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Spatial Monitoring and Reporting Tool (SMART) in Mid-Zambezi Valley, Zimbabwe: Implementation challenges and practices

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Abstract

Biodiversity monitoring and data-management technologies can enhance the protection of persecuted species, such as African elephants (*Loxodonta africana*), through providing management-relevant information. Implementing these technologies, however, often presents several capacity and resource challenges for field staff in protected areas. In the Mid-Zambezi Valley, Zimbabwe, the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) is in the process of adopting the Spatial Monitoring and Reporting Tool (SMART) as law enforcement and data management tool for adaptive management. With the support of several conservation partners, ZPWMA was able to acquire SMART equipment (computers and handheld cyber-tracker devices) as well as train rangers and officers on how to use SMART in the region. Following the training and provision of SMART equipment, most protected areas (6 out of 7) in the Mid-Zambezi Valley have adopted SMART for law enforcement and relevant data are being collected. This study draws from the first-hand experience of training workshops, interviews with field staff, observations from support visits, and discussions with conservation partners in the Zambezi Valley. We observed that the introduction of SMART was marred by (a) technical and capacity challenges, (b) behavioral and human dynamics challenges, and (c) resources challenges. These were linked to ineptness among patrol rangers and officers, discomfort with the new technology, and uneven distribution of resources to implement SMART. To help overcome some of the challenges, we propose the development of an integrated SMART implementation plan, motivation of field staff, learning from implementation models of institutions that have successfully implemented SMART, and the provision of more SMART equipment.

1 | INTRODUCTION

Wildlife management, a key component of biodiversity conservation, strives to maintain high species diversity and richness of wildlife resources. To achieve this, least threatened species like waterbuck (*Kobus ellipsiprymus*) and persecuted species like elephants (*Loxodonta africana)* both need to be protected (Konate et al., 2021; Riddle, Schulte, Desai, & van der Meer, 2010). Adaptive management and the use of data management technologies (e.g., Management Information Systems [MIST], and Spatial Monitoring and Reporting Tool [SMART]) can plausibly make wildlife management more effective. Nonetheless, the applicability and success of these technologies in effectively conserving wildlife resources varies geographically (Saunders, 2011; Schmitt & Sallee, 2002).

There has been growing use of SMART (https://smartconservationtools.org/) technology to monitor anti-poaching patrols in many wildlife areas (Moreto, 2015; Stokes, 2010; Wilfred, Kayeye, Magige, Kisingo, & Nahonyo, 2019). SMART has been widely adopted to monitor law enforcement efforts and allow adaptive management in the conservation of wildlife resources (Kuiper, Kavhu, Ms, Mandisodza-Chikerema, & Milner-Gulland, 2020; Lynam, Singh, & Chimuti, 2016). While data from SMART informs law enforcement locally, it has also been relevant to the global conservation of several endangered species (Gray et al., 2018; Hoette et al., 2016).

Although SMART implementation has grown in different countries, in developing countries such as Zimbabwe, it is still in its infancy. Lack of capacity on emerging technology and resources to support the technology are the key problems in adopting SMART over the traditional (paper-based) systems (Wilfred et al., 2019). This has been the case for some protected areas in the Mid-Zambezi Valley (MZV). In this study, we evaluate the implementation of SMART in MZV, Zimbabwe. Our specific objectives were to (a) evaluate the implementation success and challenges of SMART and (b) suggest solutions to current challenges. The setting of the study is a complex of protected areas that have adopted SMART in MZV and these include six Safari Areas (Chewore, Charara, Dande, Sapi, Hurungwe, Doma) and one National Park (Mana Pools) (Figure 1). We draw insights from discussions with conservation partners during workshops, first-hand experience of training, and interviews with field staff (patrol rangers and wildlife officers, and managers).

2 | IMPLEMENTATION OF SMART IN THE MID-ZAMBEZI VALLEY

The study was carried out in the MZV, northern Zimbabwe. The MZV is 1,187,900 ha in size and is bordered by Zambia and Mozambique (Figure 1). The MZV is characterized by a mix of photographic tourism and hunting,

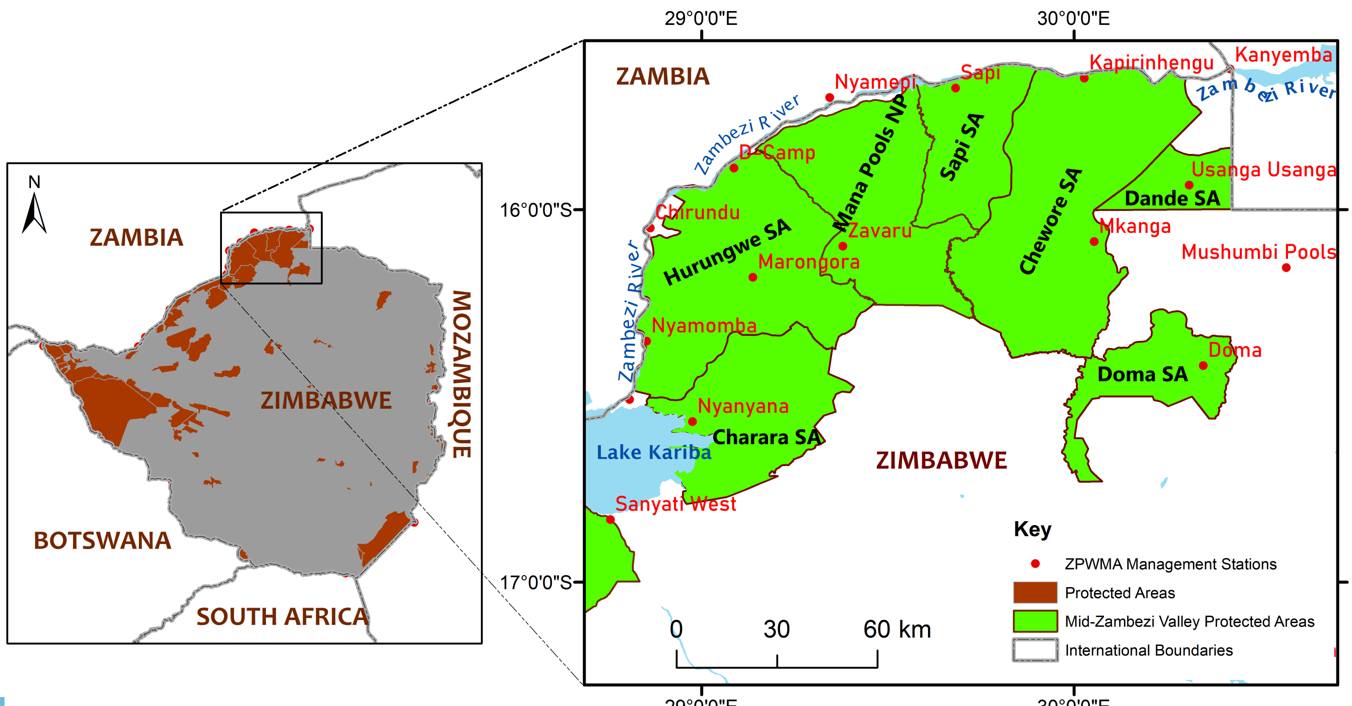

FIGURE 1 Location of protected areas in the Mid-Zambezi Valley

and some wild fauna of conservation value such as lion (*Panthera leo*), leopard (*Panthera pardus*), buffalo (*Syncerus caffer)*, and elephant. The MZV is a world heritage site and part of the UNESCO Man and Biosphere Programme. Protected areas in the MZV started the adoption of SMART in 2015 and the implementation was done by ZPWMA through the support of several non-governmental conservation partners (e.g., African Wildlife Foundation, Tashinga initiative, Panthera, CITES MIKE, North Carolina Zoo, UNDP GEF 6 Project).

Ten training workshops and seven follow-up visits (to seven stations) were delivered to 46 Wildlife Rangers and 10 Wildlife Officers (ranger supervisors with some managerial responsibilities) between January 2017 and December 2019. Participants were drawn from management stations found in the MZV. The training and field visits were meant to equip wildlife rangers and officers with expertise on how to (a) collect law enforcement data using cyber-trackers, a GPS enabled hand-held device that facilitates data collection (www.cybertracker.org), (b) upload data into the SMART database, (c) analyze data, (d) produce reports, and (e) integrate SMART reports in developing strategic law enforcement patrols. The training was also meant to enhance adaptive management toward law enforcement in the MZV. Adaptive management is the process of learning from monitoring data to change your strategies and make more strategic management decisions.

Most wildlife rangers and officers in the MZV were not acquainted with the new technology and required training. SMART equipment used during the implementation included 10 Computers and 39 cyber-trackers. The detailed procedure used during training, field visits, interviews, and discussions are provided in Data S1. This initiative advanced the integration of SMART into law enforcement patrols. However, the distribution of SMART equipment was uneven since some stations (e.g., Chewore Safari Area and Mana Pools National Park) received direct support from conservation partners while others (e.g., Dande Safari Area, Doma Safari Area, and Sapi Safari Area) did not, resulting in the SMART equipment and expertise required to set up a SMART database for law enforcement patrols not being available. The uneven distribution of SMART equipment greatly affected the complete adoption of SMART in the MZV.

3 | CHALLENGES FACED WHEN IMPLEMENTING SMART

Several challenges were observed and reported by rangers and officers during the interviews and discussions concerning the implementation of SMART in the MZV. These challenges were grouped into technical, capacity, behavioral, and resource challenges.

3.1 | Technical and capacity challenges with SMART implementation

Technical challenges reported by rangers and officers with regards to the use of SMART, ranked from the most reported to the least reported, include: (a) transfer of trained staff from Chewore Safari area to other protected areas, (b) poor internet connection to submit data collected to the main server for central storage (based at the head office) and evaluation of progress by the directorate, and (c) cyber-trackers had problems with connecting to GPS satellites when put insides pockets during patrols. Capacity challenges include the failure to (a) add new patrol members to the database, (b) update patrol mandates and teams in the database, (c) mark GPS locations of the start and the end of the patrol, (d) update configurable data models for cyber-trackers, (e) set up roles for different database users, and (f) generate SMART queries and reports.

3.2 | Behavioral and human dynamics challenges with SMART implementation

Rangers, wildlife officers, and managers generally showed appreciation of SMART as a valuable and useful tool that had the potential to enhance law enforcement data collection and decision-making. However, there were behavioral challenges that were observed to be driving resistance amongst some rangers, and this include: (a) discomfort with the new technology linked to poor capacity and the misconception that SMART is meant to police ranger activity, without seeing its potential in enhancing their performance through providing data relevant to adaptive management, (b) reluctance to collect SMART data as the recording of observation data is said to be time-consuming, and (c) favoritism in selecting SMART administrators and assigning SMART duties among patrol rangers.

3.3 | Resource challenges with SMART implementation

Resource challenges observed to be affecting SMART implementation include lack of (a) a sufficient number of cyber-tracker units to collect field data, (b) sufficient number of computers to store and manipulate SMART data, (c) digital screens to present data summaries and maps to draw spatial and temporal patterns from data, and (d) backup power sources for cyber-trackers especially when conducting extended patrols.

3.4 | The way forward

This study is among the few attempts to report some of the challenges of using SMART in protecting wildlife resources in Sub-Saharan Africa. In Zimbabwe, SMART implementation in other protected areas such as Gonarezhou and Chizarira National Parks, which are co-managed by ZPWMA and other external partners (Gonarezhou Conservation Trust and National Park Rescue), has been successful. Although not published, implementation and management regimes that were adopted in these protected areas would aid in dealing with the technical and behavioral challenges associated with SMART implementation in MZV. A look and learn exercise from these sites with a successful implementation story including other institutions with similar management regimes could be critical going forward.

Given the challenges associated with SMART implementation in the MZV, we propose the following key action areas:

1. Development of an integrated SMART implementation plan focused on improving ranger engagement, establish a SMART support team, and set procedures for performance assessment in areas with SMART (Kuiper, Kavhu, et al., 2020). The development process of this plan will involve learning from institutions that have successfully implemented SMART locally, including Gonarezhou Conservation Trust and National Park Rescue and internationally (e.g., Uganda Wildlife Authority). Additionally, the plan will entail constantly reviewing institutional capacity, stakeholder engagement, and lobbying for the prioritization of SMART adoption and rationalizing support of all the protected areas. Lessons drawn from other institutions together with consolidated technical and resource needs from the implementation plan could provide a model that can potentially be adopted at a national level. Going forward, the plan will provide a guide towards ensuring coordinated adoption of the national SMART data model, consistent utilization of SMART for law enforcement duties, and adoption of standard operating procedures for the use of SMART devices to safeguard from abuse. Overall, the plan will allow uniformity in the data collected and will improve the efficient use of SMART for law enforcement monitoring and adaptive management.
2. Acquisition of more SMART equipment. Integral to the successful implementation of SMART in the MZV is the provision of adequate SMART equipment for rangers and officers with a possible ratio of two individuals per SMART device (cyber-trackers). Additionally, there would be the need for webbing jackets with a pouch to attach cyber-trackers at positions that allow them to connect to GPS signals during patrols. Setting up a stable internet connection can be achieved from engagement with conservation partners.
3. Enhance capacity. Site-based SMART training workshops to address station-specific capacity challenges. Unlike previous training sessions, we propose a strategy which will address concerns raised by previous participants such as (a) usually there are multi-day SMART workshops and some cannot attend the full schedule, (b) wildlife officers and managers may not be comfortable being with juniors during training, and (c) more time and effort is required to practice SMART which may require a selected person to work full-time as an officer on-site leading to the uptake and implementation of SMART with a group of dedicated rangers. We propose sensitization of the human resources office on transfers that involve SMART administrators from SMART wildlife areas. Skills mapping through setting up a database of SMART users and their competencies in SMART will help in coming up with different roles at each site based on user abilities.
4. Motivate field staff with feedback. Observations by Kuiper, Massé, et al. (2021) in this landscape suggested that the provision of feedback on collected data helps to motivate field staff. To address some of the human dynamics and behavioral challenges, we, therefore, propose the introduction of monthly SMART performance reports, which provide feedback through an overall summary of collected data and high-level management decisions/contributions drawn from such data. These could be coupled with a consistent reward system for top-performing stations and patrol rangers to promote buy-in and ownership by field staff.

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CONFLICT OF INTERESTS

The authors declare that there exist no competing financial interests or personal relationships that could have appeared to influence the work reported in this study.

AUTHOR CONTRIBUTIONS

Blessing Kavhu conceived the idea and designed methodology; Blessing Kavhu collected the data; Blessing Kavhu analyzed the data; Blessing Kavhu and Kudzai S. Mpakairi led the writing of the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

DATA AVAILABILITY STATEMENT

Interview responses cannot be made public due to agreed procedures under the ethical conditions provided for this research (ZIMPARKS research policy).

ETHICS STATEMENT

The research presented in this article was approved by the directorate at the first author's organization.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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