ASSESSING THE ADAPTIVE MANAGEMENT PROCESS IN SMART SITES: LESSONS LEARNED

Alexander Wyatt[1], Rohit Singh[2], Charlotte Read[1]*

*Corresponding author ciread02@gmail.com

[1] WWF Cambodia, #21, St. 322, Boeung Keng Kang I, Boeung Keng Kang, Phnom Penh, Cambodia
[2] WWF Singapore, 354 Tanglin Rd, #02 - #03, Singapore 247672

ABSTRACT

The effective management of protected and conserved areas is crucial to the preservation of much of the world's biodiversity. The Spatial Monitoring and Reporting Tool (SMART) is one of the world's most utilised protected and conserved area management tools, used to inform research, tourism management, natural resources use, intelligence, threat analyses, and more. Through surveying staff at 49 protected and conserved areas across 14 countries, we examine how SMART is being implemented in terms of eight key factors in data management and decision-making. Results indicate room for improvement in all aspects of the adaptive process, particularly relating to the planning of systematic patrols as well as the role of management in the adaptive process. Additionally, many sites provide low levels of training and suffer from insufficient staffing. This information will help develop guidance on what is required by protected and conserved areas for the effective implementation of SMART.

Key words: Protected and conserved areas, ranger-based monitoring, Spatial Monitoring and Reporting Tool (SMART), conservation management, biodiversity

INTRODUCTION

Protected and conserved areas (PCAs) cover an increasing proportion of the Earth's surface, currently 17.13 per cent of terrestrial and inland waters (UNEP-WCMC & IUCN, 2023). Given their importance in conserving the planet's declining wildlife populations (WWF, 2020), it is crucial that PCAs are well managed. Effective management must address region or site-specific elements, such as responses to pressures and threats, social contexts, governance types and accountability. Crucially, it also relies on resilience to changing conditions and situations, meaning PCAs can benefit from adaptive management approaches (Agrawal, 2000; Prato, 2009), defined as the systematic acquisition and application of reliable information to improve management over time (Walters, 1986). Therefore, it is essential that management acquires necessary data on the conditions and interventions at ground level.

PCA and ranger-based monitoring tools may be used to obtain a consistent flow of this important information. These tools were developed to assist conservation practitioners in plugging information gaps as well as assisting in the implementation of adaptive approaches to management (Cronin et al., 2021; Stokes, 2010). By far the most widely used is the Spatial Monitoring and Reporting Tool (SMART) developed by the SMART Partnership. Current SMART Partnership members are: Frankfurt Zoological Society, Re:wild, North Carolina Zoo, Panthera, Peace Parks Foundation, Wildlife Conservation Society, Wildlife Protection Solutions, World Wildlife Fund, and Zoological Society of London. The SMART has grown from its origins as a law enforcement monitoring tool to become a globally used conservation management data tool (SMART, 2021). As a fully developed software platform, it offers tools for ranger-based data collection, storage and analyses. It is used to accurately record wildlife signs, patrol routes and illegal activities, and standardises this data to then create easily accessible information for use in maps, analyses and technical reports to aid and inform adaptive decision-making processes. SMART is used in 80 countries

around the world and is deployed in over 1,000 known conservation sites, ranging from large national parks to smaller community conservancies. It informs research, tourism management, natural resources use, intelligence, and performance and threat level assessments for protected and conserved areas (SMART, 2021).

A 'SMART patrol' approach (Stokes, 2010; SMART, 2021) centred around an adaptive framework has some generally agreed upon components (see Figure 1). The adaptive approach to conservation management is conceived of as an iterative feedback loop where data drives decision-making with continuous adaptation to change. The adaptive approach when utilising SMART will vary from site-to-site and drive continuous improvement. While many sites are implementing and using SMART for the purpose of improving patrolling and PCA management (SMART, 2021), there remains little understanding about how well these sites are implementing SMART. Studies evaluating SMART at individual sites suggest that SMART has helped to improve patrol results (Critchlow et al., 2016; Dancer, 2019; Hötte et al., 2016; Wangmo et al., 2021) and reduce threats (Duangchantrasiri et al., 2016; Wangmo et al., 2021). However, other studies demonstrate the deterrence effect of SMART patrols is weak and there is inconsistency in its implementation by management (Dancer, 2019). There has been little evaluation of a more general nature of how SMART is being implemented across the world, and where in the adaptive cycle sites are struggling most.

Table 1. An overview of the number of sites and total years of SMART implementation per country.

Countries	Number of sites	Years of implementation
Tanzania	1	0.5
Myanmar	6	1
Pakistan	2	1
Mongolia	1	1
China	10	3
Uganda	1	3
Laos	1	4
Kenya	4	4
Bhutan	6	5
Vietnam	2	5
Thailand	4	5
Indonesia	5	5
Malaysia	3	5
Cambodia	3	6

METHODS

To gain a better understanding of how SMART is being implemented and where the primary challenges arise, this study surveyed 49 sites across Asia and Africa. The survey captured eight main aspects of the adaptive management approach and related these to timelines for successful implementation across a maximum of six years. Factors achieving success in a short timeframe were of particular interest.

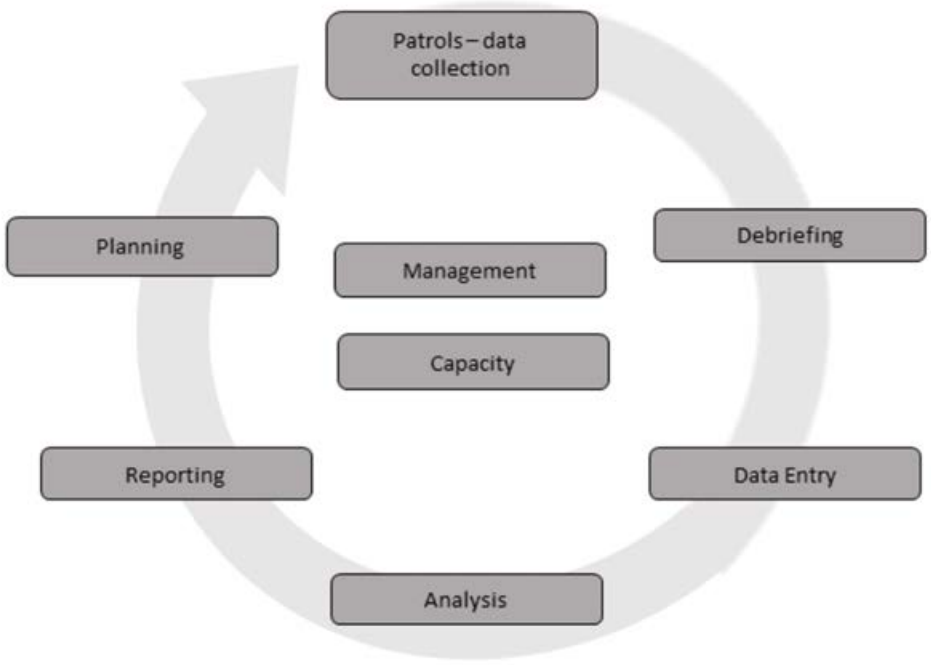


Figure 1. A simple adaptive management approach to using SMART to enhance 'management' and 'capacity'.

Asia and Africa were chosen for analysis due to a long history of SMART implementation. All sites were recruited through the WWF global network. SMART sites were defined as a single protected or conserved area, such as a national park, wildlife sanctuary or conservancy, that is implementing the SMART approach. Surveys were conducted for 49 SMART sites over two months in 2020, spanning the 14 countries below (Table 1).

The survey was used across sites and designed in consultation with SMART users on the ground and experts involved in supporting SMART implementation. The survey comprised nine sections, the first covering site identification data, country, and landscape, and the other eight covering aspects and levels of support for SMART implementation (Figure 1):

1. Staffing & Capacity (5 items)
2. Data Collection (4 items)
3. Data Entry (3 items)
4. Debriefing (1 item)
5. Analysis (3 items)
6. Reporting (3 items
7. Planning (3 items)
8. Management (3 items)

A total of 25 items utilised a mix of yes/no responses weighted 0 for 'no' and 1 for 'yes' plus a set of Likert scales ranging from 3 to 11 points. All eight scales were averaged and summed to produce a ninth aggregated 'total' score per site, per country. Most scales had key items focusing on frequencies of implementation of each aspect of the SMART approach using the following responses: 'never', 'as required' and 'monthly' (Appendix 1).

The surveys were completed by non-governmental organisation (NGO) staff along with input from local authorities. The process relied on self-reporting between the NGO and local management after a briefing or explanation by the survey team to local staff.

The relationship between the duration of SMART implementation and the aggregated total score was assessed by a Pearson product-moment correlation coefficient test using R (Studio version 2021.09.2+382). For sites with sufficient data, such as long-term consistent threat and wildlife observation data, background exploratory analyses also looked at types of enabling conditions that improved protection outcomes when total scores were similar. This was available for only two sites.

In addition to scoring sites based on the questions for each aspect of the SMART adaptive approach, the survey sought to understand numerous important aspects of SMART implementation such as levels of training received by patrol staff.

RESULTS

An overall picture of SMART implementation was developed by aggregating the results across the entire sample to see which of the eight aspects of implementation were performing best (Figure 2). As can be seen, 'reporting' was the highest performing

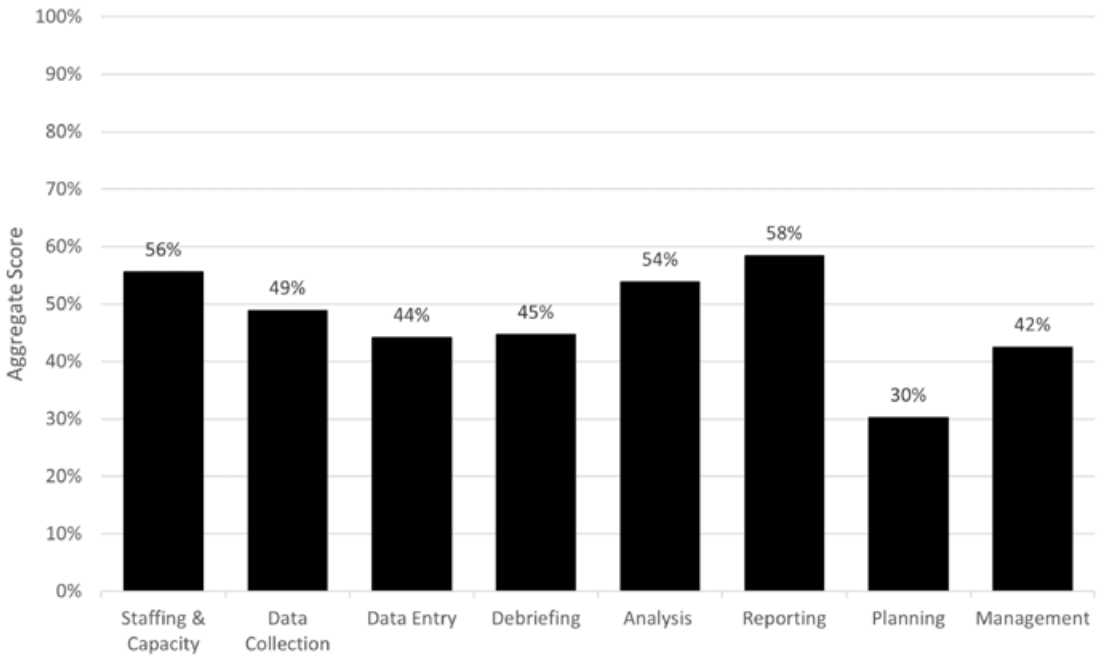


Figure 2. Assessment of each aspect of the SMART approach from sites in Africa and Asia

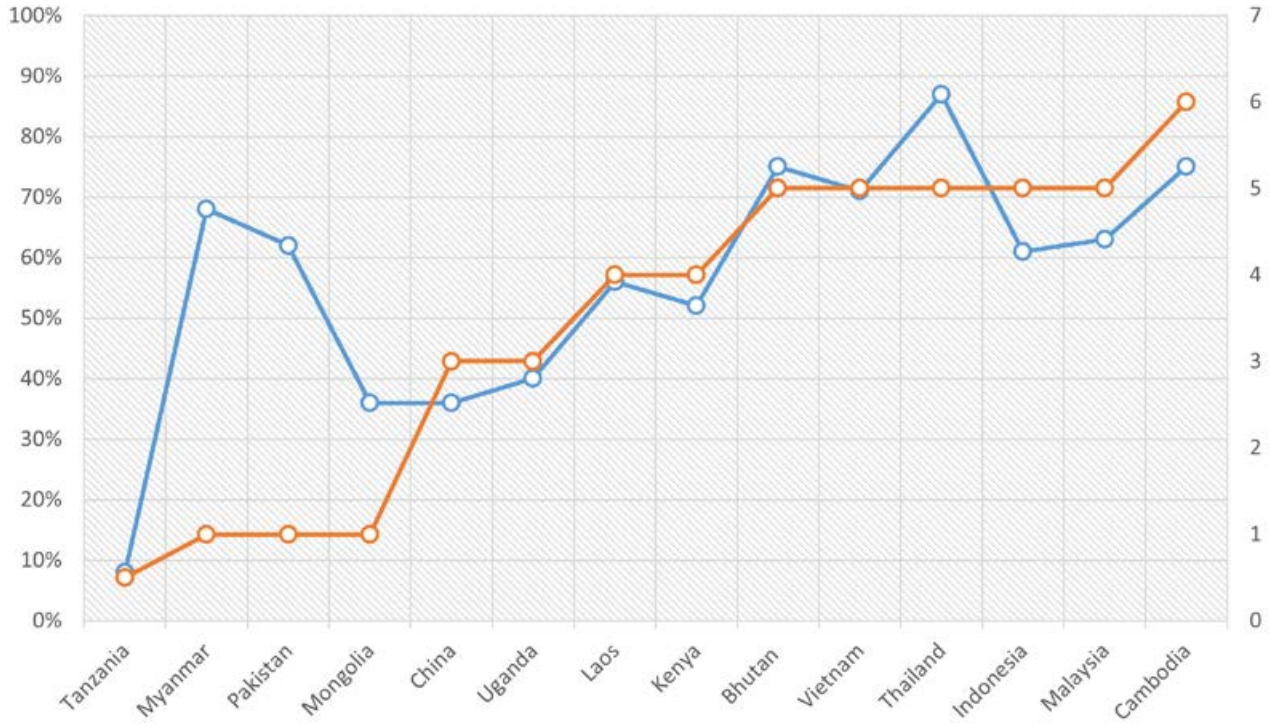


Figure 3. Mean site scores for each country compared with the mean number of years of SMART implementation demonstrating a correlation between duration of implementation and performance from sites in Africa and Asia

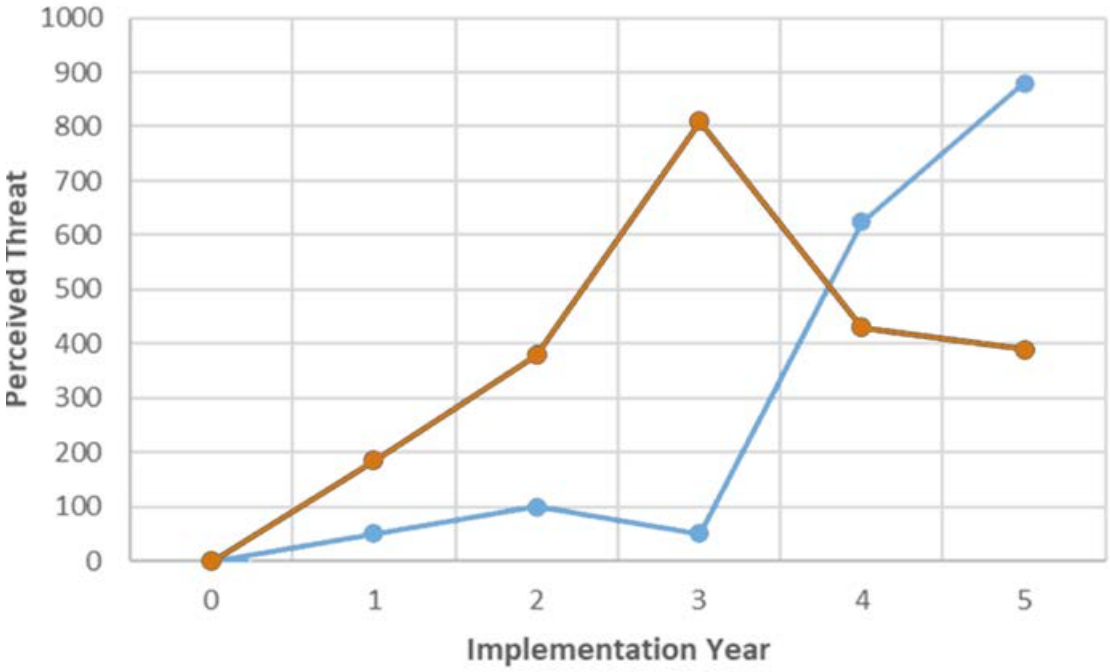


Figure 4. For SMART implementation, perceived threat falls after three years under good enabling conditions in one site yet continues to rise under poor enabling conditions in the other site

Ranger doing fire management in Loita Forest in the Mara landscape, lower Loita, Kenya © Ami Vitale / WWF-UK

aspect, with 'management and planning' performing considerably worse than others. All aspects scored below 60 per cent, suggesting significant room for improvement.

Most sites do not employ a full-time data officer, and 56 per cent of sites indicated that their designated SMART officer/administrator was spending less than 50 per cent of time on SMART-related activities. In only 9 per cent of sites, all frontline staff (rangers and community patrol members) were trained in data collection. Most sites are not conducting regular refresher training to staff, with only 44 per cent indicating these are conducted annually. 64 per cent do not have written protocols for SMART. Also key to the SMART adaptive approach is the use of data in patrol reports to plan future patrolling activities. Only 39 per cent produce such reports regularly, an additional 46 per cent indicating only 'sometimes'.

Duration of implementation was chosen for reporting because it displayed a significant positive correlation with the 'total score' that encapsulated all eight subscales, reflecting improvement with time as would be expected. The eight subscales were not correlated with time of SMART implementation, only the total score.

The second analysis consisted of the total scores, analysed per country (ranging from 8 per cent to 87 per cent, M=56 per cent, SD=0.21 per cent), and revealed a very positive correlation between duration of implementation (ranging from 6 months to 6 years, M=3.5 years, SD=1.8 years) and total score (Pearson's $r = 0.648$, $p = 0.01$). This suggests sites with a longer history of implementation performed significantly better than sites that had more recently adopted the tool. Despite this strong correlation, two nations, Myanmar and Pakistan, achieved high total scores, both in the 60s, despite implementation times as short as one year at the time of survey (Figure 3).

Notwithstanding, there is clearly much room for improvement in implementation. The weakest aspects were 'planning' (30 per cent), 'management' (42 per cent), 'data entry' (44 per cent) and 'debriefing' (45 per cent), mostly centred on process variables. Whereas the strongest, like 'data collection' (49 per cent), 'analysis' (54 per cent), 'staffing and capacity' (56 per cent) and 'reporting' (58 per cent) centred on analytic variables. It should be noted that the 'planning' aspect of the survey contained questions requiring a SMART Planning Plugin which is generally underutilised in the software tools. The survey also identified that the majority of sites do not have a full-time data officer, and only 25 per cent of sites employ an officer capable of utilising the full suite of analytical tools at the data officer level. This is notable since the full-time data officer is responsible for data management of SMART, though from these results

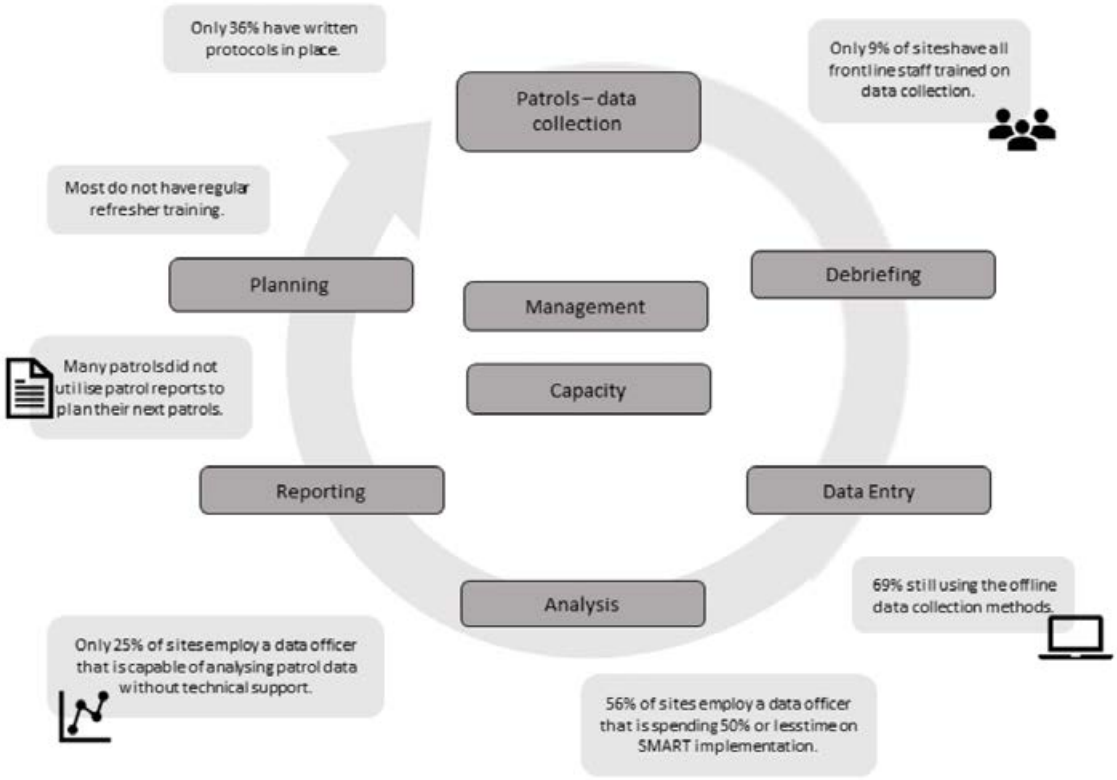


Figure 5. Overview of the SMART adaptive approach and key results.

it can be suggested that most data officers in the study sites were underutilised and undertrained, potentially impacting the implementation results of SMART. This needs further investigation to confirm this hypothesis, and to suggest improvements for management structures of staff utilising SMART. A summary of the key findings is shown in Figure 5.

Detailed time series data was available for two intentionally unidentified sites that also included data on perceived threat, defined as the number of recorded 'threat' observations over time. These two sites also happened to have opposing profiles for enabling conditions, allowing direct time series comparison between the two. Enabling conditions include levels of governance, management and investment. One site has strong enabling conditions and the other has poor enabling conditions. When compared (Figure 4), perceived threat only falls under strong enabling conditions and this only after three years of SMART implementation. It should be noted that this comparison relies only on two sites and the differences in threat reduction could be due to numerous other factors.

DISCUSSION

This survey-based exploration of SMART implementation across 49 sites and 14 nations in Asia and Africa uncovered three main findings. The first is there is significant room for improvement across all eight aspects of implementation, given that none of them reached scores much higher than 60 per cent. The second was that implementation time across years correlated significantly with aggregated total scores. This means that achieving a high level of SMART implementation takes time. The scatter around the trend line is tight except in the cases of Pakistan and Myanmar, both of which achieved high total scores despite having only a year of implementation experience. The reasons behind their unusual ability to achieve scores more akin to nations with five years' experience deserves further exploration. The third main finding was that 'perceived threat' as a major outcome variable can dramatically fall after three years of SMART implementation but only under good enabling conditions, here defined as strong management, governance and investment. This confirms the second finding by suggesting 1–3 years of SMART

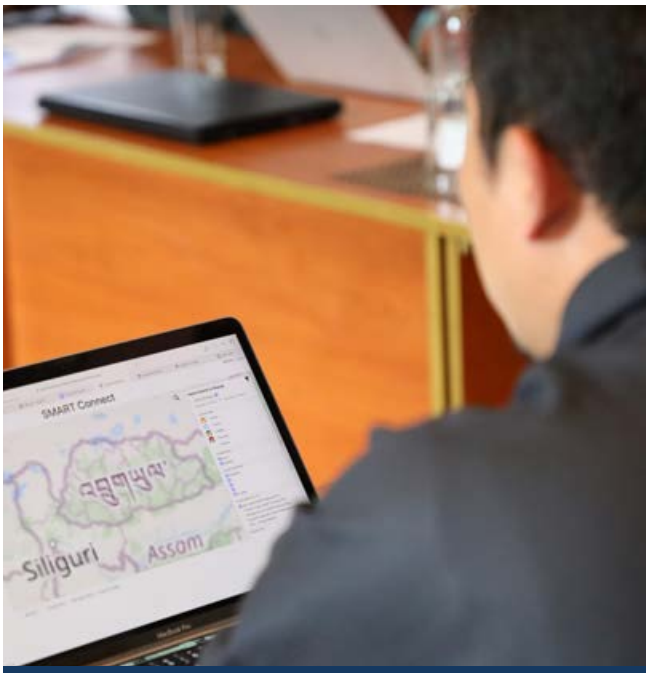
A group of female rangers out on patrol in Sarpang Forest Division in Bhutan © Rohit/Singh/WWF US

implementation might be the minimum requirement for positive outcomes. This is because the data suggests a trend for the sites per country to achieve maximum efficiency around 3 years of SMART implementation, except in the case of Pakistan and Myanmar which were outliers achieving success within only six months.

Challenges

Given that SMART is implemented in 1,000 PCAs around the world (SMART, 2021), it is imperative to understand the challenges in achieving an adaptive approach to SMART implementation. By understanding gaps in implementation, management and conservation outcomes can be optimised (Powlen et al., 2021). The uptake of SMART can be viewed as a positive step by PCAs, offering an evidence base for holistic management processes and even for other tools such as, for example, the management effectiveness tracking tool (METT) and Conservation Assured (Dudley et al., 2020; Hockings et al., 2021; Stolton et al., 2021). Moreover, SMART directly empowers site staff with information to improve patrol decisions (Dancer, 2019; Hötte et al., 2016; Wangmo et al., 2021) and conservation results, such as a reduction of threats to biodiversity and population recovery (Duangchantrasiri et al., 2016; Wangmo et al., 2021). But as conceptualised in the SMART adaptive approach (Figure 1), this process relies on multiple layers for effective implementation. From field staff, such as rangers, to higher level management, each has a role to play in the effective use of the tool, and each level requires different skill sets and competencies. Therefore, the effectiveness of the implementation of SMART relies heavily on how it is implemented. Simply adopting SMART in a PCA will not yield positive conservation or management outcomes without this crucial consideration, especially when regarding training and data handling, and adaptive action that is a continuation of the management process based on information by SMART.

In many studies, positive outcomes have relied on the enabling conditions present in field (Arthur, 2021; Fox et al., 2013; Lockwood, 2010). Without sufficient consideration and support from local authorities, for example, it is unlikely that SMART implementation will be effective in producing positive outcomes. This is perhaps demonstrated by those sites with more recent implementation scoring better than some of those with longer histories of SMART use, although this could also be a result of significant hands-on support and guidance from experts during initial phases of implementation. Enabling conditions include governance structures,



Rangers learning SMART Connect in Bhutan © WWF Bhutan

accountability mechanisms and the general commitment to conservation by local or national governments (Porter-Boland et al., 2012). This also extends to adequate funding to effectively manage PCAs and implement SMART, crucial for ensuring sufficient staffing and equipment for field teams. As seen in the survey results, many sites suffer from low levels of training and in-house capacity as well as a limited use of SMART outputs in the form of reports. A lack of training, in-house capacity or written protocols at a site, for example, extends beyond SMART implementation and may be more of a reflection of wider shortcomings or operational procedural differences between sites. These factors remain relevant to assessment results. Further study could investigate whether these factors are consistent over time, and further research could assist in developing management strategies accordingly.

Despite some concerns over the capacity of staff to effectively implement an adaptive SMART approach, the results indicate that some of the more complicated aspects of the software application, such as analysis and reporting, scored relatively well. Many PCAs covered in the survey receive support from non-governmental conservation organisations for capacity building at the 'data officer/administrator' level. 'Planning' and 'management', which scored relatively poorly, are aspects that rely on individuals working at different levels, such as PCA managers. Limited SMART-focused training has been directed at this level and there is a poor understanding of the competencies required at all levels of implementation, from field staff to local and national operatives. Without understanding the competencies required across each level of implementation, from rangers to managers, it is understandable that these competencies may be lacking.

A way forward

Excluding the more challenging impediments to effective SMART implementation, such as general governance in a country or PCA, the survey helps highlight where improvements could be made. The poorer performance of management relative to other aspects of the approach underlines the need to build capacity at different levels of the adaptive approach. The over-reliance on data officers or administrators may be drawing focus away from other equally important aspects of the approach. The SMART Partnership, a collaboration of nine conservation organisations (SMART, 2021), has acknowledged this issue and has developed detailed competencies for roles at various levels of the SMART approach (Stanciu et al., 2021). Though each site will differ, SMART competencies aim to define and distil the skills and knowledge required to implement SMART across four broadly defined personnel levels (Stanciu et al., 2021). This will aid in understanding, as well as directing future training to PCA staff at all levels.

Other challenges, such as lack of consistent training of frontline staff and a lack of clear or written protocols, should also be addressed through management plans and increased communication efforts made to all staff involved. The long-term cost of equipment, training and infrastructure for SMART implementation needs to be carefully considered and factored into the management processes of sites along with other aspects of PCA management. In fact, whether SMART implementation is appropriate or sustainable for any particular PCA should also be considered prior to adoption of the tool, as with any novel technological intervention (Cronin et al., 2021).

This study suggests that the continuing evolution of SMART, both as a software tool and approach, will improve conservation results. Consistent feedback from implementing sites as well as the production of easy-to-use guidance documents and training, focused at all levels of implementation, will likely improve SMART implementation results in many sites with sufficient enabling conditions. Regular review and reflection at implementing sites as well as alignment with other widely used monitoring tools that rely on quantitative evidence, such as METT, will also likely increase the utility of SMART. In those sites without sufficient enabling conditions or commitment by implementing agencies, we cannot expect SMART, nor any other tool, to yield positive conservation outcomes. Continued

assessment of what is required on a site-by-site basis, and whether the investment in tools such as SMART is worthwhile, will continue to be needed.

CONCLUSION

The survey was designed to provide a simple snapshot overview of SMART implementation. The survey suggests that the quality of SMART implementation increases over time, with management adapting to the use of the tool. However, some of the higher scoring sites with more recent deployments suggest that higher quality implementation is not solely a result of longer implementation periods. A much more in-depth and detailed study would be needed to explore these results and outline additional factors leading to success. The performance of sites in the assessment generally reflect the perceptions of SMART experts through direct observation, yielding results that could be interesting and useful to other implementing agencies. With a sufficient understanding of the gaps in effective SMART implementation, it becomes possible to address these gaps, aiming for stronger implementation, stronger PCA management and ultimately stronger conservation efforts.

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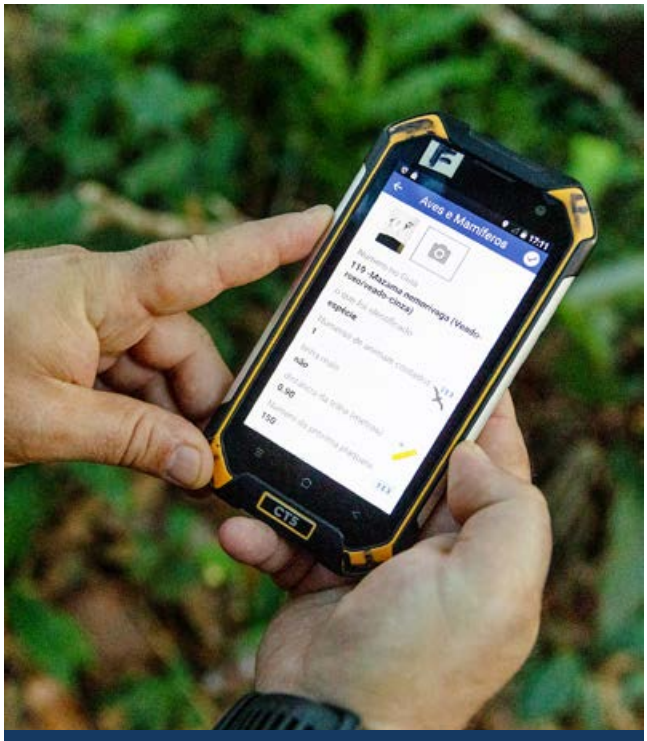

SMART Mobile application for field data collection © Myke Sena / WWF-Brazil

ABOUT THE AUTHORS

Alexander Wyatt is the Wildlife Crime Program Coordinator for WWF Cambodia. His experience lies in wildlife conservation, particularly in improving protected area management and effectiveness in Asia and beyond. orcid.org/0000-0002-9833-3203

Rohit Singh is the Director of Wildlife Enforcement and Zero Poaching for WWF Singapore. He has over 16 years of experience in wildlife law enforcement, conservation and protected area management. orcid.org/0000-0002-8175-9072

Charlotte Read is a wildlife crime research intern for WWF Cambodia with interests in protected area management, especially in relation to combatting the illegal wildlife trade. She has experience in conservation journalism and research. orcid.org/0000-0002-2400-3340

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RESUMEN

La gestión eficaz de las áreas protegidas y conservadas es crucial para preservar gran parte de la biodiversidad mundial. La Herramienta de Seguimiento e Información Espacial (SMART) es una de las herramientas de gestión de áreas protegidas y conservadas más utilizadas en todo el mundo, y se emplea para informar sobre la investigación, la gestión del turismo, el uso de los recursos naturales, la inteligencia, el análisis de amenazas y mucho más. Mediante encuestas al personal de 49 áreas protegidas y conservadas de 14 países, examinamos cómo se está aplicando SMART en lo que respecta a ocho factores clave en la gestión de datos y la toma de decisiones. Los resultados indican que hay margen de mejora en todos los aspectos del proceso adaptativo, sobre todo en lo relativo a la planificación de patrullas sistemáticas, así como al papel de la administración en el proceso adaptativo. Además, muchos centros ofrecen escasa formación y carecen de personal suficiente. Esta información ayudará a desarrollar orientaciones sobre lo que necesitan las áreas protegidas y conservadas para la aplicación eficaz de SMART.

RESUME

La gestion efficace des zones protégées et conservées est essentielle à la préservation d'une grande partie de la biodiversité mondiale. L'outil de suivi et de rapport spatial (SMART) est l'un des outils de gestion des zones protégées et conservées les plus utilisés au monde. Il sert à informer la recherche, la gestion du tourisme, l'utilisation des ressources naturelles, le renseignement, l'analyse des menaces et bien d'autres choses encore. En interrogeant le personnel de 49 aires protégées et conservées dans 14 pays, nous examinons comment SMART est mis en œuvre en fonction de huit facteurs clés de la gestion des données et de la prise de décision. Les résultats indiquent qu'il est possible d'améliorer tous les aspects du processus d'adaptation, en particulier en ce qui concerne la planification des patrouilles systématiques et le rôle de la direction dans le processus d'adaptation. En outre, de nombreux sites offrent un faible niveau de formation et souffrent d'un manque de personnel. Ces informations permettront d'élaborer des orientations sur les besoins des zones protégées et conservées pour une mise en œuvre efficace de SMART.