may be useful, their capabilities have yet to be rigorously tested in the field (Linchant et al. 2015; Pimm et al. 2015), and their value is lost when placed in the hands of corrupt or incompetent security personnel. Malilangwe has found GPS enabled radios that collect data for monitoring patrol effort, and custom-built databases for managing intelligence networks and rhino populations very useful. However, we have not allowed technology to divert focus away from the basics of security management. Malilangwe's success is testament to the power of getting the fundamentals right. A low level of poaching has been achieved using the skills of dedicated personnel, with sophisticated technology only being adopted when it is guaranteed to add additional value.

Dehorning has not been used as a strategy to deter poaching at Malilangwe. While dehorning may be feasible in reserves with few rhinos, it is prohibitively expensive for large populations (estimated to cost US$ 250,000 every two years at Malilangwe). Rhinos regrow their horns, so the expense is not a once off, with dehorning being necessary after every 24 months. In addition, we do not believe that the effects of dehorning on the biology of rhinos have been adequately researched, and therefore we have focused our resources on other methods of protection instead.

Adequate funding is critical for the successful protection of rhinos. In our opinion sophisticated technology cannot compensate for a lack of funding primarily because advanced systems are expensive to both purchase and maintain. A certain level of funding is therefore a prerequisite. However, we believe that adequate funding will not achieve success in the absence of quality leadership. Money must be spent wisely and in our opinion the bulk of the funding should go towards adequately remunerating staff.

Malilangwe's strategy has produced good results, but it may not work everywhere. The reserve is fully electric-fenced, and of medium size (50,000 ha). Many protected areas are far larger, and policing them to the same standard would be logistically difficult and prohibitively expensive. While a fence does not stop poachers, it contains rhinos, making their protection easier. Rhinos are known to make unexpected long distance movements (Shrader and Owen-Smith 2002), leaving the safety of unfenced reserves, and increasing their vulnerability to poaching. A fence is also an advantage when prosecuting poachers in court because it is a barrier that must be intentionally crossed. With an electrified, 2.4 m high, wire-mesh fence, entry is deliberate by default, and poachers cannot claim to have naively wandered across the boundary and into the reserve. Unlike many protected areas in Zimbabwe, Malilangwe is situated relatively far from an international boundary. This is an advantage because poachers cannot easily evade capture by rapidly leaving the country. For these reasons, while the current threat persists, we believe the future for rhinos is for them to be protected in fenced, medium-sized reserves like Malilangwe, as opposed to large, unfenced parks. This appears to be a common viewpoint because many medium and large-

sized reserves that harbor rhinos are fenced. However, there are instances where rhinos have been re-introduced into large, unfenced areas, which in our opinion is too risky and costly a strategy. Packer et al. (2013) showed that while fenced reserves can maintain lions at 80 % of their potential densities on annual management budgets of \$500 km^{-2}, unfenced areas require in excess of \$2,000 km^{-2} to attain half the potential density of lions. It would be useful to conduct a study to determine whether rhino populations follow a similar trend with respect to funding and fences.

Savvy poachers should avoid well-protected reserves, preferring to focus their efforts on areas where the relative risk of being caught is lower. This suggests that Malilangwe's security efforts may have simply deflected poachers to areas with less protection, and that Malilangwe's strategy will only be properly tested when lower risk options are no longer available.

Although Malilangwe's strategy is relatively simple, it is difficult to implement because a considerable amount of sustained effort is required to maintain the necessary level of discipline and morale. Problems arise daily, and personal sacrifice by managers is the order of the day. This takes its toll over time, and only certain character types have the grit to push through (Duckworth 2016).

This paper has focused on anti-poaching strategy at the reserve level. However, long-term protection of rhinos is not only dependent on reserve-level management, but also on strategies at the national and international levels (Ferreira et al. 2014). Without new and bold methods to control poaching, rhino protection is unlikely to succeed, regardless of the quality of enforcement at the reserve scale (Challender and MacMillan 2014).

Conclusion

A successful, reserve-level, rhino anti-poaching strategy that is based on seven fundamental pillars of management has been described. Of the seven management areas, leadership, intelligence and funding are considered the most important. While the strategy may not be applicable under all circumstances, the underlying philosophy of striving to get the basics of rhino protection in place before the addition of more sophisticated technological layers, should have relevance in African and Asian rhino range states.

References

Barichievy C, Munro L, Clinning GC, Whittington-Jones GM, Masterson G. 2017. Do armed field-rangers deter rhino poachers? An empirical analysis. *Biological Conservation* 209:554–560.

Biggs D, Courchamp F, Martin R, Possingham HP. 2013. Legal Trade of Africa's Rhino Horns. *Science* 339:1038–1039. http://science.sciencemag.org/content/339/6123/1038.

Büscher B, Ramutsindela M. 2016. Green violence: Rhino poaching and the war to save Southern Africa's peace parks. *African Affairs* 115:1–22. http://dx.doi.org/10.1093/afraf/adv058.

Challender DWS, MacMillan DC. 2014. Poaching is more than an enforcement problem. *Conservation Letters* 7:484–494.

Duckworth A. 2016. *Grit: The power of passion and perserverance*. Simon & Schuster, New York.

Ferreira SM, Ouma BO. 2012. A proposed framework for short-, medium- and long-term responses by range and consumer states to curb poaching for African rhino horn. *Pachyderm* 51:52–59. http://edepot.wur.nl/244730.

Ferreira SM, Pfab M, Knight M. 2014. Management strategies to curb rhino poaching: Alternative options using a cost-benefit approach. *South African Journal of Science* 110:1–8. http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0038-23532014000300016&nrm=iso.

Hart AG, Rolfe RN, Dandy S, Stubbs H, MacTavish D, MacTavish L, Goodenough AE. 2015. Can handheld thermal imaging technology improve detection of poachers in African bushveldt? *PLoS ONE* 10:1–13. https://www.ncbi.nlm.nih.gov/pubmed/26110865.

Jennings K, Stahl-Wert J. 2003. *The serving leader: 5 powerful actions that will transform your team, your business and your community*. Berrett-Koehler, San Francisco.

Knight M. 2018. African Rhino Specialist Group report. *Pachyderm* 59:14–26.

Kulas JT, McInnerney JE, DeMuth RF, Jadwinski V. 2007. Employee satisfaction and theft: Testing climate perceptions as a mediator. *The Journal of Psychology* 141:389–402. https://doi.org/10.3200/JRLP.141.4.389-402.

Linchant J, Lisein J, Semeki J, Lejeune P, Vermeulen C. 2015. Are unmanned aircraft systems (UASs) the future of wildlife monitoring? A review of accomplishments and challenges. *Mammal Review* 45:239–252.

Lu-Ming T, Jui-Yun W. 2017. How can financial organizations improve employee loyalty? The effects of ethical leadership, psychological contract fulfillment and organizational identification. *Leadership & Organization Development Journal* 38:679–698. https://doi.org/10.1108/LODJ-07-2015-0142.

Martin E. 2004. Rhino poaching in Nepal during an insurgency. *Pachyderm* 36:87–98.

Martin E, Vigne L. 2012. Strategies to decrease rhino poaching in Africa: our personal view. *SWARA* 62:62–69.

Matzler K, Renzl B. 2006. The Relationship between interpersonal trust, employee satisfaction, and employee loyalty. *Total Quality Management & Business Excellence* 17:1261–1271. https://doi.org/10.1080/14783360600753653.

Mulero-Pazmany M, Stolper R, van Essen LD, Negro JJ, Sassen T. 2014. Remotely piloted aircraft systems as a rhinoceros anti-poaching tool in Africa. *PLoS ONE* 9:1–10. https://www.ncbi.nlm.nih.gov/pubmed/24416177.

Muntifering JR, Linklater WL, Clark SG, Uri-Khob S, Kasaona JK, Uiseb K, Du Preez P, Kasaona K, Beytell P, Ketji J, Hambo B, Brown MA, Thouless C, Jacobs S, Knight AT. 2015. Harnessing values to save the rhinoceros: insights from Namibia. *Oryx* 51:98–105. https://www.cambridge.org/core/article/harnessing-values-to-save-the-rhinoceros-insights-from-namibia/2843A44A342126427D1F9DC89DC24FC9.

Packer et al. 2013. Conserving large carnivores: dollars and fence. *Ecology Letters* 16:635–641.

Pimm SL, Alibhai S, Bergl R, Dehgan A, Giri C, Jewell Z, Joppa L, Kays R, Loarie S. 2015. Emerging technologies to conserve biodiversity. *Trends in Ecology & Evolution* 30:685–696. http://www.sciencedirect.com/science/article/pii/S0169534715002128.

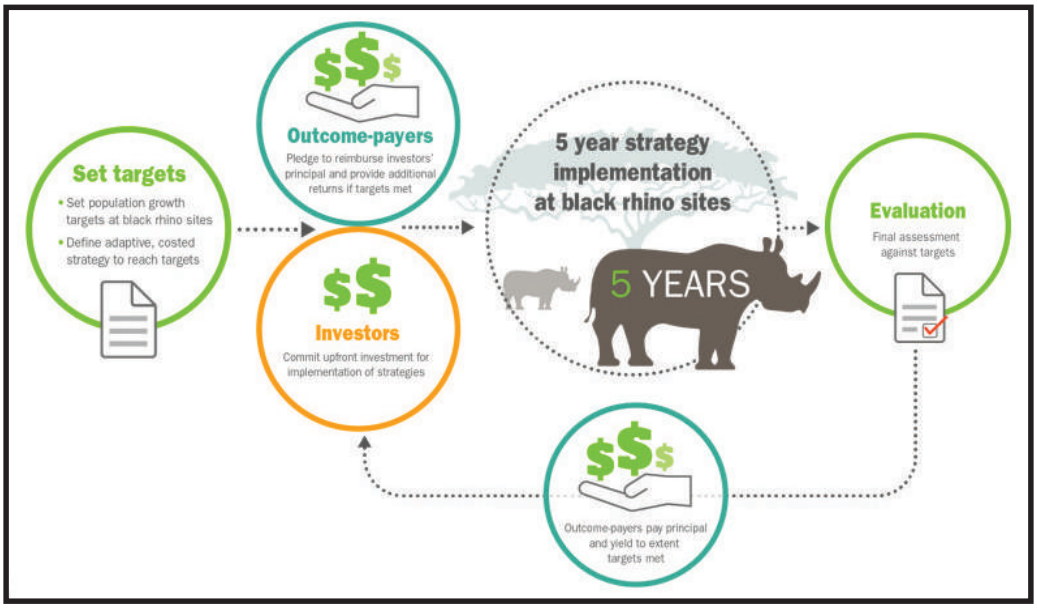
Save the Rhino International. 2018. Poaching statistics. *https://www.savetherhino.org/rhino_info/poaching_statistics*. [Accessed 11 April 2018]

Shrader AM, Owen-Smith N. 2002. The role of companionship in the dispersal of white rhinoceroses (Ceratotherium simum). *Behavioral Ecology and Sociobiology* 52:255–261. https://doi.org/10.1007/s00265-002-0506-y.

Ugboro IO, Obeng K. 2000. Top management leadership, employee empowerment, job satisfaction, and customer satisfaction in TQM organizations: an empirical study. *Journal of Quality Management* 5:247–272. http://www.sciencedirect.com/science/article/pii/S1084856801000232.

Waldron A, Mooers AO, Miller DC, Nibbelink N, Redding D, Kuhn TS, Roberts JT, Gittleman JL. 2013. Targeting global conservation funding to limit immediate biodiversity declines. *Proceedings of the National Academy of Sciences* 110:12144–12148. http://www.pnas.org/content/110/29/12144.

Above. Jeffries et al. *The Rhino Impact Investment Project: a new, outcomes-based finance mechanism for selected AfRSG-rated 'Key' black rhino populations.* pp. 88-95
Figure 1. A diagrammatic representation of the Rhino Impact Bond



Centre and below. Ball et al. *What does it take to curtail rhino poaching? Lessons learned from twenty years of experience at Malilangwe Wildlife Reserve, Zimbabwe.* pp. 96-104

Centre left. Figure 2. During selection, candidates are challenged physically and mentally.

Centre right. Figure 3. Firearms training.

Below. Figure 4. Scout picket (Photos © *Mike B Ball*)