PARKS

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IUCN WCPA WORLD COMMISSION ON PROTECTED AREAS

IUCN PROTECTED AREA DEFINITION, MANAGEMENT CATEGORIES AND GOVERNANCE TYPES

IUCN defines a protected area as:
A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.

The definition is expanded by six management categories (one with a sub-division), summarized below.

Ia Strict nature reserve: Strictly protected for biodiversity and also possibly geological/ geomorphological features, where human visitation, use and impacts are controlled and limited to ensure protection of the conservation values.

Ib Wilderness area: Usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, protected and managed to preserve their natural condition.

II National park: Large natural or near-natural areas protecting large-scale ecological processes with characteristic species and ecosystems, which also have environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities.

III Natural monument or feature: Areas set aside to protect a specific natural monument, which can be a landform, sea mount, marine cavern, geological feature such as a cave, or a living feature such as an ancient grove.

IV Habitat/species management area: Areas to protect particular species or habitats, where management reflects this priority. Many will need regular, active interventions to meet the needs of particular species or habitats, but this is not a requirement of the category.

V Protected landscape or seascape: Where the interaction of people and nature over time has produced a distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.

VI Protected areas with sustainable use of natural resources: Areas which conserve ecosystems, together with associated cultural values and traditional natural resource management systems. Generally large, mainly in a natural condition, with a proportion under sustainable natural resource management and where low-level non- industrial natural resource use compatible with nature conservation is seen as one of the main aims.

The category should be based around the primary management objective(s), which should apply to at least three-quarters of the protected area – the 75 per cent rule.

The management categories are applied with a typology of governance types – a description of who holds authority and responsibility for the protected area.

IUCN defines four governance types.

Governance by government: Federal or national ministry/agency in charge; sub-national ministry/agency in charge; government-delegated management (e.g. to NGO)

Shared governance: Collaborative management (various degrees of influence); joint management (pluralist management board); transboundary management (various levels across international borders)

Private governance: By individual owner; by non-profit organisations (NGOs, universities, cooperatives); by for- profit organsations (individuals or corporate)

Governance by indigenous peoples and local communities: Indigenous peoples' conserved areas and territories; community conserved areas – declared and run by local communities.

For more information on the IUCN definition, categories and governance type see the 2008 *Guidelines for applying protected area management categories* **which can be downloaded at: www.iucn.org/pa_categories**

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PARKS is published to strengthen international collaboration in protected area development and management by:

- exchanging information on practical management issues, especially learning from case studies of applied ideas;
- serving as a global forum for discussing new and emerging issues that relate to protected areas;
- promoting understanding of the values and benefits derived from protected areas to communities, visitors, business and others;
- ensuring that protected areas fulfil their primary role in nature conservation while addressing critical issues such as ecologically sustainable development, social justice and climate change adaptation and mitigation;
- changing and improving protected area support and behaviour through use of information provided in the journal; and
- promoting IUCN's work on protected areas.

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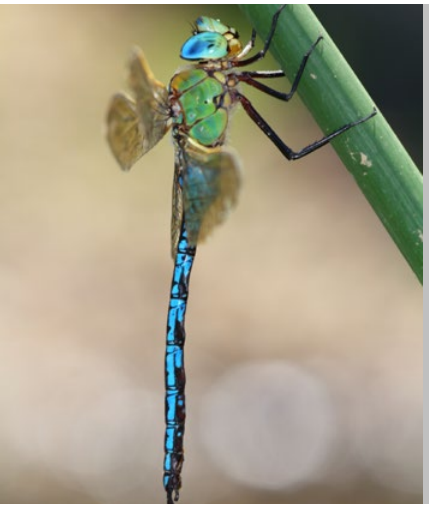

PARKS: THE INTERNATIONAL JOURNAL OF PROTECTED AREAS AND CONSERVATION

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Coffee Cultural Landscape, Sevilla, Colombia © Summer Sun

EDITORIAL

Paulina G. Karim, Issue Editor

> *"We call to change the relationship between humans and nature to address environmental challenges in a comprehensive manner, and to make peace with nature."*
>
> Declaration of the World Coalition for Peace with Nature: A Call for Life - UN Biodiversity Conference 2024, Cali, Colombia

This issue of *PARKS* comes almost a month after the 2024 United Nations Biodiversity Conference (CBD COP16) concluded in Cali, Colombia. "It was a good COP", I overheard one delegate say when boarding a plane at Alfonso Bonilla Aragón International Airport. "We could've achieved more", said another. Was it? Could we? Every participant seemed to be carrying home their own set of reflections and emotions, packed tight alongside fragrant Colombian coffee beans and single origin chocolate bars. What is certainly true, however, is that, as H.E. Susana Muhamad, Minister of Environment and Sustainable Development of Colombia and COP16 President has put it, it was "La COP de la gente" (COP for the people)[1]. Establishment of the Cali Fund to share the benefits from uses of digital sequence information on genetic resources and adoption of a new Programme of Work on Article 8(j) to strengthen the role of Indigenous Peoples and local communities along with other important outcomes[2] may serve as sound evidence to this people-centred approach.

COP16 was also about relationships. "Declaration of the World Coalition for Peace with Nature" carried the spirit of the Conference symbol – the resilient Inírida flower that never dies or falls apart[3]. It reiterated the fact that if we want to achieve the vision, mission, goals, and targets of Kunming-Montreal Global Biodiversity Framework, it is our very relationship with Mother Earth that needs to change, become more harmonious and balanced[4]. As time goes on, we may continue to ponder on a set of larger questions. Is it about *making peace with* nature? Ot is it about *living in harmony with* nature? Aren't we a part of nature? Then would 2050 Vision also mean making peace and living in harmony with oneself

1 https://www.larepublica.co/analisis/susana-muhamad-3992197/gracias-colombia-hicimos-historia-con-la-cop16-3992304

2 https://www.cbd.int/article/agreement-reached-cop-16

3 https://www.cbd.int/article/colombia-unveils-logo-cop16

4 https://www.cop16colombia.com/es/wp-content/uploads/2024/10/DECLARATION-OF-THE-WORLD-COALITION-FOR-PEACE-WITH-NATURE.pdf

Inírida flower – the resilient symbol of CBD COP16 © Elder Chih-You Ken

and with each other? Can we make it happen? These questions are for each one of us to think about and act upon.

PARKS Journal continues to play its role in navigating the course of human-nature relationship by building global knowledge and sharing best practices related to area-based conservation. In this issue we are proud to present to our readers a wide diversity of themes, ecosystems and article types. An editorial essay, five full papers, three short communications, and a book review explore such topics as: Indigenous Peoples' stewardship of wild areas, the role of rangers as Planetary Health Workers and first responders, resilience of bird species to landscape fragmentation and the role of citizen science in Brazil, management effectiveness in Malaysian protected areas, sustainable use and conservation planning in the Amazon, multi-tiered collaborative management in Lao PDR, environmentally-friendly guided bus tours in Taiwan's national park, landscape approaches for the 30 by 30 Target, a new recommendation for OECM recognition in highly-fragmented landscapes, and Northwest Namibia's conservation journey. We hope there is something to everyone's conservation liking.

As 2024 comes to close, we express our gratitude to everyone who has been with us on this 30th year-long journey: our authors, reviewers, handling editors, our proofreader and designer, and of course to you, dear readers. May the year ahead bring us peace and harmony – with Nature, with each other, and within.

EDITORIAL ESSAY: WILD12 AND THE 10TH IRF WORLD RANGER CONGRESS: TWO CONGRESSES BUT SHARED MESSAGES

Sue Stolton[1], Mike Appleton[2], Erinn Drage[3], Nigel Dudley[1], Chris Galliers[4], Adam Hanson[6], Amy Lewis[6], Vance G. Martin[5], Jennifer Meyer[6], Mónica Álvarez Malvido[4], Madhu Rao[8], Kent H. Redford[9], Rohit Singh[7] and Hannah L. Timmins[1,5]

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[8] WCPA and Wildlife Conservation Society
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ABSTRACT

IUCN WCPA was one of many sponsors supporting two important conservation congresses over the last few months. The World Wilderness Congress (WILD12) and the 10th International Rangers Federation World Ranger Congress (WRC10) brought together two groups on the frontline of conservation, Indigenous peoples and rangers, with parallel goals of fostering connections, building capacity and understanding and renewing hope and energy for reversing biodiversity loss. This short editorial essay provides an overview of both events and how they relate to the global decision-making around implementation of the Kunming-Montreal Global Biodiversity Framework.

Keywords: wilderness, rangers, Indigenous peoples, WCPA, Global Biodiversity Framework

WILD12

In August 2024, the 12th World Wilderness Congress (WILD12)[1] was held in the *He Sápa* (the Black Hills) of South Dakota, USA, the sacred territory of the *Oceti Sakowin Oyate* (Lakota Nation). Hosted by the Sicangu Lakota Treaty Council, directed by Phil Two Eagle, and organised by the WILD Foundation, the congress brought 700 Indigenous leaders, conservation professionals and wilderness advocates from 36 countries, including representatives from over 50 Tribes and Indigenous Nations, together for a week of ceremony and discussion.

This event was particularly notable as one of the largest international conservation congresses hosted by Indigenous peoples, with Indigenous perspectives on wilderness playing a central role in many sessions. Acknowledging past and ongoing injustices to Indigenous peoples was a central theme, recognised as an essential step in building relationships and developing a strong foundation for conservation of the world's dwindling wilderness.

Discussions spanned a wide range of issues including reconciliation and co-stewardship, methods and approaches to wilderness management, community led conservation, rewilding, restoring and connecting social and ecological systems and storytelling. A Global Indigenous Peoples Caucus was held alongside the Symposium, providing a place for Indigenous attendees to share stories, reflections and perspectives.

The outcomes of WILD12 included a set of Resolutions[2] which will be incorporated into the global environmental agenda and adopted by individual organisations. The central He Sápa Resolution and Declaration *On Sovereignty and Wilderness: Deepening the Wilderness Concept Through Indigenous Knowledge and Wisdom* calls for the acknowledgement that nature is multi-dimensional, transcending the material and physical realms. The resolution urges that the language used around conservation respect the rights and roles of Indigenous peoples, Indigenous knowledge and wisdom

1 https://wild.org/wild12/

2 https://wild.org/wild12/resolutions/

10.2305/ERIF4355

WILD12 delegates led by Maidi Andersson, a Sámi reindeer herder, present a resolution during the closing ceremony calling for a ban on all old growth deforestation in Sápmi © Giulia Gasparrini

systems and natural and customary law. The declaration stresses the need to reconcile differing worldviews to expand and strengthen the wilderness concept, ensuring that Indigenous perspectives are fully integrated. The committee that developed the Declaration (made up equally of Indigenous and non-Indigenous people) fully appreciated the difficulty, perhaps impossibility, of integrating knowledge of nature transmitted orally for millennia into an English language document. However, embracing Indigenous words and terminology that are equivalent to the English language concept of wilderness, in addition to making sector-wide commitments that prioritise keeping Indigenous peoples on their traditional lands and territories, were generally regarded as necessary actions for the improvement of the global reputation of the wilderness concept.

Other resolutions focused on *Advancing the Rights of Antarctica and Ratifying the High Seas Treaty*. Resolutions themed on Indigenous rights and world views included: *Through the Eyes of Buffalo: A Strategic Platform to Restore All Natural World Relationships, Indigenous Law and Guardianship of Nature* and *Making Space to Protect White Animals, Messengers of Peace*. A strong youth focus ran throughout the congress and was encapsulated in the resolution on *Mainstreaming Mentorship of Young Ecological Stewards*.

10th IRF World Ranger Congress

Just over a month later, in early October 2024, WCPA, through its role as a partner in the Universal Ranger Support Alliance (URSA), was one of the many sponsors of the 10th International Ranger Federation (IRF) World Ranger Congress (WRC10) in Hyères, France. Organised by the IRF and the Gardes Natures de France, 450 rangers and supporters from 88 countries came together for a week of discussions and events.

In a profession which is often stereotyped and misunderstood, the importance of diversity, equity and equality were a strong theme of WRC10; 49 per cent of the participants were female and 15 per cent identified as Indigenous people or from local communities, representing a diversity that is often not so evident when people think about rangers. One goal of the IRF is to reposition rangers as Planetary Health Workers (Stolton et al., 2023), a thread that ran throughout the congress and a central call in the final output – the *Hyères Ranger Declaration*.[3]

The congress discussions were strongly influenced by the progress made since WRC9, held in Chitwan, Nepal in 2019. Implementation of the resultant WRC9 *Chitwan Declaration*[4] and *Action Plan* (URSA, 2021) has encompassed raising awareness, developing global standards, highlighting ranger voices and advocating for ranger needs on the international stage. *The Hyères Ranger Declaration* includes a wide range of actions, focused on these themes, including calling for:

1. Better recognition of rangers' rights and the many roles and responsibilities they have in protecting our

3 https://www.internationalrangers.org/resource/hyeres-ranger-declaration-2024/

4 https://www.internationalrangers.org/wp-content/uploads/Chitwan-Declaration_2019_EN.pdf

Rohit Singh, the newly elected vice-chair of the International Rangers Federation, presenting the *Hyères Ranger Declaration* © IRF

planet and safeguarding ecosystem services.

2. The implementation of a range of tools and standards around rights, safeguarding, competencies and welfare to name just a few, developed with and for the ranger community over recent years, building on the data from the first ever IRF *State of the Ranger Report* (IRF, 2024), which provides a needs assessment and baseline for repeat assessments at each future WRC, on progress made to fill these needs.[5]
3. A substantive increase in ranger numbers not only to address the current conservation requirements but also to support the expansion of protected and conserved areas under Target 3 of the Kunming-Montreal Global Biodiversity Framework (GBF) along with the need to close the skills and equipment gap to ensure the calls for increased effectiveness under Target 3 are met.
4. Ensuring equity and equality across the ranger profession to meet the inclusiveness targets also stressed in the GBF.
5. Recognising the importance of accountability and responsibility in the ranger profession by continuing to widely disseminate and implement the *IRF Code of Conduct* (IRF, 2021).

The declaration also forms the nucleus of the *Message from Hyères to Cali by the Ranger Community*, which urges governments, NGOs and ranger employers to endorse and thus demonstrate their support for rangers at CBD COP 16.[6]

Taking messages to the CBD COP 16

On the face of it, these two congresses were very different: an Indigenous led congress with a focus on respecting Indigenous peoples' stewardship of wild areas and a Ranger led congress with a focus on the need for recognition of rangers' role as Planetary Health Workers. But in fact, both had similar messages, which go to the heart of achieving the GBF and should be central to the discussion and outcomes of the Convention on Biological Diversity's (CBD) Conference of the Parties (COP) being held in Colombia, which will conclude as this issue of *PARKS* is released.

Both congresses stressed that conservation will only be successful if the custodians and stewards of nature are adequately and sustainably supported. This means ensuring that the roles of Indigenous peoples and local communities are acknowledged and respected where they have traditions and knowledge to support effective conservation. Similarly, the many workers supporting

5 https://www.internationalrangers.org/resources/ and https://www.ursa4rangers.org/ursa4rangers-resources/

6 Call-to-Cali.pdf (internationalrangers.org)

Rangers gathered for the 10th International Rangers Federation World Ranger Congress in Hyères, France © IRF

area-based conservation worldwide, who go by various names including rangers, wardens, custodians, etc, must be recognised, trained, nurtured and appreciated for the many different roles they play.

Central to both these messages is the need to recognise the rights and roles of the people that are actively protecting and conserving lands, seas and inland waters, their biodiversity and associated ecosystem services. Linked to this is the enduring need for actions to promote equity to ensure equality in conservation as a whole.

Highlighting the work of IUCN WCPA

The work of WCPA was threaded throughout both congresses. The very first World Wilderness Congress had a powerful stream of Indigenous thinking, and this tradition has continued at every congress. Despite this, the very word 'wilderness' has sometimes proved offensive to many Indigenous peoples, with its implication of being empty, uninhabited and unstewarded lands. The WCPA Wilderness Specialist Group has worked diligently over many years to address this misunderstanding, and was very explicit in its *Wilderness Protected Areas: Management guidelines for IUCN Category 1b protected areas* (Casson et al., 2016) that designated wilderness does not exclude humans, rather it excludes certain human impacts. WILD12 was an opportunity to show the progressive work done by WCPA to collaborate directly with Indigenous people to more fully interpret the concept of wilderness in a way that resonates positively with both Indigenous peoples and non-Indigenous conservation interests. This work was commended at WILD12, with the resulting collaboration evident throughout the organisation and

During a treaty signing among Indigenous delegates at WILD12, Catherine Murupaenga-Ikemn (Māori) and Stephanie Little Hawk Big Crow (Lakota) perform the hongi, a traditional Māori greeting © Giulia Gasparrini

execution of the congress. As the outcomes of WILD12 continue to manifest, the organisers sincerely hope that the wilderness movement will continue to grow, enhanced by far more Indigenous leadership at the helm.

At WRC10, the URSA partnership, of which WCPA is a founding member, reported a significant contribution to the implementation of the previous congress action plans, including a wide range of material on ranger professionalisation.[7] Madhu Rao, Chair of WCPA, gave a keynote address at WRC10, signed a memo

7 Home - URSA | Universal Ranger Support Alliance (ursa4rangers.org)

of understanding (MOU) between WCPA and IRF to continue close collaboration and launched the first volume of the *WCPA Good Practice Guidelines* aimed at rangers, developed by rangers (Stolton et al., 2024).

Celebrating those whose work has made major contributions to the conservation world is central to WCPA. At WILD12, WCPA honoured two longtime Wilderness advocates and researchers, Vance Martin and Alan Watson, with the prestigious 'Fred Packard Award for Outstanding service to Protected Areas' in recognition of their extraordinary contributions to conservation in wilderness areas around the world. [8] At WRC10, the IUCN WCPA International Ranger Awards 2025 were launched, with nominations for the award open until 31 January 2025.[9]

WCPA's collaboration will continue as the outcomes of both congresses are implemented and the various declarations and resolutions are translated into calls for action at the CBD COP 16[10].

8 https://iucn.org/story/202408/iucn-wcpa-recognises-wilderness-champions-12th-world-wilderness-congress#:~:text=Vance%20Martin%20has%20devoted%20his%20entire%20life%20advocating,a%20long-serving%20co-lead%20of%20WCPA%E2%80%99s%20Wilderness%20Specialist%20Group.%E2%80%9D

9 https://iucn.org/our-union/commissions/world-commission-protected-areas/our-work/wcpa-awards/iucn-wcpa-international

10 https://iucn.org/our-union/commissions/world-commission-protected-areas/our-work/iucn-wcpa-cop16

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Universal Ranger Support Alliance (2021). *Action plan for supporting implementation of the International Ranger Federation's Chitwan Declaration and furthering the professionalisation of rangers (2021–2025)*, https://www.ursa4rangers.org/download/597/?tmstv=1728882713

RESUMEN

La CMAP de la UICN fue uno de los muchos patrocinadores de dos importantes congresos de conservación celebrados en los últimos meses. El Congreso Mundial de Vida Silvestre (WILD12) y el 10º Congreso Mundial de Guardaparques de la Federación Internacional de Guardaparques (WRC10) reunieron a dos grupos en la primera línea de la conservación, los pueblos indígenas y los guardaparques, con objetivos paralelos de fomentar las conexiones, crear capacidad y comprensión y renovar la esperanza y la energía para revertir la pérdida de biodiversidad. Este breve ensayo editorial ofrece una visión general de ambos acontecimientos y de su relación con la toma de decisiones a escala mundial en torno a la aplicación del Marco Mundial para la Biodiversidad de Kunming-Montreal.

RÉSUMÉ

La CMAP de l'UICN a été l'un des nombreux sponsors à soutenir deux importants congrès sur la conservation au cours des derniers mois. Le Congrès mondial de la nature (WILD12) et le 10e Congrès mondial des rangers de la Fédération internationale des rangers (WRC10) ont rassemblé deux groupes en première ligne de la conservation, les peuples autochtones et les rangers, avec des objectifs parallèles de favoriser les liens, de renforcer les capacités et la compréhension et de renouveler l'espoir et l'énergie pour inverser la perte de biodiversité. Ce bref éditorial donne un aperçu des deux événements et de leur lien avec la prise de décision mondiale concernant la mise en œuvre du Cadre mondial pour la biodiversité de Kunming-Montréal.

SAFEGUARDING WILDLIFE AND HUMAN LIFE:RANGERS AS FIRST RESPONDERS

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ABSTRACT

Rangers' role as emergency first responders is becoming increasingly important in the face of escalating climate-related natural disasters and extreme weather events. Drawing on a review of literature and data collected from surveys and focal group discussions, this study explores rangers' role as first responders in Asia. A total of 52 rangers from 12 countries were surveyed, revealing the diverse expectations, responsibilities and challenges rangers are facing. Of these, 59.6 per cent of rangers had experienced increased responsibilities during a disaster, including evacuations, rescue and recovery operations, and delivery of essential supplies like food and water. Despite their essential contributions, a majority (over 60 per cent) of rangers surveyed had not received training on first aid, flood response, emergency evacuation or disaster response. Although results varied by specific issue, overall findings indicate an urgent need for policy changes to professionalise the ranger workforce, improve training and access to resources, and establish institutional support systems for rangers. Highlighting rangers' contributions outside of conservation increases visibility of the unique value rangers add in other sectors like public health and safety.

Keywords: protected and conserved areas, natural disasters, emergency response, disaster risk reduction, essential workers, conservation

INTRODUCTION

As the body of literature on conservation rangers continues to grow, there is increased awareness of their diverse roles and responsibilities (Singh et al., 2021a). The International Ranger Federation (IRF) defines rangers as "wildlife wardens, forest guards, foresters, scouts, watchers, and other frontline staff," responsible for protecting nature, cultural heritage, and the rights of present and future generations (Belecky et al., 2019; IRF, 2021). They represent an incredibly diverse workforce, including state employees, volunteers, local community members and Indigenous people (IRF, 2021). Recent global recognition and ongoing advocacy and research have highlighted the critical role rangers play in conservation, acting as essential workers in achieving global biodiversity targets (Appleton et al., 2022).

Despite increased visibility, rangers continue to face formidable challenges. A 2019 global survey revealed that 57.3 per cent of rangers never or rarely have access to clean drinking water on patrol, and 84.8 per cent believe their job is dangerous due to encounters with poachers (Belecky et al., 2019). This belief is not baseless, considering 44.2 per cent of ranger deaths are due to homicide, the leading cause of on-duty ranger deaths (Belecky et al., 2019). Despite exposure to risks including zoonotic disease, dangerous wildlife encounters and poor hygiene conditions, most rangers do not have insurance for serious injury or death or are unsure of their insurance benefits (Belecky et al., 2019). More recent findings from the worldwide State of the Ranger Report show only 53 per cent of rangers have adequate health and safety training and only 38 per cent have life insurance, demonstrating the persistence of these problems (IRF, 2024). Further, just over 60 per cent of rangers believe their wages are sufficient to cover basic needs (IRF, 2024). Challenges like inadequate salaries, extended periods of time away from family, and fear of retaliation for reporting corruption can create problematic conditions conducive to misconduct such as accepting bribes or abusing human rights (Belecky et al., 2019; Woodside & Vasseleu, 2021).

Pakistani Rangers working in flood-affected areas © Jana Sindhu WWF Pakistan

To achieve the Convention on Biological Diversity's 30-by-30 target, it is estimated that the ranger workforce needs to grow by 1.2 million personnel, a 400 per cent increase (Appleton et al., 2022; IRF & URSA, 2023). Widespread workplace hazards, poor employment conditions and low earning potential for rangers are potentially detrimental to recruitment and retention (Belecky et al., 2021b). Further, in many regions, the work of rangers urgently needs government and institutional support and recognition as a profession to effectively perform the wide range of duties and responsibilities expected of them (Stolton et al., 2023). International efforts of the IRF, supported by the Universal Ranger Support Alliance (URSA) and other conservation NGOs, advocate for rangers globally, strengthening representation, sharing resources and tools, and establishing support networks to maintain the momentum generated in the last decade (URSA, 2021).

Acting as vital links between biodiversity, ecosystem services, local communities, visitors and government agencies, rangers uphold the rule of law in protected and conserved areas (PCA) worldwide. Recently, they have also led efforts in climate change mitigation, adaptation and pandemic management (Singh et al., 2021a; Stolton et al., 2023). Besides wildlife monitoring, habitat management and community outreach, it is not uncommon for rangers to lead or support emergency response efforts for extreme weather events, natural disasters or other emergencies, particularly in remote PCAs and surrounding areas (Singh et al., 2021b).

Quantifying and communicating rangers' contributions to problems outside of conservation can help address the broad lack of organisational and government agency support structures and gaps in institutional capacity.

In particular, a more comprehensive understanding of how rangers contribute towards public health and safety outcomes can provide the justification for necessary workforce expansion, professionalisation, improved working conditions, and the funding required to implement these goals (Anagnostou et al., 2022; Appleton et al., 2021; Appleton et al., 2022; Belecky et al., 2021b; Wyatt et al., 2022). Further, these improvements are essential to adequately prepare rangers to effectively respond to the increasing frequency and severity of disasters and weather-related emergencies. Efforts to highlight the full breadth and depth of rangers' contributions must continue in order to reposition rangers as a priority within global and regional policy (Stolton et al., 2023). Even with the development of a more nuanced and accurate understanding of the complex, dynamic, expanding roles of rangers in recent years, significant knowledge gaps remain.

While the prevalence of extreme weather and disasters including typhoons, droughts, floods, and wildfires continues to rise, improved warning and disaster management systems have reduced deaths and economic loss (Shivanna, 2022). These advancements, while beneficial, are not addressing the underlying problems. The World Meteorological Organization (WMO) reported

a fivefold increase in climate-related disasters over the past 50 years, with a notable surge in the last decade (WMO, 2021a; WMO, 2021b). Consequently, extreme weather and disaster resilience are an increasingly urgent priority, with widespread mitigation and adaptation measures including agroforestry, wetland restoration or carbon sequestration (McGuigan et al., 2022; Murti & Buyck, 2014; WCPA, 2023). Because of their size, biomass and biodiversity, PCAs are uniquely suited for climate change adaptation, mitigation and disaster risk reduction strategies (Hockings et al., 2020; Singh et al., 2020). Dune ecosystem protection in New Zealand, mangrove forest preservation and expansion in India, and Spekboom (Portulacaria afra) planting in South Africa are all adaptation strategies specifically applied within PCAs (Murti & Buyck, 2014). As PCA stewards, rangers are often essential in planning and executing adaptation, mitigation and risk reduction strategies, and serve as the first responders for the growing number of disasters and emergencies in these remote or inaccessible areas.

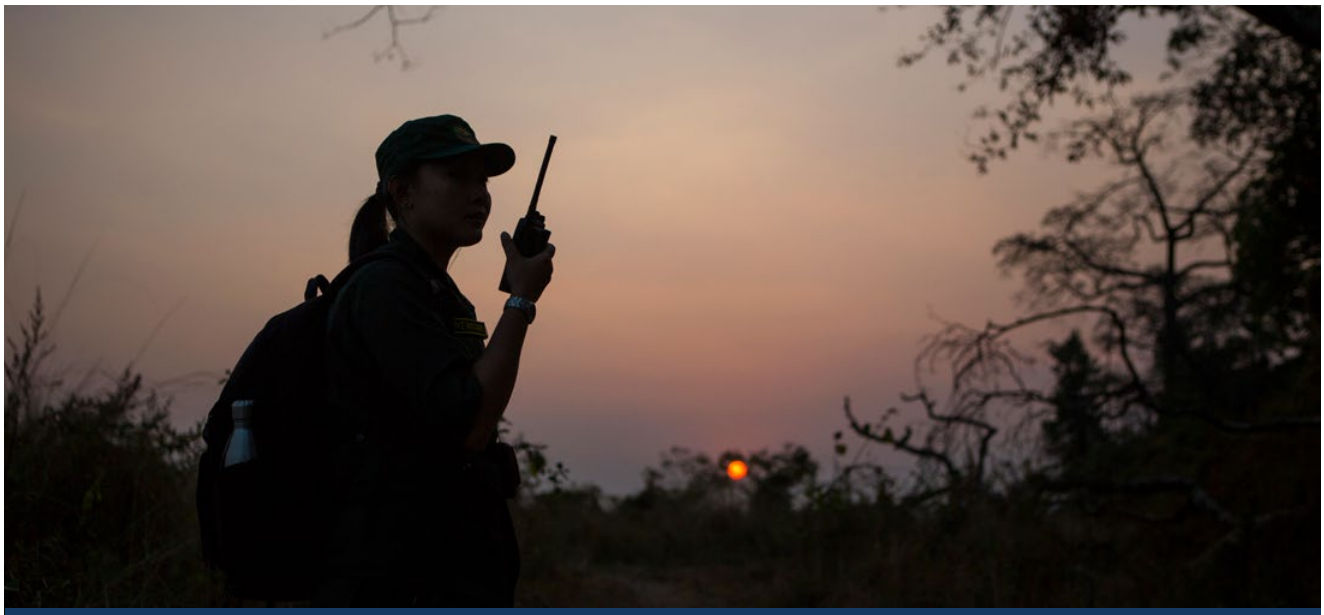
RANGERS' ROLE AS FIRST RESPONDERS

Emergency first responders are trained and equipped to provide immediate assistance and medical care during emergencies, natural disasters and other critical incidents (Harris et al., 2018). Traditionally recognised first responders, including paramedics, firefighters and police officers, face challenges to quickly reach remote areas or simply may not have the personnel or capacity to respond to large-scale emergencies (Jones et al., 2023; Spencer-Goodsir et al., 2022). Apart from rangers' role in climate change adaptation, mitigation and disaster risk reduction, they often stand at the intersection of public health, safety, and disaster and emergency response. Rangers have relevant, place-based knowledge of landscapes and the environment, reinforced by formal and informal relationships with local communities, which can significantly impact emergency services' operations, logistics and overall effectiveness. Depending on the region, rangers may perform emergency first responder duties, but this topic remains largely unexplored (IRF et al., 2022; Stolton et al., 2022). Public health, safety, and emergency planning and response have been identified as clearly within the scope of ranger duties (Appleton & Stanciu, 2023). Although these responsibilities have been identified, there is not a cohesive understanding of the implications for rangers. Recent literature recognises rangers as essential planetary health workers and the expansion of their duties during natural disasters and global pandemics, but a deeper, targeted analysis of rangers' role as emergency first responders is needed (Aisha et al., 2024; Singh et al., 2021b; Stolton et al., 2023).

Few studies examine rangers' roles as first responders, therefore, highlighting workforce limitations and the mechanisms underlying them can provide support for recognition by international bodies, governments and employers. Further, these limitations can indicate specific areas of need related to professionalisation, working conditions, capacity or support structures. Highlighting ranger contributions that are overlooked or underappreciated demonstrates the vital nature of ranger work, building momentum for policy change. The current dialogue must shift to acknowledge the broader multi-sector value of rangers beyond environmental conservation, which can unlock future opportunities for the improvement of the ranger profession. This paper aims to provide insights about how rangers in Asia perceive their role as first responders and to identify relevant limitations and challenges rangers encounter while performing these duties. Further, this exploratory paper seeks to better understand the growing expectations and responsibilities of rangers, contributing towards better outcomes for public health, safety, disaster risk reduction and conservation.

METHODS

This paper uses two primary data sources: 1) a regional online survey of rangers in Asia; and 2) a focal group discussion at the Asian Ranger Forum (ARF) in Guwahati, India in December 2023, both coordinated by IRF and URSA. The single-stage survey followed a cross-sectional design, revealing trends, attitudes and responses of 52 rangers from across Asia. The survey was administered in English, via Google Forms and distributed by ARF's WhatsApp group, ranger associations, and by QR codes. Respondents were self-selected based on voluntary recruitment materials, and survey questions were a combination of demographic, Likert scale, dichotomous and multiple response questions. All respondents received information about the survey's purpose, data use and confidentiality, and provided consent to participate voluntarily prior to completing the questionnaire. Data were anonymous and aggregated by country, therefore none of the data can be used to personally identify any of the survey respondents. The survey explored a variety of topics related to rangers' role in emergency response including expanded duties, equipment and safety. The ARF focal group discussion engaged over 150 rangers and conservation practitioners from across Asia. The session structure included case study discussions complemented by interactive question-and-answer segments involving both panellists and the audience. This session served as an opportunity to share perspectives and qualitative anecdotes on emergency and disaster response, how rangers are currently contributing within this space, and what gaps and barriers exist.



Singye Wangmo using walkie talkie in Royal Manas National Park, Bhutan © Simon Rawles / WWF-UK

Insights from the survey and the focal group discussion have revealed broad themes about rangers and their work as emergency first responders.

It is important to acknowledge the limitations of this study, including language, sample size, and geographic location of participants. While most rangers at the 2023 ARF had a working knowledge of the English language, some rangers' English proficiency either excluded them from participation or potentially impacted their answers. A plurality of survey respondents (37 per cent) were from India, due to the ARF being held there and the higher level of English language proficiency in the country. This may bias results and limit the study's generalisability to the broader region. This study's sample size is adequate to capture a general impression of ranger perceptions but is not statistically significant and ultimately insufficient to draw conclusions at regional or national levels. Finally, this survey primarily focused on rangers' role as first responders during extreme weather events and natural disasters. For a more complete perspective, future studies should expand the scope to include ranger contributions to routine emergencies.

LITERATURE REVIEW

Acknowledging reality: Rangers are already emergency first responders

Urban areas typically have better access to emergency services due to the density of first responder staff and resources, but these essential services are more limited for rural or remote communities. PCAs, the foundation of area-based conservation, are often expansive natural terrestrial and marine zones commonly located in rural or remote areas. Rangers may be the only available personnel to respond to emergencies impacting the rural communities, visitors and others in the vicinity of a PCA (Stolton et al., 2022). A 2020 study validates these findings, indicating that 50 per cent of rangers in South America were based in a remote location, followed by Asia (40.5 per cent), Africa (38.6 per cent), and Central America and the Caribbean (26.9 per cent) (Singh et al., 2021b). In these cases, rangers can expand and enhance first responder capacity where other emergency services agencies are insufficient or unavailable.

Rangers' unique qualifications and rural work locations can make them the most practical resource to fill critical gaps during emergencies. During wildfires, rangers coordinate fire suppression efforts, evacuations, and protect homes and vulnerable wildlife habitats (Appleton & Stanciu, 2023; IRF, 2019). Similarly, during floods or severe storms, rangers are instrumental in conducting evacuations, rescues, and delivering critical supplies (Aisha et al., 2024). During the COVID-19 pandemic, rangers provided emergency medical assistance, enforced public health orders, delivered rations to communities and distributed health kits (Singh et al., 2021b). ARF survey responses showed that 49 per cent of rangers in Asia were assigned as first responders during extreme weather or natural disasters. Besides large-scale emergencies, rangers also respond to more frequent, routine incidents such as a PCA visitor with a medical emergency, a vehicle collision, or human–wildlife conflict resulting in injuries. There is a universal requirement for all rangers to be able to "prevent and respond correctly to accidents and emergencies" (Appleton & Stanciu, 2023). These job requirements often resemble those of other public servants including police, firefighters or emergency medical services.

Deficits in support, training and workforce conditions limit effectiveness and increase risk for rangers

Although rangers around the world perform emergency first responder duties, many countries do not recognise rangers as essential workers or first responders, resulting in limited government support, resources and training opportunities (Singh et al., 2021b). In certain instances, rangers may already be recognised as essential frontline workers, but still do not receive the same benefits as other essential workers, including comparable salary, medical insurance, or relevant training and equipment (Belecky et al., 2021b). The 2019 Life on the Frontline study showed over 75 per cent of rangers did not receive annual first aid or emergency training and 56.9 per cent of rangers did not have access to communications equipment while on patrol (Belecky et al., 2019). These training, equipment and benefit limitations jeopardise the safety and health of both rangers and the communities they serve. When rangers do not have access to training for first aid or disaster response, or the appropriate communications or safety equipment, it degrades their ability to perform their duties effectively and safely. Growing research supports this, with data from 2006–2021 indicating that ranger deaths related to drowning and firefighting are increasing substantially, potentially related to the sharp increase in extreme weather events (Galliers et al., 2022). At 24.7 per cent, human–elephant conflict (declared a disaster in some countries) is the second leading cause of ranger deaths in Sri Lanka and has resulted in significant property damage, injury and death in local communities (Prakash et al., 2021).

Understanding specifically how rangers respond to emergencies and what obstacles prevent them from effectively performing these duties can reveal critical gaps related to working conditions, standards, capacity and government support. Similarly, it is imperative to continue highlighting ranger contributions as first responders to advocate for recognition from international bodies like the International Labour Organization (ILO). Acknowledging rangers' diverse contributions in sectors beyond conservation is essential for identifying new institutional support pathways to enhance the ranger profession.

SURVEY RESULTS AND THEMATIC DISCUSSION

A total of 52 rangers were surveyed from 12 countries in the Asia-Pacific region. 79 per cent of respondents were male and 21.2 per cent were female. A majority of rangers (73 per cent) were between the ages of 30 and 50 years old. Only 17 per cent of rangers had served for more than 20 years and nearly one-third (31 per cent) had served for 10–15 years.

The quantitative survey data and qualitative insights from the focal group discussion shed light on four thematic elements of rangers' role as first responders. These themes underscore the increasing demands placed on rangers and key shortcomings that must be addressed for rangers to do their jobs professionally and effectively.

Detrimental impact of emergencies and natural disasters on rangers and their work

Extreme weather events and natural disasters have detrimental impacts on rangers and their work; 75 per cent of rangers reported increased frequency of extreme weather events (e.g. floods, heatwaves), with 71 per cent noting increased intensity of these events. While most rangers (69 per cent) reported no injuries from extreme weather events, 89 per cent of rangers reported that their region had been impacted in some manner by extreme weather or disasters and 69 per cent noted that their workstation was negatively impacted. These crises are also detrimental to a majority of rangers' routine work, reducing their ability to conduct law enforcement patrols, habitat management, visitor engagement, community outreach, human–wildlife conflict mitigation, and wildlife monitoring (see Figure 1). Similarly, findings from studies on the impact of the COVID-19 pandemic and the 2022 flood disaster in Pakistan show rangers' routine work is adversely affected by disasters (Aisha et al., 2024; Singh et al., 2021b). Depending on the specific nature of the extreme weather event or disaster, routine ranger duties can be degraded due to declines in visitors, reduced access to sites within PCAs, diversion of essential supplies, or movement control measures (Aisha et al., 2024; Singh et al., 2021b). Finally, 40 per cent of rangers reported that extreme weather or disaster events resulted in lost or damaged equipment and 53.8 per cent stated their department did not provide replacement equipment or personal belongings following a disaster.

While these emergencies would negatively impact any organisation, a common thread that emerged from the data was the need for more rangers. Disasters and large-scale emergencies amplify the challenges posed by an already existing shortage of ranger personnel (Appleton et al., 2022). The impact of disasters on rangers and their work can perhaps be mitigated by a more robust workforce with the capacity to sustain essential routine operations while simultaneously responding to emergencies.

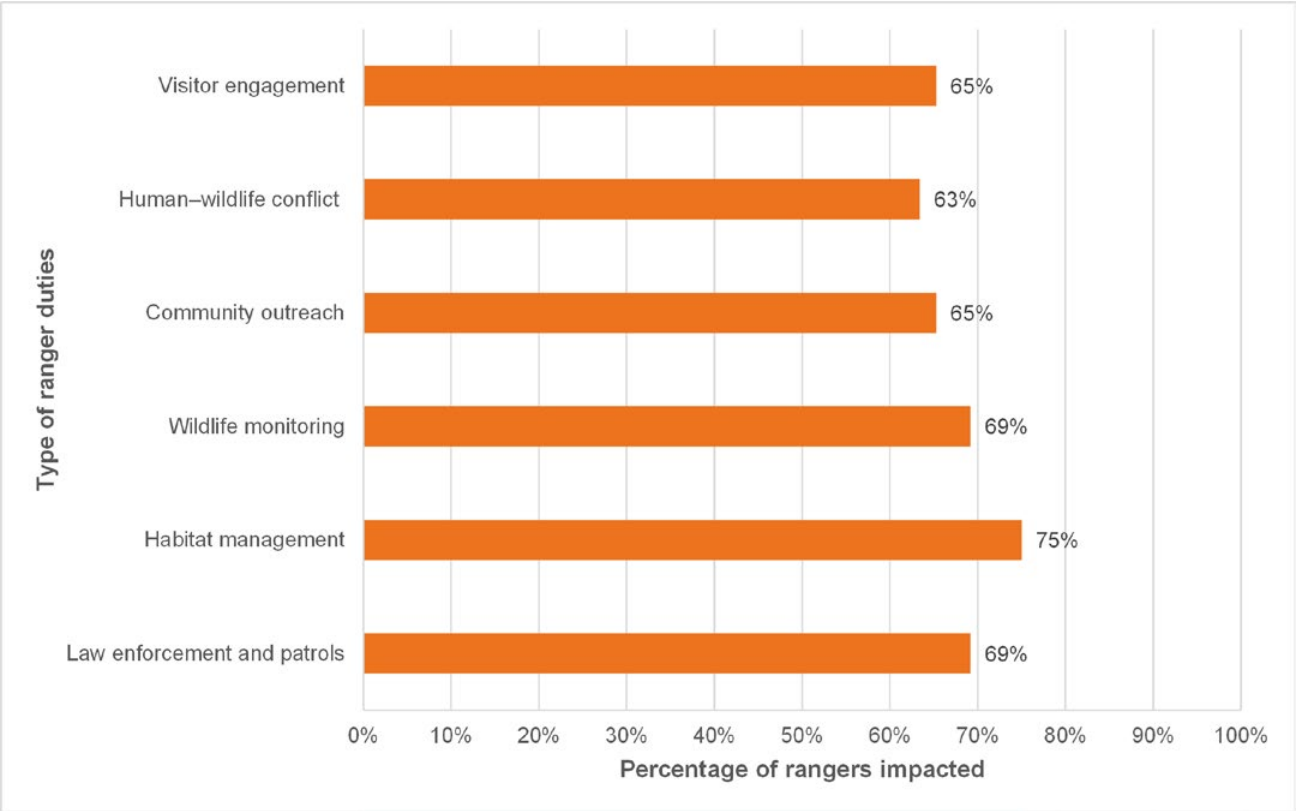
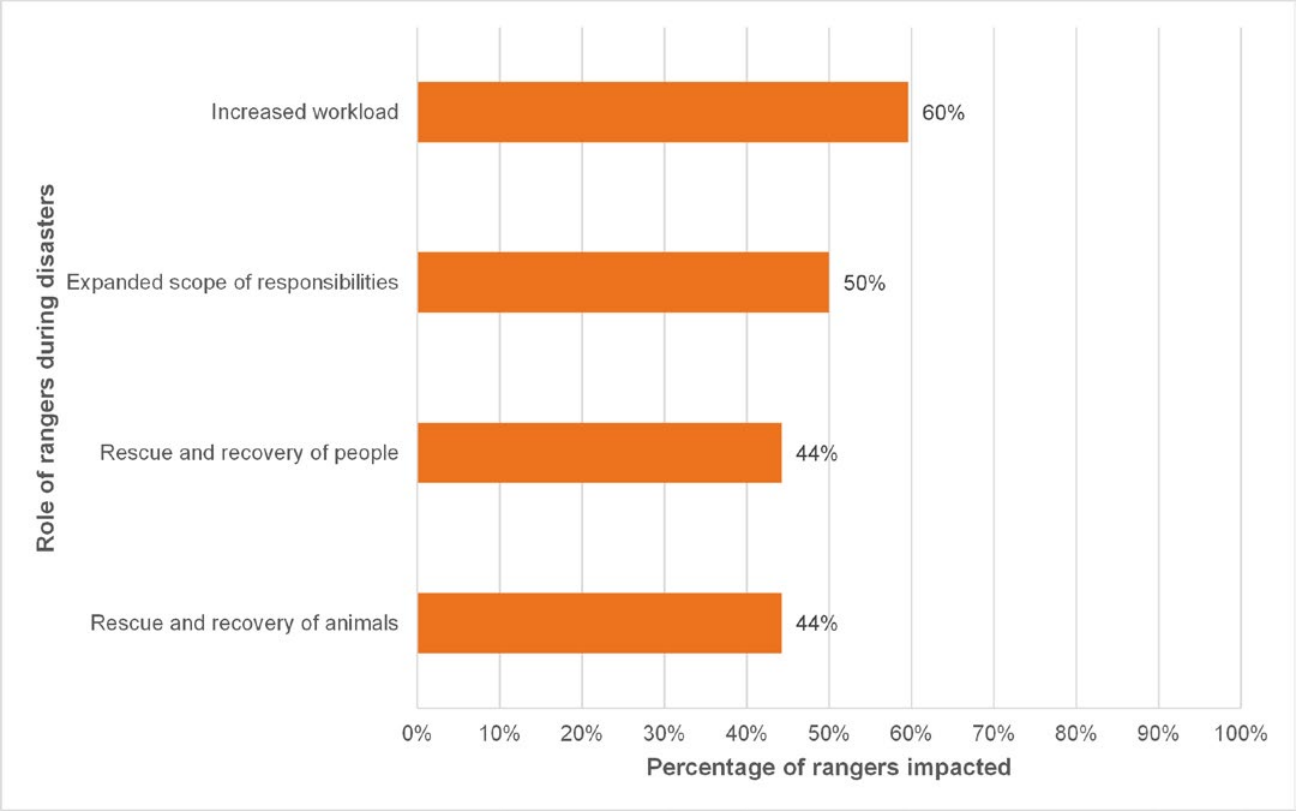


Figure 1. Percentage of rangers in Asia reporting work impacts from extreme weather or disasters, indicating widespread effects across various routine ranger duties.



F**igure 2.** Percentage of rangers in Asia reporting additional tasks and responsibilities during extreme weather or natural disasters.

Emergencies and increased responsibilities for rangers

During disasters and extreme weather events, 50 per cent of rangers reported expanded responsibilities and a majority (60 per cent) had an increase in workload. Employers and managers assign rangers to perform duties including evacuation of communities; rescue and recovery of humans, wildlife and livestock; and distribution of essential goods (see Figure 2). For example, the focal group discussion revealed that Bhutanese rangers' routine duties evolved, shifting to border patrol, repairing important infrastructure, delivering food, and waste management during the COVID-19 pandemic. Viewpoints shared during the discussion also communicated rangers' contributions to saving peoples' lives and homes during fires in Australia, indicating expanded responsibilities related to fire suppression and management.

Large-scale disasters can rapidly overwhelm available emergency services staff and resources, shifting demands onto other personnel. Although some countries (India, Bhutan and Nepal) recognise rangers as essential workers, many other countries do not. Essential worker designation may only be temporary or conditional, during the aftermath of a disaster, or it may not occur at all. Rangers are more commonly asked to perform duties and assume responsibilities of emergency first responders without receiving the official recognition of these added responsibilities. Focal group discussions indicated that when there was a critical need for personnel support, rangers were quickly designated as essential workers, but when essential workers were prioritised to receive the COVID-19 vaccine, rangers did not receive this benefit. Compared to other essential workers, this places a disproportionate burden on rangers, demonstrating a misalignment between employment requirements and benefits. Additional research, awareness campaigns and advocacy can incrementally reframe the perceived role of rangers to accurately reflect their first responder job requirements. This can provide the validation necessary to support the equal employment benefits for rangers.

Training, equipment, capacity and support deficits

Fifty-four per cent of rangers in Asia felt unsafe while performing their duties during a disaster or extreme weather event. There are many potential contributing factors to this, including lack of the training and equipment necessary to perform emergency first responder duties. A majority (62 per cent) of rangers reported either inadequate first responder training or uncertainty about the adequacy of their training. The ranger perceptions regarding training are consistent with the reported training frequency, as a majority of rangers surveyed did not receive training in disaster risk reduction, medical support, flood response or emergency evacuations (see Figure 3). Specifically, Figure 3 shows over 60 per cent of rangers did not receive any of the categories of training included in the survey, with the most significant training deficiency reported for flood response training at 92 per cent.

The challenges posed by inadequate emergency and disaster training are exacerbated by a lack of essential equipment. Nearly half (46 per cent) of rangers did not have access to flood response equipment and 62 per cent of rangers reported they do not have access to sufficient equipment or skills to rescue or translocate wildlife. Of the rangers surveyed, 36.5 per cent did not have access to official communications devices during a disaster. This is consistent with the global and Asia regional findings from the Life on the Frontline study, which reported a lack of communications equipment for 38 per cent of rangers on patrol (Belecky et al., 2019). Life on the Frontline also indicated 38 per cent of rangers in Asia used their personal funds to purchase communications devices (Belecky et al., 2019). Finally, 40 per cent of rangers reported that extreme weather or disaster events resulted in lost or damaged equipment and most (54 per cent) stated their department did not provide replacement equipment or personal belongings following a disaster.

Externally supported (aid funding and conservation NGO-funded) equipment or training are sometimes the only forms of continued support that rangers receive in some regions. The persistent training and equipment deficits highlighted in the survey results indicate that structural changes are needed within existing organisational and governmental institutions in Asia. This need for institutional change is reflected at a global level, where conservation NGOs continue to address urgent ranger support gaps around the world. This external assistance is crucial; however, it should be considered a temporary measure. To create enduring change, employers and governments must acknowledge rangers' role as first responders so rangers can begin to receive additional funding, support and prioritisation.

First responders benefit communities and conservation

The focal group discussion identified rangers' role as emergency first responders as a mechanism to increase legitimacy and build trust with communities. Of rangers surveyed, 60 per cent identified themselves as local community members or Indigenous people (see Figure 4). Place-based and community affiliations often manifest in

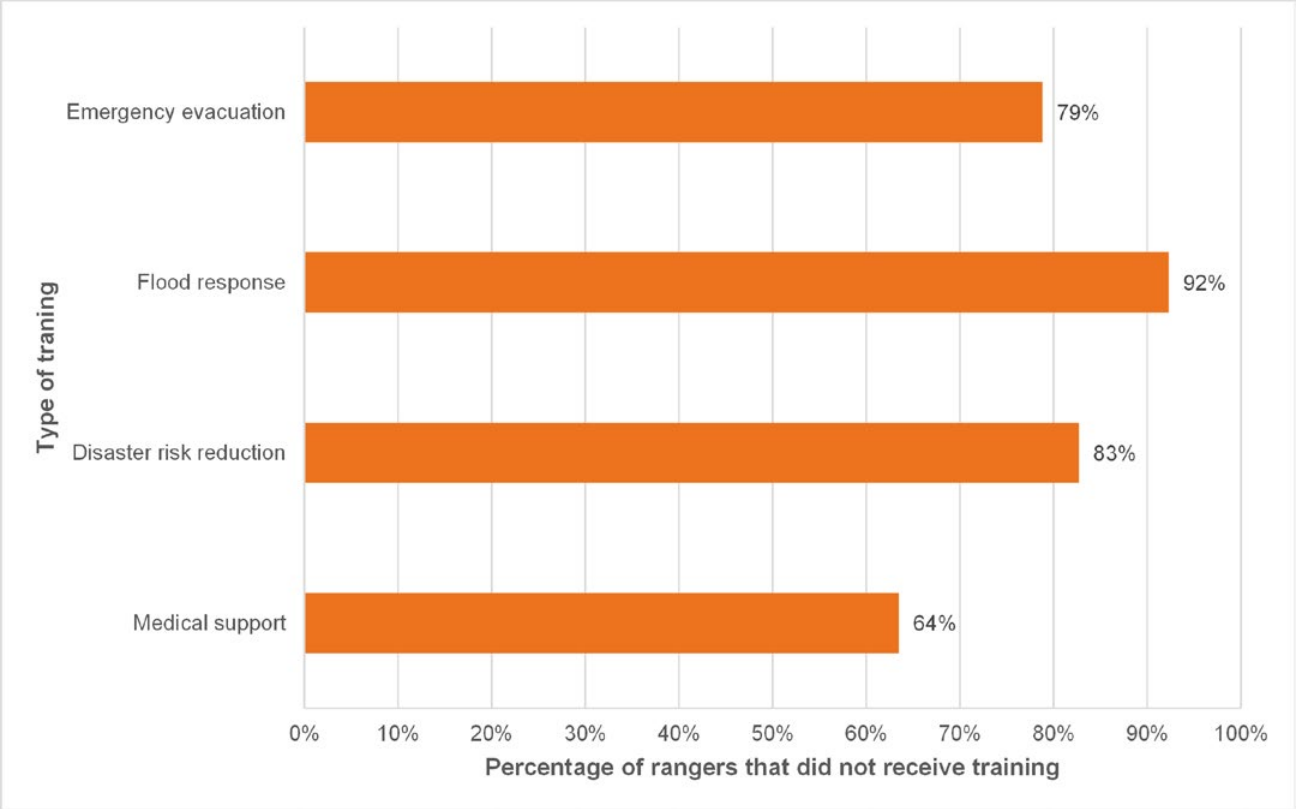


Figure 3. Percentage of rangers in Asia reporting that they did not receive training in the previous 12 months on emergency evacuation, flood response, disaster risk reduction or medical support.

Firefighting in a peat swamp (KSDA). Palangkaraya, Central Kalimantan (Borneo), Indonesia © Alain Compost / WWF

Forest Guards and park rangers having a quick brief before they head into the forest for their patrol at Thua Thien Hue Saola Nature Reserve, Viet Nam © WWF-US / Justin Mott

rangers' inherent commitment to serve their fellow community members (Aisha et al., 2024). Despite this, ranger–community relationships can often be strained and complicated, reflecting a legacy of colonialism, inequality and violence (Stolton et al., 2022). Historically, many Indigenous people and local communities (IPLCs) have been forcibly displaced and denied access to their ancestral lands after areas have been designated as PCAs. This distrust has intensified with recent cases of corruption and human rights abuses perpetrated by rangers, damaging the credibility of conservation efforts, rangers, their employers and NGOs that support them (Belecky et al., 2021a; Brockington et al., 2007; People not Poaching, 2022). These challenges emphasise the compelling need for professionalisation and accountability within the ranger workforce and intentional efforts to build strong ranger–community relationships.

Indigenous people and local communities' trust and support is shown to decrease the likelihood of poaching in PCAs (Belecky et al., 2019). Prioritising a rights-based, collaborative approach to conservation that engages IPLCs can add value by reducing misunderstandings and conflict and increasing compliance and reporting of illegal activity (Ackerley et al., 2023; Belecky et al., 2019; Moreto et al., 2017; People not Poaching, 2022; Stolton et al., 2022). This approach also acknowledges the interconnectedness between IPLCs and nature, and their inherent rights, ensuring just, inclusive outcomes for everyone.

The Chitwan Declaration adopted at the 2019 World Ranger Congress specifically addresses building mutually respectful, transparent, trusting relationships with communities as a top priority (IRF, 2019). URSA's Building Trust with Rangers and Communities scoping report calls for rangers to become community first responders, prepared to use first aid skills during medical emergencies, including women in labour or accidents (Stolton et al., 2022). Rangers' assistance with these incidents represents beneficial, constructive interactions with communities, building rapport and mutual respect. Every incident response is an opportunity to demonstrate that rangers are a reliable and trustworthy resource committed to serving communities (Stolton et al., 2022).

Attitudes expressed within focal group discussions and the broader ranger literature indicate that enhanced community–ranger relationships are a beneficial byproduct of rangers' role as emergency first responders. Therefore, rangers must be encouraged, trained and equipped to maintain and improve their contributions to emergency and disaster response, which enhances PCA management, conservation outcomes, and the health and well-being of both rangers and IPLCs.

CONCLUSION

Growing frequency and intensity of extreme weather and large-scale disaster events are increasing the scope of duties, responsibilities and demands placed on rangers. These events also highlight the growing need for a professional ranger workforce with the capacity to

function as emergency first responders. This study's findings indicate that rangers already function as emergency first responders in diverse contexts. Despite this indispensable role, rangers are often met with little recognition and support, and a majority of rangers feel underequipped, undertrained and unsafe performing first responder duties. These results mirror trends reflected in the broader ranger sector and raise important considerations supporting the call for policy change within international and national governmental institutions.

While the limitations of this study prevent its application to entire countries or the Asia Pacific region, the themes presented provide foundational perspectives on rangers' contributions as first responders. Perceptions from the survey reveal some of the specific functions and capabilities rangers provide during emergencies, demonstrating their adaptability, versatility and unique value as frontline essential workers. Responsibilities including, but not limited to, evacuation support, rescue, recovery, and delivering essential goods are assigned to rangers during emergencies or natural disasters. This study also shows there are serious shortcomings that limit rangers' ability to perform these duties effectively and safely. Communications devices, medical training and flood response equipment are examples of resource and training gaps impacting rangers. Improvements to ranger working conditions are broadly beneficial for the ranger workforce and conservation, but also support rangers in the execution of duties related to public health, safety and disaster response. Rangers' critical multi-sector contributions introduce opportunities to access new funding sources external to conservation.

Beyond resource and support limitations, additional considerations related to legal constraints and liability can have serious implications for rangers and their employers. Additional research is needed to understand current roles and responsibilities, required qualifications or licensing, and legal conditions rangers must operate within and how these are regulated. While rangers are expected to perform first responder duties without sufficient training and support, it remains unclear how they are navigating the legal fulfilment of these duties within complex insurance and liability considerations. All of these factors amplify the legal and personal safety risks rangers encounter while responding to emergencies when compared to conventional first responders. Therefore, within relevant regionally specific contexts and legal constraints, it should also be considered whether rangers are the most suitable personnel to perform first responder duties.

With this study's focus on extreme weather events and natural disasters, future research should investigate rangers' role during routine emergencies, including vehicle accidents or PCA visitors with a medical emergency. Such research would complement the insights from this study's survey and focal group discussion, providing a more comprehensive understanding of the regional status of rangers' contributions to emergency response. Additionally, increasing the sample size in subsequent research will capture additional nuance and provide results that are more broadly representative of the region. This study's findings also suggest that improved ranger–community relationships are a beneficial byproduct of rangers' fulfilment of an emergency first responder role. Future research endeavours could further explore the intersection between ranger first responder duties and ranger–community relationships.

This study contributes to the developing discussion of rangers' role as emergency first responders, but additional research is essential to fully understand the depth and breadth of this role. These insights are crucial for accurately representing and communicating rangers' contributions within relevant institutions, which can then address ranger training, equipment and support requirements. Addressing the needs of the ranger workforce not only supports conservation efforts, but also enables rangers to effectively perform emergency first responder duties, which are critical for effective public health and safety measures and disaster management.

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RESUMEN

El papel de los guardabosques como primeros intervinientes en emergencias es cada vez más importante ante la escalada de desastres naturales y fenómenos meteorológicos extremos relacionados con el clima. Sobre la base de una revisión de la literatura y los datos recogidos de las encuestas y discusiones de grupos focales, este estudio explora el papel de los guardaparques como primeros en responder en Asia. Se encuestó a 52 guardabosques de 12 países, lo que revela las diversas expectativas, responsabilidades y retos a los que se enfrentan. De ellos, el 59,6% había experimentado un aumento de sus responsabilidades durante una catástrofe, incluidas las evacuaciones, las operaciones de rescate y recuperación, y la entrega de suministros esenciales como alimentos y agua. A pesar de su contribución esencial, la mayoría (más del 60%) de los guardas encuestados no había recibido formación en primeros auxilios, respuesta a inundaciones, evacuación de emergencia o respuesta a catástrofes. Aunque los resultados variaron en función de la cuestión específica, las conclusiones generales indican una necesidad urgente de cambios políticos para profesionalizar la mano de obra de los guardabosques, mejorar la formación y el acceso a los recursos, y establecer sistemas de apoyo institucional para los guardabosques. Destacar las contribuciones de los guardabosques fuera de la conservación aumenta la visibilidad del valor único que los guardabosques añaden en otros sectores como la salud pública y la seguridad.

RÉSUMÉ

Le rôle des gardes forestiers en tant que premiers intervenants en cas d'urgence devient de plus en plus important face à l'escalade des catastrophes naturelles liées au climat et aux événements météorologiques extrêmes. Cette étude explore le rôle des rangers en tant que premiers intervenants en Asie, en s'appuyant sur une revue de la littérature et sur des données recueillies lors d'enquêtes et de discussions de groupes focaux. Au total, 52 gardes forestiers de 12 pays ont été interrogés, révélant la diversité des attentes, des responsabilités et des défis auxquels les gardes forestiers sont confrontés. Parmi eux, 59,6 % ont vu leurs responsabilités s'accroître lors d'une catastrophe, notamment en ce qui concerne les évacuations, les opérations de sauvetage et de récupération, et l'acheminement de fournitures essentielles telles que l'eau et la nourriture. Malgré leur contribution essentielle, la majorité (plus de 60 %) des gardes interrogés n'avaient pas reçu de formation sur les premiers secours, les interventions en cas d'inondation, les évacuations d'urgence ou les interventions en cas de catastrophe. Bien que les résultats varient en fonction des questions spécifiques, les conclusions générales indiquent qu'il est urgent de modifier les politiques afin de professionnaliser les rangers, d'améliorer la formation et l'accès aux ressources, et de mettre en place des systèmes de soutien institutionnel pour les gardes forestiers. La mise en évidence des contributions des gardes forestiers en dehors de la conservation accroît la visibilité de la valeur unique que les gardes forestiers apportent dans d'autres secteurs tels que la santé et la sécurité publiques.

THE RESILIENCE OF BIRD SPECIES IN A BRAZILIAN ATLANTIC FOREST REMNANT IN THE FACE OF ACCELERATED EXTINCTIONS IN THE NEOTROPICS

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ABSTRACT

The Caetetus Ecological Station is located in south-eastern Brazil. It is a unique protected area given it was set aside for preservation in the early 1930s, when all surrounding forests were clear-cut. Because the birds of this area have been inventoried on a number of occasions since the late 1970s, Caetetus represents a singular case study to evaluate how the bird communities have changed over time in a relatively small (2,178-ha) but intact site. We searched the literature, ornithological platforms data and included our unpublished surveys to compile ornithological records. From the 184 species initially reported, all but two appear to be still present. Unlike other well-studied forest fragments in the Neotropics, where between 10–27 per cent of all forest bird species are suggested to have become locally extinct, Caetetus stands out as a notable exception. We suggest that, based on all available evidence for other similar forests, Caetetus' long-standing undisturbed status could be the main driver for this persistence of species. However, it is uncertain how bird species will be affected by fragmentation and species relaxation in the long term, and how they will respond to climate change. The ability to access citizen science records on public databases makes current and future tracking of species persistence much easier and more comprehensive.

Keywords: avian communities, Caetetus Ecological Station, historical records, literature review, ornithological platforms, seasonal semideciduous forests.

INTRODUCTION

After the Amazon, the Atlantic Forest is the second largest tropical forest in South America, covering parts of Argentina, Paraguay and Brazil. It once occupied approximately 13 per cent of the Brazilian territory (Vancine et al., 2024). It is among the most threatened worldwide hotspots for biodiversity (Myers et al., 2000) and is home to thousands of endemic plant and vertebrate species (Figueiredo et al., 2021; da Silva & Casteleti, 2003). Currently, only 22.9 per cent (37,327 Mha) of its original vegetation cover remains, 97 per cent of which consists of highly disturbed, isolated forest remnants smaller than 50 ha (Vancine et al., 2024). The remaining Atlantic Forest cover is mainly composed of small secondary forest fragments with low connectivity inserted within agricultural landscapes, vulnerable to edge effects and specific anthropogenic disturbances, such as selective logging, livestock trampling and pesticides (Vancine et al., 2024). As a result, forest fragments have since undergone ecological changes resulting from their partial or full protection, as shown by medium and long-term studies in the region, monitored in the last 10–20 years (Souza et al., 2020).

Fragmentation reconfigures the landscape affecting species distribution and movement patterns of wildlife. Within the remaining fragments, overharvesting threatens mainly medium and large-sized species across all trophic levels, reducing their populations (Benítez-López et al., 2017). The conversion of large areas of habitat into a number of small patches affects the distribution and

abundance of species in the landscape, with negative effects on most species, while habitat loss leads to changes in landscape configuration, such as size, shape and degree of isolation of habitat patches (Ewers & Didham, 2005).

Despite the attention given to birds worldwide, 1,445 or 13 per cent of the 11,162 bird species are threatened with extinction, with threats from agriculture, climate change, selective logging, and hunting and trapping affecting the largest number of bird species (IUCN, 2023). These threats often interact synergistically. Agricultural expansion, for example, is accompanied by degradation of the remaining habitat, and the increased accessibility of habitat remnants permits consumptive usage of birds for bushmeat and the wildlife trade (Symes et al., 2018). In previous studies, in a myriad of landscapes of the Atlantic Forest, researchers studied bird communities in severely fragmented scenarios and have provided important results on the responses of bird communities to habitat fragmentation (e.g. Aleixo & Vielliard, 1995; Donatelli et al., 2004; Pizo & Tonetti, 2020; Willis, 1979; Willis & Oniki, 1981). Frequently, their results suggest the effect of patch size, shape and isolation, as well as broader landscape features (matrix composition, connectivity and vegetation cover) are the main drivers of the loss and reduced distribution of bird species (Pizo & Tonetti, 2020).

Because internally modified habitats might not demonstrate the natural responses of bird communities to large-scale landscape fragmentation, several researchers focused their studies on protected areas, assigning them as control areas, on the assumption that they represent preserved habitats. This assumption is true for the continuous forests protected by the Serra do Mar State Park (300,000 ha) in São Paulo state, for example. However, protected areas further west of these vegetation blocks were delineated 40 years ago when they constituted some of the few remaining forests, following extensive deforestation in inland São Paulo during the 19th century for coffee plantations. Consequently, despite their protected status, these areas have lost some forest species and cannot function as control areas (Cavarzere et al., 2023).

Like taxonomic studies, inventories have been largely, but incorrectly, disregarded by scientists due to the fact that they are not hypothesis-driven studies. Monitoring of bird communities from Brazilian protected areas has been limited, resulting in few assessments of the patterns of bird communities over time (e.g. Cavarzere et al., 2023). However, inventories are needed more than ever, as they are the base upon which studies provide large datasets (e.g. Hasui et al., 2018) indicating large-scale ecological responses.

In this study, we wished to compile, organise and evaluate ornithological data produced over a period of about 50 years in a relatively small patch of Seasonal Semi-deciduous Forest that was never clear-cut and remains mostly without anthropic modifications. Its birds were first censused in the late 1970s, and surveys and inventories have been carried out at least once in every decade since then. We hypothesised that this site may demonstrate a lower loss of forest bird species when compared to larger areas of continuous seasonal semi-deciduous old growth forests that have been subjected to clear-cutting or anthropogenic modification. In addition to testing this hypothesis, we wished to compile all information sources to create a solid avian database to be used as a reference upon which future studies can compare their results.

MATERIAL AND METHODS

Study area

Caetetus Ecological Station (hereafter Caetetus) is a 2,178-ha remnant of Seasonal Semi-deciduous Forest, which once covered almost the entire interior of São Paulo state in south-eastern Brazil (Figure 1). Because 7 per cent of Interior Atlantic Seasonal Forests remain, and only 6.8 per cent of these remnants are protected (0.8 per cent of the original cover), they represent the most threatened Atlantic Forest vegetation type in southern Brazil (Carlucci et al., 2021). This forest type occupies the interior plateaus of São Paulo and is characterised by the loss of leaves of 20–50 per cent of all individual trees during the driest months of the year. It is among the most diverse habitats of the Atlantic Forest (da Silva & Casteleti, 2003).

Caetetus was deliberately left standing from 1931 onwards, while the remaining forested areas around it were clear-cut and destined for coffee plantations. This forest had never been subjected to selective logging and was intentionally preserved by its owner. While there have been instances of fires and cattle encroachment along its borders, these events occurred more recently. The man who ordered the pristine forest to be left in this area that contains many springs was Olavo Amaral Ferraz, then owner of the Paraíso Farm. Initially this preservation was to maintain his hunting activities, but he later began protecting the animals, even feeding them during the driest months. Worried about the fate of his forest reserve after his death, he asked the Government of the state of São Paulo to create a protected area, which materialised after 12 years, in 1976 (Tabanez et al., 2005). Thus, although border effects, erosion and pollution of the Peixe River and illegal hunting pose threats to Caetetus, it is one of the few remnants that most closely represent the pristine forests that covered western São Paulo (Figure 1).

Figure 1. Representations of the vegetation at Caetetus Ecological Station in south-eastern Brazil: (a) aereal view of the fragment, (b) a corridor with a neighbouring private forest, (c) view of the preserved forest and (d) tree height comparison between the preserved forest to the right as opposed to the border and neighbouring private forest to the left. Images from the collection of the Fundação Florestal.

Most of the Caetetus borders onto cleared land, primarily coffee plantations and pastures for cattle (Tabanez et al., 2005). Therefore, the protected area is largely isolated from natural habitat, though a few contiguous remnants add another 1,000 ha to the total forest area (Figure 2). The mean annual temperature is 21.5 ºC, with June as the coldest and January and February as the hottest months (16.5–24.7 ºC), and the mean annual precipitation is 1,431 mm (21–251 mm), with July as the driest and January as the rainiest months (Tabanez et al., 2005).

Unpublished field data

Two methods were used. Birds were mist-netted (10 m x 3 m x 20 mm) in irregular intervals from 2006 to 2023, when 10 net lines were kept open for approximately 12 h each day for one or two days at a given month. Individuals were identified and then released. Nets were checked every hour, or earlier, if weather conditions were inclement. Species were also censused using lists of 10 species, in which 10 species are recorded in sequence, without repetition of species per list, while observers walked along transects (MacKinnon & Phillipps, 1993). Species already detected can only be recorded again in subsequent lists. Sampling effort is given as the number of accumulated lists. We started observations about 15 min before sunrise, and birds were visually identified with binoculars and aurally. Inventories were carried out from 2006 to 2023 (Supplementary Online Material 2).

Secondary data

Literature review

Avian publications based on Caetetus were searched on Doaj (https://doaj.org/), Google Scholar (https://scholar.google.com/), Jstor (https://www.jstor.org/), Scopus (https://www.scopus.com/home.uri), Scielo (https://scielo.org/pt/) and Web of Science (https://www.webofscience.com/wos/) using the following Boolean operators and combinations of keywords: bird* OR avian* OR ornithol*, as well as their Portuguese counterparts ave* OR avian* OR ornitol*, AND Caetetus.

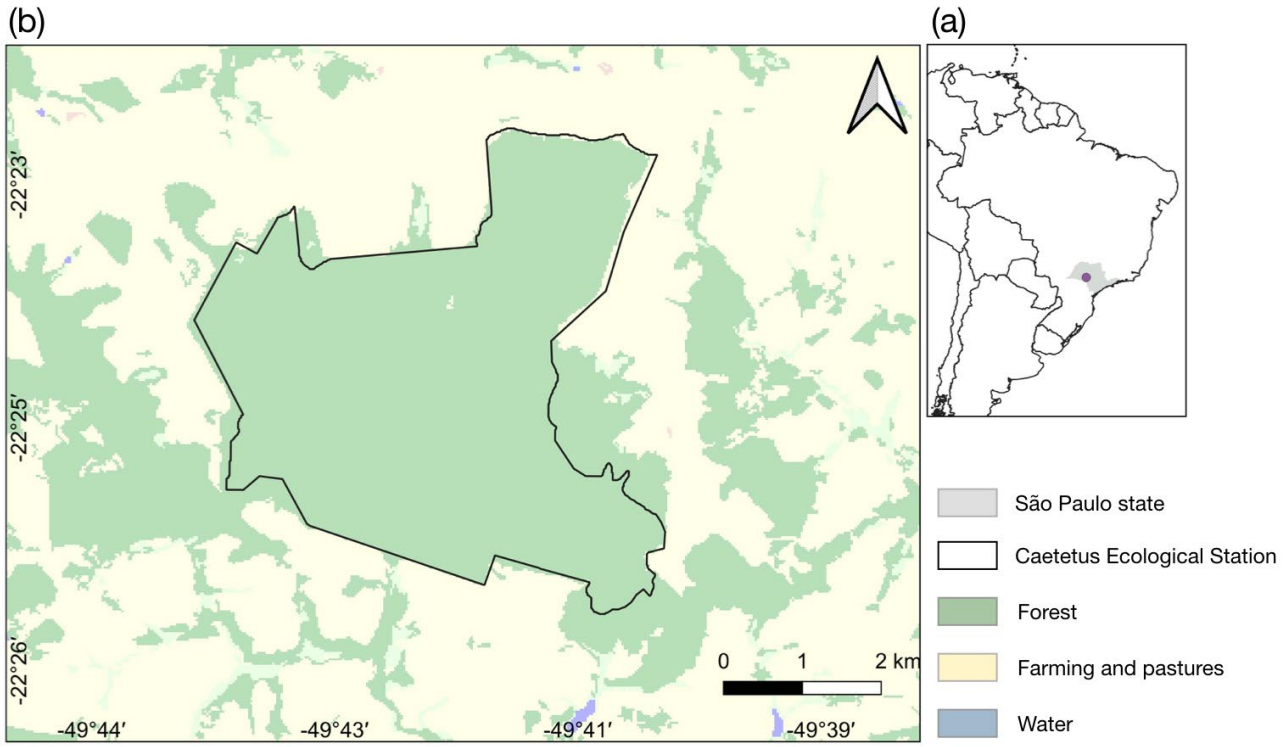

Figure 1. São Paulo state, south-eastern Brazil, within South America (a) and Caetetus Ecological Station and landscape use in its surroundings (b).

In Google Scholar the first 10 pages of results were considered. This review, conducted until 31 December 2023, resulted in 23 papers, one book and one book chapter (Supplementary Online Material 1). The Global Biodiversity Information Facility (GBIF; https://www.gbif.org/) and the Sistema de Informação sobre a Biodiversidade Brasileira (SiBBr; https://www.sibbr.gov.br/) were consulted but contained no Caetetus bird records.

Ornithological platforms

Records of bird species deposited in the online ornithological platforms eBird (https://ebird.org/) – both lists and media files under Caetetus (259 species in 443 observations), iNaturalist (https://www.inaturalist.org/) – under Caetetus (four species in four observations), WikiAves (WA), under observation area 'Estação Ecológica dos Caetetus', (https://www.wikiaves.com.br/especies.php?&t=ao&ao=781) (173 species in the same number of documented records) and xeno-canto (https://xeno-canto.org/) – under Gália (seven species and seven observations) – were considered until 31 December 2023. The list produced by the members of the Centro de Estudos Ornitológicos (CEO), an NGO that inventories birds within São Paulo, was also consulted (https://ceo.org.br/avifaunaestado/avifest.htm). Only species recorded within and in the immediate surroundings of Caetetus were considered. The WikiAves record of the Palm Tanager Thraupis palmarum (WA3464587 and WA3464652) was discarded as a misidentification.

Analyses

Species records were critically evaluated and categorised according to the presence of documented evidence (specimen, photograph, audio or video recording), which produced a primary list. Species from the literature that lack documentation but are likely to occur in Caetetus based on distribution were included in a secondary list. Published records of species whose documental evidence is invalid or whose distribution falls outside the Caetetus region and requires further documentation were included in the tertiary list. To assess how species accumulated over time we constructed a collector curve based on the number of species as a function of the years.

The sequence of species and taxonomic arrangements followed the Brazilian Ornithological Records Committee (Pacheco et al., 2021). The 1976 census was the baseline against which all subsequent records were compared (Willis & Oniki, 1981).

We also checked whether records were made within the Ecological Station, or from the surroundings. Species that were unequivocally detected within a 100 m buffer from the borders of the station were considered as probable residents of Caetetus. Species that inhabit environments which are not represented within the station, such as Cerrado vegetation, were excluded from all analyses. This was the case of the Pearly-vented Tody-tyrant *Hemitriccus margaritaceiventer*. Relevant taxonomic arrangements are mentioned in Supplementary Online Material 2.

RESULTS

Overall, from 1976–2023 (47 years), 346 bird species were recorded from Caetetus (Supplementary Online Material 2). Most records came from traditional researchers. By 1996, 12 species already recorded were mentioned in eBird. It was only in 2016 when both eBird and WikiAves accounted for 42 species which were filed as observed before (Figure 3). The primary list accounted for 183 (53 per cent) species, while another 133 (38 per cent) undocumented species were included in the secondary list; the remaining 30 (9 per cent) species were entered on the tertiary list (Supplementary Online Material 3).

Four species were detected only once in the 1970s, and never recorded again. These are the Rusty-breasted Nunlet *Nonnula rubecula*, the Saffron Toucanet *Pteroglossus bailloni*, the Chilean Elaenia *Elaenia chilensis* and the Tawny-headed Swallow *Alopochelidon fucata* (Supplementary Online Material 3).

DISCUSSION

We considered three possible explanations for the high persistence rates for bird species in Caetetus: habitat quality and disturbance; landscape connectivity and fragmentation; and history of clear-cutting.

Habitat quality and disturbance

One factor is that Caetetus represents a singular well-preserved environment for forest bird species when compared to protected areas that were delimited after the clear-cutting of the inland forests. Such areas are somewhat depauperate in habitat-specialist bird species, especially due to, among other reasons, habitat modification (Aleixo & Vielliard, 1995; Cavarzere et al., 2023; Ribon et al., 2003; Willis, 1979). This is particularly problematic in fragmented landscapes, where only a subset of tree species may survive, compromising the sustainability of regenerated forests in the long term (de Souza & Batista, 2004), consequently altering the dynamics of bird communities.

For example, a 1,400-ha semi-deciduous forest remnant some 115 km to the south-east has a similar history to Caetetus and has been monitored since the 1950s (Magalhães, 1999). However, being privately owned, it seems more susceptible to external hazards, such as arson fires, logging and hunting. There, the forest cover is quite degraded, with an irregular canopy and a large abundance of lianas, mainly along the edges and clearings. Selective logging up to 200 m into the fragment occurred in the 1990s along the northern edge (Antunes, 2005). As a result, it has lost almost 10 per cent of all forest species over the last 40 years (Antunes, 2005). Public protected areas within the Atlantic Forest domain may also suffer from edge effects and disturbances, and the loss of forest bird species has been strongly suggested in protected areas in interior São Paulo (Aleixo & Vielliard, 1995; Antunes, 2005; Cavarzere et al., 2023).

Landscape connectivity

We also considered the issues of matrix quality, which is fundamentally relevant to forest birds and their functional connectivity. The best chance for survival of habitat specialists would be expected in a large fragment connected to other forests (Pizo & Tonetti, 2020). For Caetetus this criterion for survival is met.

However, the loss of forest species has been documented in seasonal semi-deciduous forest fragments with similar matrix compositions in the state (Bispo et al., 2012; Cavarzere et al., 2017). It has been suggested that the restoration to approximately 30% of native habitat is needed to preserve the integrity of vertebrate communities within a given landscape (Banks-Leite et al., 2014). The current distribution of seasonal forest fragments does not correspond to this landscape configuration and the loss of forest species seems to be a prevailing pattern in inland forests in São Paulo state (Table 1).

Protected areas in interior São Paulo did not harbour habitat-specialist species even in the 1970s (Willis & Oniki, 1981), and we found few published studies which compared bird communities in the same Semi-deciduous Forests between intervals of several decades. They strongly suggest local extinctions of habitat-specialists (Aleixo & Vielliard, 1995; Antunes, 2005; Cavarzere et

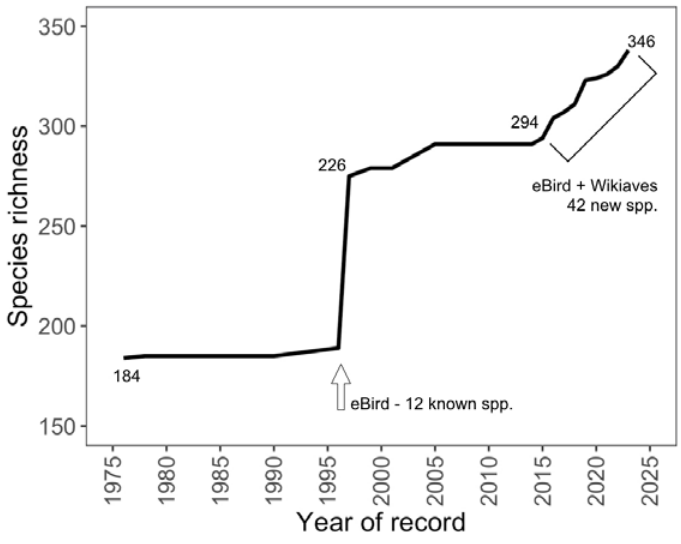

Figure 3. Collector curve indicating how fast the species richness accumulated over the years in Caetetus Ecological Station, south-eastern Brazil.

al., 2017). The only remaining large Semi-deciduous Forest in São Paulo is the Morro do Diabo State Park (> 37,000 ha), which represents what is left of the western forests in the state. However, this forest block does not remain as undisturbed as Caetetus given serious conflicts over landownership and the widespread destruction of its forests for timber and cattle pasture during the last 50 years (Valladares-Padua et al., 2002). In fact, 75 per cent of the entire area burnt in 1968. Some researchers demonstrated that new bird species can be recorded in large, protected areas, such as Morro do Diabo (e.g. Willis & Oniki, 1981), but there is no study comparing that locality regarding the composition of past and current bird communities.

Stage of regeneration

Another fragment (>2,000 ha) with advanced successional stage vegetation found in the municipality of Matão, north-western São Paulo, is known to harbour several Atlantic Forest endemic bird species. Old bird records (from 1905 and 1982) indicate the existence of Atlantic Forest endemics and forest-specialist species in that locality (Willis & Oniki, 2003). In this site, removal of hardwood was reported from the 1960s until 1990, as well as uncontrolled fires have been reported. However, no clear-cutting of vegetation was ever reported (Rozza, 1997).

The age of temperate forests has been suggested to determine species abundance and composition according to each species' habitat preference (Conner & Dickson, 1997), but this theory has been disputed as a determinant of bird community recovery in Atlantic Forest fragments within a gradient of regeneration stages (Dias et al., 2016). However, ornithologists do not particularly address the issue that, in São Paulo, most forest fragments represent regeneration after previously clear-cuttings (Victor et al., 2005). In the north-eastern Atlantic Forest, forests' recovery after clear-cutting showed a distinct structure that profoundly interfered with bird movements (Faria et al., 2009). A southern Semi-deciduous Atlantic Forest which was previously clear-cut and actively reforested was not able to maintain the bird community comparable to surrounding native forests, though it was connected to source areas for 40 years (Quagliato & Cavarzere, 2021).

Based on the available evidence discussed above, the only exclusive feature of Caetetus is the fact that it was never clear-cut. Thus, we propose the maintenance of Caetetus as a never clear-cut, almost intact forest over 90 years, to be the primary driver of the resilience of forest bird species.

As revealed by other studies which evaluated the contribution of citizen science and ornithological platforms, researchers tend to rapidly accumulate species records in initial years, but citizen scientists greatly contribute to both the number of observations and new species, with increasing

Table 1: Number of recorded species and presumed locally extinct (lost) species in fragmented Seasonal Semi-deciduous Forests. When available, a brief observation regarding the vegetation history is provided. 'Years' refers to the interval between the first and last bird inventories.

Source	Forest name	Forested area (ha)	Recorded species	Lost species	Observation	Years
Antunes (2014)	Santa Carlota	1,400	195	0	Not available	25
This study	Caetetus	2,250	346	2 (0.5 per cent)	Fragmented in 1931; never clear-cut	47
Ribon et al. (2003)	Viçosa region	12,000	221	28 (17 per cent)	Extensively clear-cut in the 1870s	68
Antunes (2005)	Barreiro Rico	1,451	202	20 (10 per cent)	Extensively fragmented in 1956; selective logging until the 1980s; isolated	45
Donatelli et al. (2004)	Mata do Rincão	600	300	20 (6 per cent)	Selective logging until the 1970s; interspersed with Eucalyptus	18
Aleixo & Vielliard (1995)	Santa Genebra	251	248	30 (12 per cent)	Fragmented in 1969, delimited in 1984; isolated	16
Cavarzere et al. (2017)	Ipanema	5,000	410	89 (22 per cent)	Deforestation since the 19th century; isolated	200

observation hours in more recent years (Januário et al., 2023). Caetetus is once again an exception, as traditional researchers have accumulated more information over the years. However, several important recent records have been contributed by citizen scientists who make their verifiable data freely available online and who are more likely to perform continued inventories. Thus, publicly available databases with both researcher and citizen scientist records should enable analyses over time and space to better inform conservation science.

CONCLUSIONS

Caetetus is a unique protected area given its history as a fragment that has never been clear-cut. It also stands out for having a good historic reference of the bird community, which was surveyed in the late 1970s. These exceptional features allowed a comparison with bird inventories conducted over five decades. Comparisons with other forest remnants strongly suggest that being preserved and never clear-cut was a primary factor in the persistence of all but two forest species, a hypothesis that should be considered for future studies. Thus, prioritising protection of long-standing undisturbed areas must be treated as an urgent need. The continued monitoring of the forest birds is necessary, as the outcomes of their relaxation and response to climate change and other threats remain unclear. Due to the high costs of long-term studies and the tendency of traditional researchers to engage in distinct research works, accessing citizen science records in public databases significantly facilitates current and future tracking of species persistence, making it easier and more comprehensive, thus contributing to conservation science.

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SUPPLEMENTARY ONLINE MATERIAL

Supplementary Online Material 1. Studies conducted at the Caetetus Ecological Station, south-eastern Brazil, recovered by the literature review.

Supplementary Online Material 2. Tables for Results and Discussion section.

Supplementary Online Material 3. List of bird species reported from the Caetetus Ecological Station, south-eastern Brazil.

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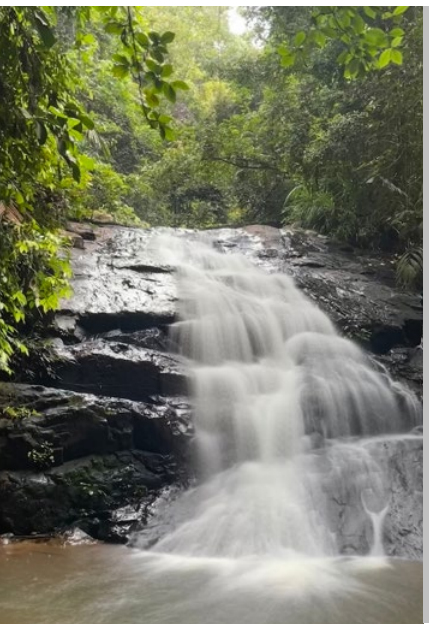
RESUMEN

La Estación Ecológica de Caetetus está situada en el sudeste de Brasil. Se trata de un área protegida única, ya que se reservó para su conservación a principios de la década de 1930, cuando se talaron todos los bosques circundantes. Dado que las aves de esta zona han sido inventariadas en varias ocasiones desde finales de la década de 1970, Caetetus representa un caso de estudio singular para evaluar cómo las comunidades de aves han cambiado con el tiempo en un sitio relativamente pequeño (2.178 ha) pero intacto. Buscamos en la bibliografía, en los datos de las plataformas ornitológicas e incluimos nuestros estudios inéditos para recopilar los registros ornitológicos. De las 184 especies citadas inicialmente, todas menos dos parecen seguir presentes. A diferencia de otros fragmentos de bosque bien estudiados en el Neotrópico, donde se sugiere que entre el 10 y el 27% de todas las especies de aves forestales se han extinguido localmente, Caetetus destaca como una notable excepción. Sugerimos que, basándonos en todas las pruebas disponibles para otros bosques similares, el hecho de que Caetetus no haya sido perturbado durante mucho tiempo podría ser el principal factor de esta persistencia de especies. Sin embargo, es incierto cómo se verán afectadas las especies de aves por la fragmentación y la relajación de las especies a largo plazo, y cómo responderán al cambio climático. La posibilidad de acceder a los registros de la ciencia ciudadana en bases de datos públicas hace que el seguimiento actual y futuro de la persistencia de las especies sea mucho más fácil y exhaustivo.

RÉSUMÉ

La station écologique de Caetetus est située dans le sud-est du Brésil. Il s'agit d'une zone protégée unique, car elle a été mise en réserve au début des années 1930, lorsque toutes les forêts environnantes ont été coupées à blanc. Comme les oiseaux de cette zone ont été inventoriés à plusieurs reprises depuis la fin des années 1970, Caetetus représente une étude de cas singulière pour évaluer comment les communautés d'oiseaux ont changé au fil du temps dans un site relativement petit (2 178 ha) mais intact. Nous avons consulté la littérature, les données des plates-formes ornithologiques et nous avons inclus nos études non publiées pour compiler les données ornithologiques. Des 184 espèces initialement signalées, toutes sauf deux semblent encore présentes. Contrairement à d'autres fragments de forêt bien étudiés dans la région néotropicale, où entre 10 et 27 % de toutes les espèces d'oiseaux forestiers auraient disparu localement, Caetetus constitue une exception notable. Nous suggérons que, sur la base de toutes les preuves disponibles pour d'autres forêts similaires, le fait que Caetetus soit resté intact depuis longtemps pourrait être le principal moteur de cette persistance des espèces. Cependant, on ne sait pas comment les espèces d'oiseaux seront affectées par la fragmentation et la relaxation des espèces à long terme, ni comment elles réagiront au changement climatique. La possibilité d'accéder aux enregistrements de la science citoyenne dans des bases de données publiques facilite grandement le suivi actuel et futur de la persistance des espèces et le rend plus complet.



DEVELOPING STRATEGIES TO IMPROVE METT SCORES AND OVERALL MANAGEMENT EFFECTIVENESS IN SELECTED MALAYSIAN PROTECTED AREAS

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ABSTRACT

Effective management of protected areas (PAs) is essential for ensuring long-term sustainability and conservation of biodiversity and ecosystem services. In this study, we assess the management effectiveness of select PAs in Malaysia using the Management Effectiveness Tracking Tool (METT). The METT scores were analysed for sites across different IUCN management categories (Categories I, II and V). The analysis determined the variations in the overall METT scores and element scores within and across each management category. Common strengths and weaknesses in the management of the sites were identified across the PAs as well as the most common and major threats across these sites which were 'biological resource use and harm' and 'natural system modifications', respectively. Based on the findings, strategies are proposed to improve the overall management effectiveness and subsequently, the METT scores, including with enhanced research and monitoring and robust stakeholder engagement. The findings underscore the importance of robust management frameworks and continuous monitoring to ensure the effectiveness of PA management.

Keywords: protected area management effectiveness, Management Effectiveness Tracking Tool, METT-4, PAME assessment

INTRODUCTION

Protected areas (PAs) serve as the last frontier for wildlife and flora conservation; as high value conservation areas and for preservation of endemic species (Le Saout et al., 2013; Stoll-Kleemann & Job, 2008; Stolton et al., 2015). PAs also contribute to human well-being through the preservation of the natural environments that provide various ecosystem services benefiting mankind (Ma et al., 2020). While the establishment of PAs has been emphasised in international conventions and policies since the 1900s, there has been less emphasis on understanding the actual efficacy of established PAs (IUCN, 2010). Various global biodiversity frameworks starting from the Convention on Biological Diversity (CBD) Programme of Work on Protected Areas (PoWPA) in 2004 (Secretariat of the Convention on Biological Diversity, 2004), the Aichi Biodiversity Targets in 2011 and subsequently, the Kunming-Montreal Global Biodiversity Framework in 2022 have emphasised not only the establishment of protected and conserved areas but also the management effectiveness of the established sites, bringing more prominence to improving the overall effectiveness of PAs globally (Maney et al., 2024; Xu et al., 2021).

Since the creation of its first PA, the Chior Wildlife Reserve in 1903 (KATS, 2019a), Malaysia has gazetted more than 500 PAs, albeit in varying sizes, encompassing more than 13 per cent of terrestrial and 3 per cent of marine areas (KATS, 2019a). As one of the 12 most biodiverse countries in the world, Malaysia's effort in PA establishment towards conserving its rich biodiversity (KATS, 2019b; KATS, 2020) is commendable. Malaysia has also considered the effectiveness of PA management by way of Protected Area Management Effectiveness (PAME) assessments to reduce the occurrence of 'paper parks' (Dudley & Stolton, 1999). This is evident with the adoption of the National Policy on Biological

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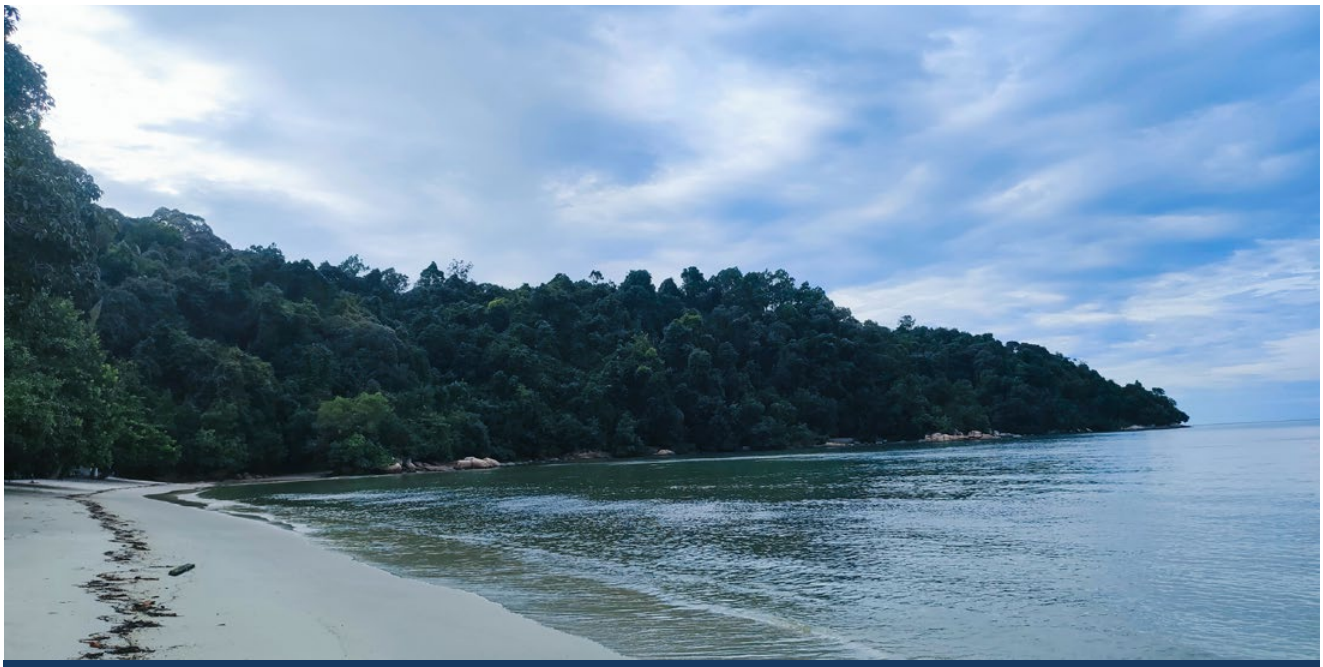

Penang National Park © Lavaniadevi G

Diversity 2016–2025 and its subsequent revised version, 2022–2030, which contain specific actions to enhance the management effectiveness of Malaysia's PAs (NRE, 2016; NRECC, 2023). The Malaysian Government has also directed more funding towards incentivising PAs by way of Ecological Fiscal Transfer (EFT), where the fund allocation criteria include PA hectarage and performance (NRECC, 2023).

The Management Effectiveness Tracking Tool (METT) is one of the most widely used PAME tools globally (Stolton et al., 2019) and has been regularly updated as PA management challenges and management responses develop. The current version, METT-4, (Abidin et al., 2022; Stolton et al., 2021) is a comprehensive assessment that is recommended to be carried out at intervals of one to two years. The METT assessment scores provide a quick indicator of the relative management effectiveness of different sites. This is especially useful for PA management agencies that manage multiple sites and for higher-level PA managers who can utilise this broad indicator to understand the overall status of the sites under their management. However, the *METT Handbook* and other related studies (Stolton et al., 2021; Stolton et al., 2019) warn against the use of the METT score as a 'pass' or 'fail' and instead recommend understanding the results in terms of the six elements (Context, Planning, Input, Process, Output and Outcome) of the IUCN World Commission on Protected Areas (WCPA) Framework (Hockings et al., 2006).

In this paper, we aim to enhance the overall management effectiveness of selected PAs in Malaysia with a focus on the following objectives: (a) review the current state of PA management effectiveness in Malaysia by establishing the initial management effectiveness status for selected sites via METT scores; (b) identify the current challenges and deficiencies in management effectiveness within the selected sites; and (c) develop strategies to improve METT scores and overall management effectiveness in selected sites.

Study Area

Malaysia consists of Peninsular Malaysia (West Malaysia), Sabah and Sarawak (together referred to as East Malaysia), and is found between the latitudes and longitudes of 01–07°N and 100–119°E. Malaysia is characterised as having a tropical rainforest climate (Peel et al., 2007) with average temperatures between 26°C and 28.7°C and average annual rainfall of 2,400 mm (Tang, 2019).

Sixteen PAs in Peninsular Malaysia, Sabah and Sarawak were assessed using METT-4 (Figure 1). These sites are managed by various PA management agencies and are categorised into different IUCN PA management categories due to the differences in the management objectives and permitted activities within the sites. The IUCN management categories for the 16 PAs are listed in Table 1. See Supplementary Online Material 1 for detailed information on the sites.

As many of the PAs in Malaysia have yet to undertake any management effectiveness assessments, this study serves to establish a baseline of the sites' management effectiveness and to identify management needs.

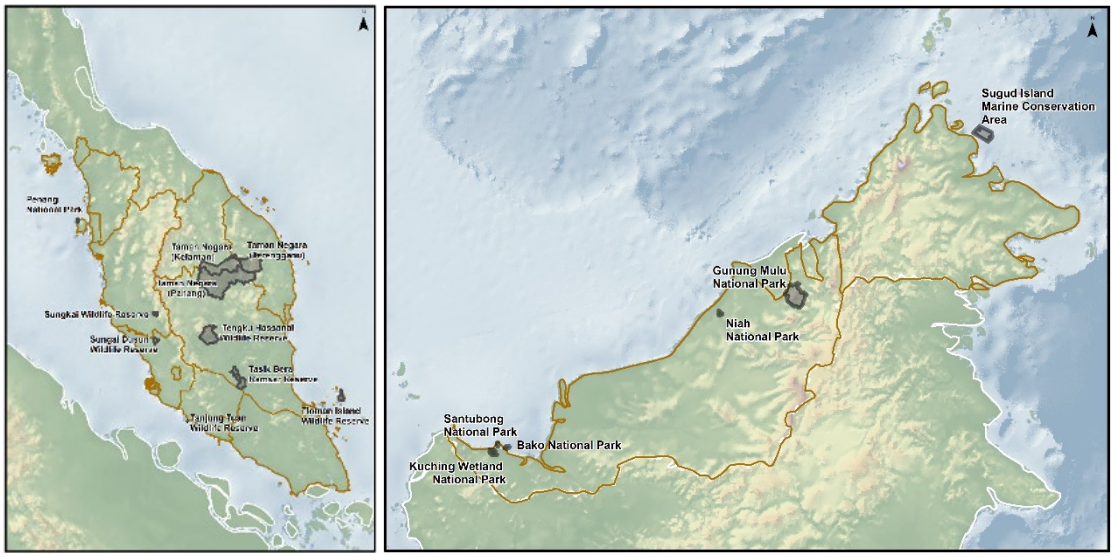

Figure 1. Map of the 16 PAs assessed in Malaysia (Source: Base map © ESRI, 2012)

Table 1. PAs assessed in Malaysia and their IUCN management categories

Sites	IUCN Management Category
Peninsular Malaysia	
Tengku Hassanal Wildlife Reserve Tioman Island Wildlife Reserve Sungkai Wildlife Reserve	Category Ia
Sungai Dusun Wildlife Reserve	Category Ib
Pahang National Park Terengganu National Park Kelantan National Park Penang National Park	Category II
Tasek Bera Ramsar Site Tanjung Tuan Wildlife Reserve	Category V
Sarawak	
Bako National Park Kuching Wetlands National Park Mulu National Park Niah National Park Santubong National Park	Category II
Sabah	
Sugud Island Marine Conservation Area	Category II

METHODOLOGY

Data collection consisted of a series of workshops involving the staff from the 16 PAs. The workshops included an introductory session on PAME, the evaluation tools available in the PAME process as well as an introduction to the METT. Following this, the PA staff were trained in conducting the PAME assessment, especially in the use of the METT.

The data collected from the workshops including the METT assessment scores were then analysed to identify the prevalent threats, common challenges and successes across the 16 PAs to understand the PA management norms across Malaysia. Quantitative data such as the METT scores for the sites were analysed and visualised using graphical representation. In this paper, violin plots are used to visualise the METT score distribution across the different IUCN management categories. We have also followed the METT-4 templates, in using spider charts to visualise the element scores for the sites across the IUCN management categories, as each METT-4 question corresponds to a specific IUCN-WCPA Framework

METT Workshop in Sarawak © Alfred Keleman

element. These charts provide detailed breakdown of the gaps and strengths of the individual sites within each IUCN management category.

Common threats based on the frequency of the specific threat across the 16 assessed PAs and the major threats, based on the aggregate scoring of the threat extent and severity, across the assessed PAs were also identified and were then visualised in a graphical representation. See Supplementary Online Material 2 for the detailed methodology.

In addition, further analysis was carried out on the prioritised "Actions to Improve Management" to develop evidence-based strategies which could enhance the overall PA management efficacy in Malaysia and subsequently, improve the METT scores achieved by each site. Ethical and technical considerations are important in this study, especially to ensure the confidentiality of sensitive information on the sites. Therefore, we do not share the actual METT scores obtained by the individual PAs in this paper.

RESULTS AND DISCUSSION

Analysis of overall METT scores and METT element scores

The analysis of the overall METT scores and the METT element scores for the individual sites within each PA category for the 16 sites assessed gives valuable information on the trend of management effectiveness within various IUCN management categories. Overall, these 16 sites showcased varying levels of management effectiveness with some similar gaps in the METT management elements found across the categories and sites (Figure 2).

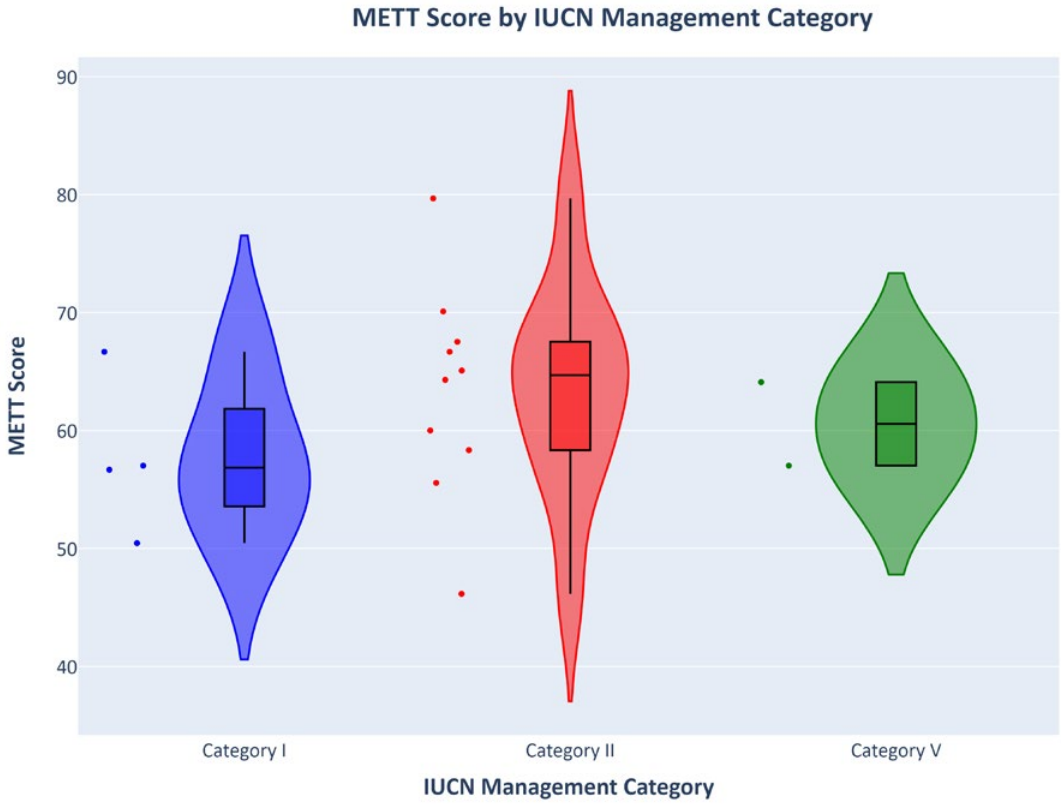

Figure 2. Violin plot visualising the distribution of METT scores achieved by the sites assessed within specific IUCN management categories. The violin plots are overlaid with box plots to denote the median (line within the box), interquartile range (black box) and outliers (points beyond the whiskers). The points (in blue, red and green) show the METT score distribution across each category.

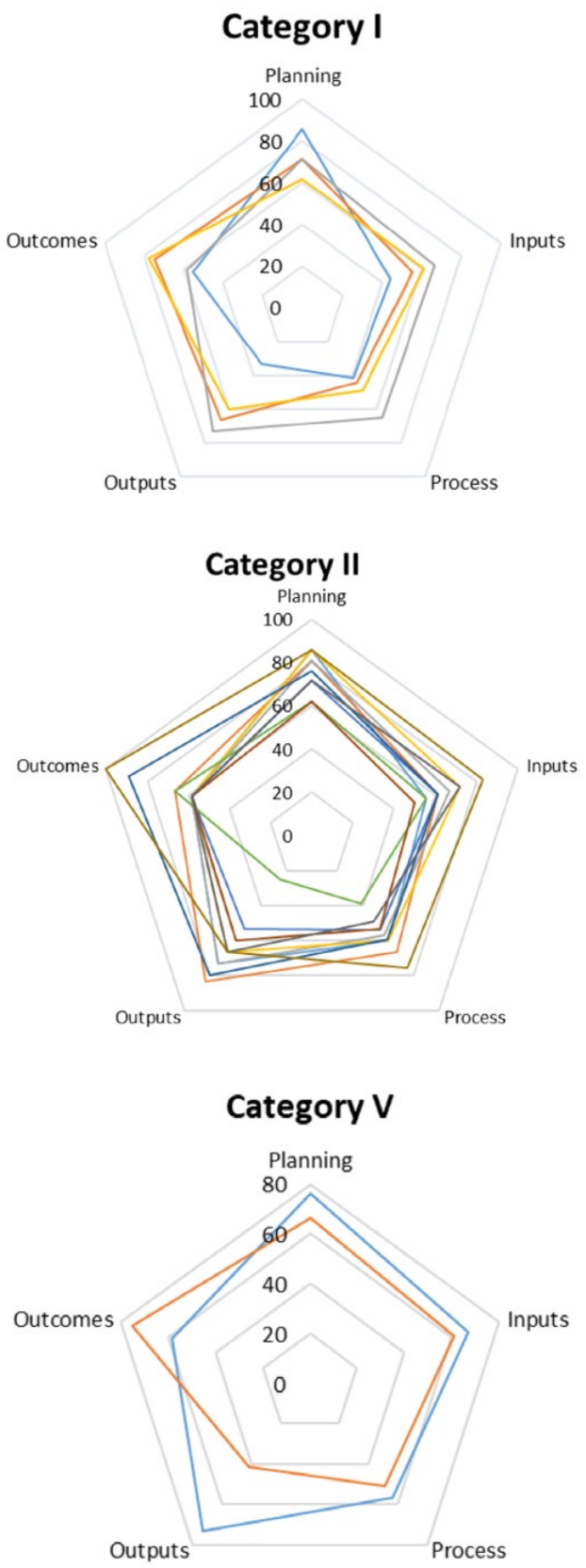

Figure 3. Spider charts denoting the METT element score results for 16 Malaysian PAs by IUCN PA management categories. Each coloured line within the spider charts denotes the METT management element scores of the individual Malaysian PA that was assessed.

The violin plot produced (Figure 2) shows distinctive patterns in the score distributions across the different IUCN management categories. From the analysis, the three categories display violin plots of differing widths which signifies differences in the management effectiveness of the sites. The widest section of the violin plot represents a higher probability of sites within that category obtaining a similar range of METT scores.

Based on the violin plot, Category I sites exhibit a relatively narrow distribution of scores which could imply that the management undertaken across sites within this category is quite similar. This is consistent with the findings from the spider chart of METT element scores for PAs in Category I (Figure 3). With the exception of one outlier, PAs in this category have similar moderate scores for most elements and some gaps in the Process element. From these analyses, there are several possible interpretations for the similar results across sites including similar management policies, consistent and stable funding or relatively similar age of the site with well-established management practices (Dudley et al., 2007; Nugraha et al., 2024).

Sites that were categorised as Category II showcased the narrowest distribution of METT scores and the median score for the sites was the highest among all categories (Figure 2). There is a clear variability in the scores achieved by the individual sites with some sites achieving relatively high scores and some with lower scores which may imply variability in the sites' available resources, such as funding or available staffing to undertake management. The analysis of the spider chart for Category II (Figure 3) supports this as the sites had variable scores (moderate to high) for the element Input which includes METT questions on the sufficiency of resources (budget, staffing, etc.). Additionally, some PAs with a high influx of tourists may have additional plans or policies in place to manage issues or threats related to tourism (Bhuiyan et al., 2013) and may even benefit from increased resources to manage the tourism aspect (Chan, 2015). However, as seen from the spider chart, there is high variability in the Outcomes of the sites which could possibly be a reflection of the tourism management in concert with conservation of the site, with some sites being better prepared to mitigate the impacts from tourism activities than others.

There was also a diverse range of METT scores achieved by sites in Category V, resulting in the widest distribution of scores (Figure 2). This could possibly be due to the differences in the management capacity across the sites resulting from governance issues, resource availability, differences in the PA size and even the identification of

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site-specific threats (Hockings et al., 2006; Leverington et al., 2010). The spider chart analysis of the sites in Category V (Figure 3) also shows variable scores of the METT elements, especially for the Outputs and Outcomes elements. This indicates that there is a marked difference across the sites in undertaking management actions through implementation of the sites' management plans or work plans and in meeting their respective conservation goals. For example, a site assessed under Category V has some limitations in its governance structure, in that one of its co-managing agencies does not have enforcement powers within the site which could lead to the site being unable to undertake effective enforcement activities and in the long run, fail to achieve the site's conservation goals. Ideally, the METT assessment should be conducted collaboratively with all the relevant partners to ensure the responses provided are comprehensive, however, this was not the case. Further investigation is required to determine if this was a potential factor that contributed to the lower METT score or if there are other underlying factors.

Exploring the strengths and weaknesses in protected area management in Malaysia

The strengths and weaknesses of the PAs were assessed and analysed qualitatively by looking at the scores that each site obtained for the METT questionnaire (Figures 4 and 5). The top ten METT questions with the highest score (score of three) and lowest scores (score 0/1) for most of the PAs were identified to assess and evaluate the performance of the PAs, and the METT management element that each question corresponds to was identified to understand the management areas that need to be strengthened.

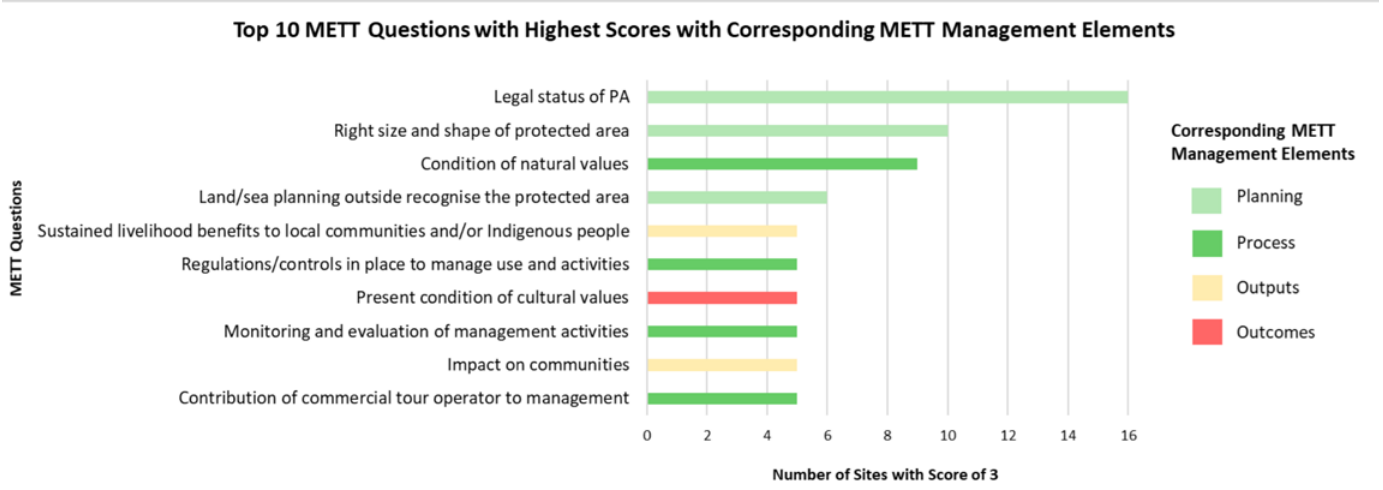


Figure 4. Top ten METT questions with the highest score across the 16 sites assessed

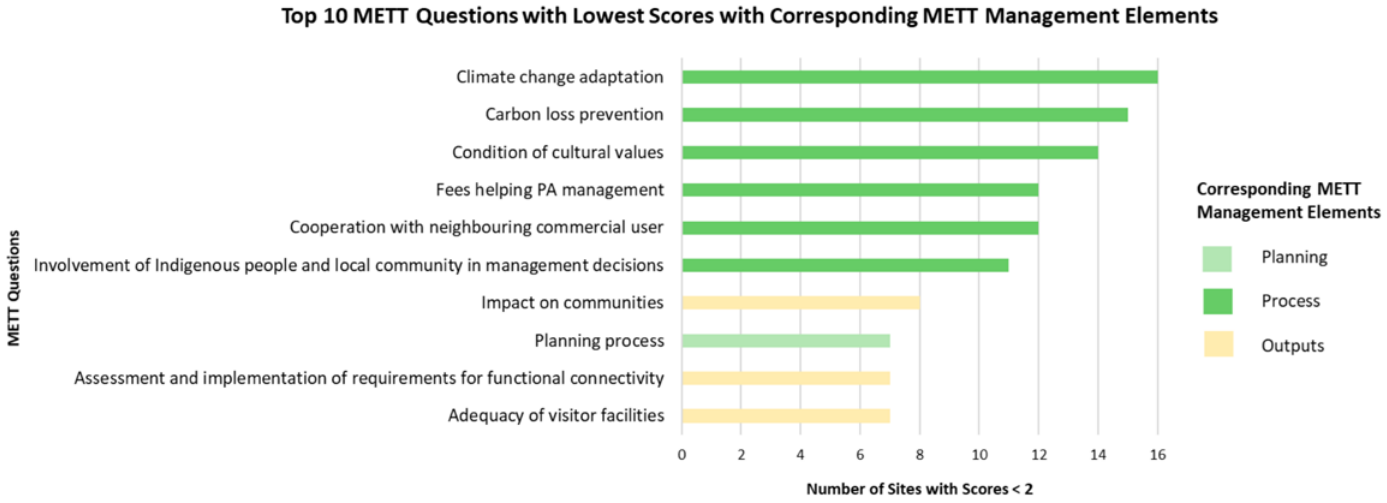


Figure 5. Top ten METT questions with the lowest scores across the 16 sites assessed

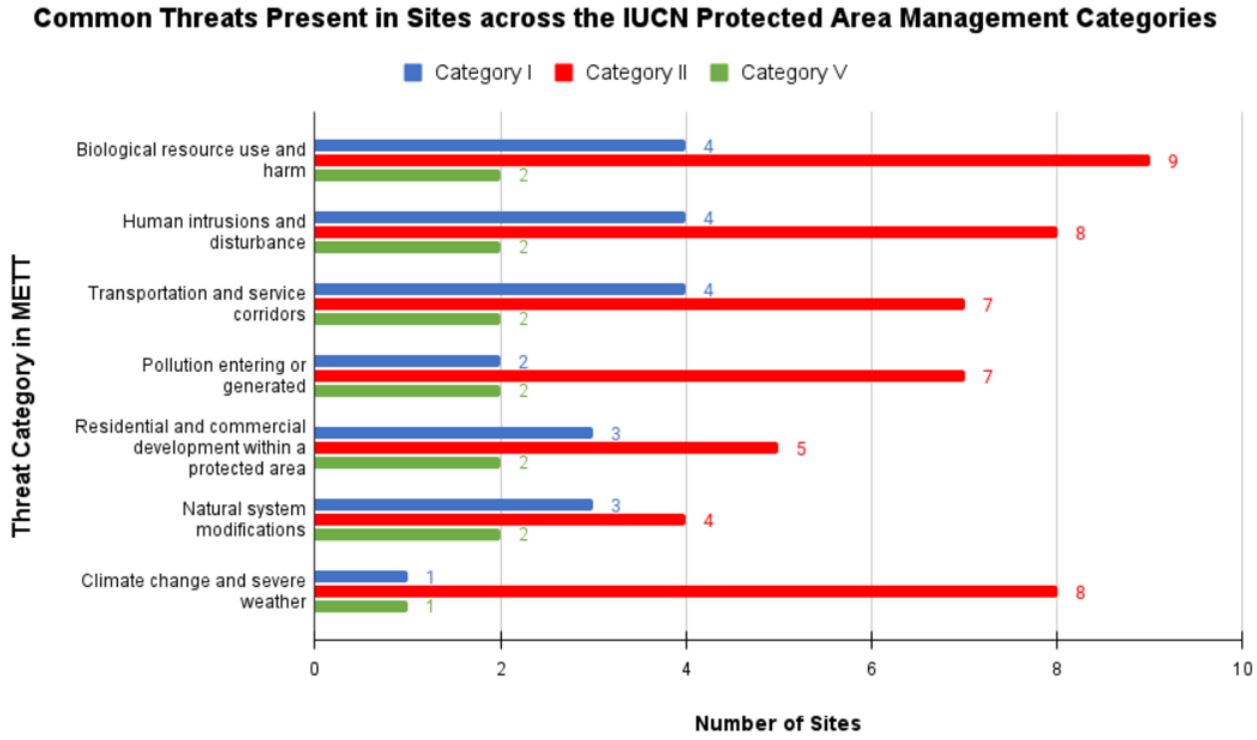


Figure 6. Common threats identified across the 16 PAs assessed in Malaysia categorised by the IUCN PA management categories

The analysis of the METT-4 questionnaire identified certain common strengths across the PAs assessed (Figure 4). In general, most of the METT questions under the Planning element were generally scored well. One of the aspects in which all sites were able to obtain the highest score was the legal status of the PA under the Planning element. This is due to Malaysia only designating a site as a PA once it has undergone legal gazettement (Bakar, 2018; NRECC, 2023). Therefore, all the sites that undertook the METT assessment were able to score well due to the sites being formally gazetted and recognised as PAs by the Malaysian government. The higher scores for METT questions under the Planning element indicates that these PAs have sufficient legal framework, appropriate boundaries and are recognised as PAs in external land use planning (Hockings et al., 2006; Stolton et al., 2021).

Figure 5 shows the common challenges across the PAs based on the lowest scores in the METT questionnaire. Based on the analysis, the questions under Process and Outputs elements generally scored lower with major gaps in climate change adaptation, PA fees and community engagement. The main challenge faced by many of the PAs in Malaysia was the climate change adaptation

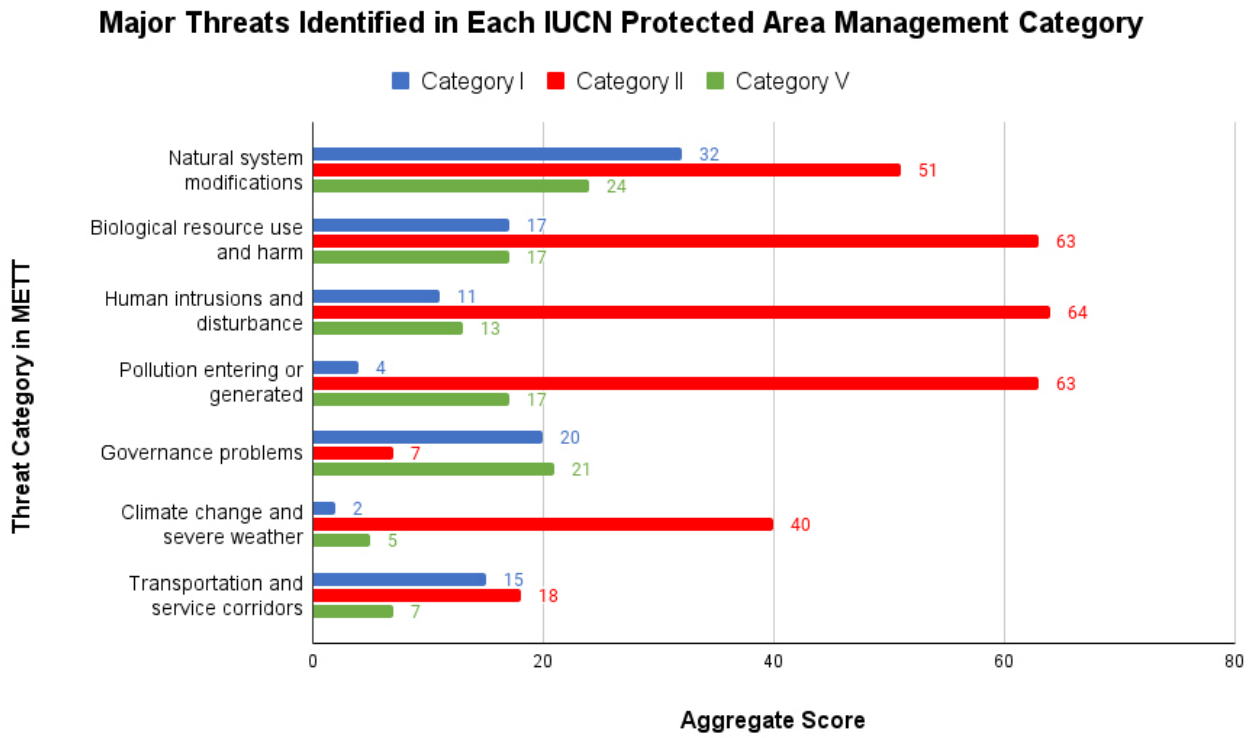


Figure 7. Major threats identified using aggregate scores across the 16 PAs assessed in Malaysia categorised by the IUCN PA management categories

aspect because it has not been considered as a traditional threat for terrestrial PAs possibly due to a lack of understanding of its long-term impacts. Climate change impacts on terrestrial habitat occur quite incrementally (Pierrehumbert, 2002), therefore this leads PA staff to assign less priority to mitigating these impacts (Schneider & Kuntz-Duriseti, 2002). There is a definite need for enhanced understanding and skills to recognise the climate change impacts and subsequently, establish climate change monitoring protocols specific to their sites and develop adaptation plans to mitigate the effects.

Common and major threats across PAs in Malaysia

An analysis of the threats found in the 16 PAs determined distinct differences in the common and major threats across the IUCN PA management categories (Figures 6 & 7).

Overall, the most common threat across all management categories is biological resource use and harm with the exception of one site in Category II. This threat category includes threats such as wildlife poaching, logging and illegal resource extraction, which is one of the most prevalent threats to PAs in Malaysia (Mohd-Azlan & Lawes, 2011; Rayan & Linkie, 2015) and across the world (de Matos Dias et al., 2020). Based on the METT assessments undertaken, we found that while this threat category was present in 15 out of 16 assessed PAs, only two sites received low scores (score 0/1) for METT Question 3 (PA regulations/controls) and six sites received low scores for Question 17 (Protection systems) which are questions relevant for threat management and mitigation. This is an indication that the protection system at the majority of these sites is effectively implemented to manage biological resource use and harm and minimise the threat impact. To manage this threat, the sites carry out regular enforcement patrols as well as integrated patrols (*Ops Bersepadu Khazanah* in Malay) involving multiple enforcement agencies which has been effective in reducing wildlife crimes in Malaysia (Bernama, 2023).

Besides common threats, the analysis also determined the major threats using aggregate scores of the threat extent and severity across the PA categories (Figure 7). The major threat identified under PA Category I and Category V is natural system modifications such as habitat clearing/destruction, while the major threat for Category II is human intrusions and disturbance which includes unsustainable tourism. Analysis of the METT data shows that though natural system modifications and human intrusions and disturbance are identified as major threats across the assessed PAs, five sites scored highly (score of 3) for Question 33 (Threats being addressed) and only three out of 16 assessed sites received low scores. This points to most of these sites being able to manage threats well while a small number of sites might benefit from targeted interventions to

mitigate and minimise the threat impacts. It is equally important for the sites to address the root cause of this threat and give importance to effective land use planning (Question 4) to ensure land use planning surrounding the PA is aligned with the PA management objectives.

Strategies to improve overall management effectiveness and METT scores

Other than a few of the key existing strategies outlined in the previous section, improving the efficacy of the PAs in Malaysia and improving the sites' METT scores requires a few comprehensive strategies.

Enhancing research and monitoring outcomes

One of the most important strategies to improve the METT score is to enhance ecological research and monitoring that specifically contributes to improving the understanding of the site's outcome (Rodrigues & Cazalis, 2020; Zhang et al., 2017). This will improve the robustness of the existing monitoring activities, especially in the development of monitoring protocols for key indicator species within the site and addressing the sites' research gaps such as climate change impacts and adaptations. The need for this strategy is highlighted by the METT assessment undertaken which shows six sites scoring low on METT Question 9 (Resource inventory), suggesting that these sites lack the necessary data and information for effective site management. While the majority of the sites scored medium on Question 19 (Research) with most sites engaged in some form of habitat/species monitoring activities, these often lack robust scientific methods and would be actions and practices that are easily undertaken by rangers. This was evident when most sites could only complete the detailed assessment on species and habitat based on their best estimates without any available data. Modern technologies can also be explored for use under this strategy to optimise resources (financial and human resources) while enhancing management practices (Dalton et al., 2021; Gonzalez et al., 2016; Jiménez López & Mulero-Pázmány, 2019; Lahoz-Monfort & Magrath, 2021). There is also a need for the sites to look beyond their routine tasks and to work towards enhancing conservation outcomes to achieve their management objectives. This could include developing robust thresholds and performance measures (Hilton & Cook, 2022) in order to improve the overall management effectiveness of the site.

Stakeholder engagement including local communities and Indigenous peoples

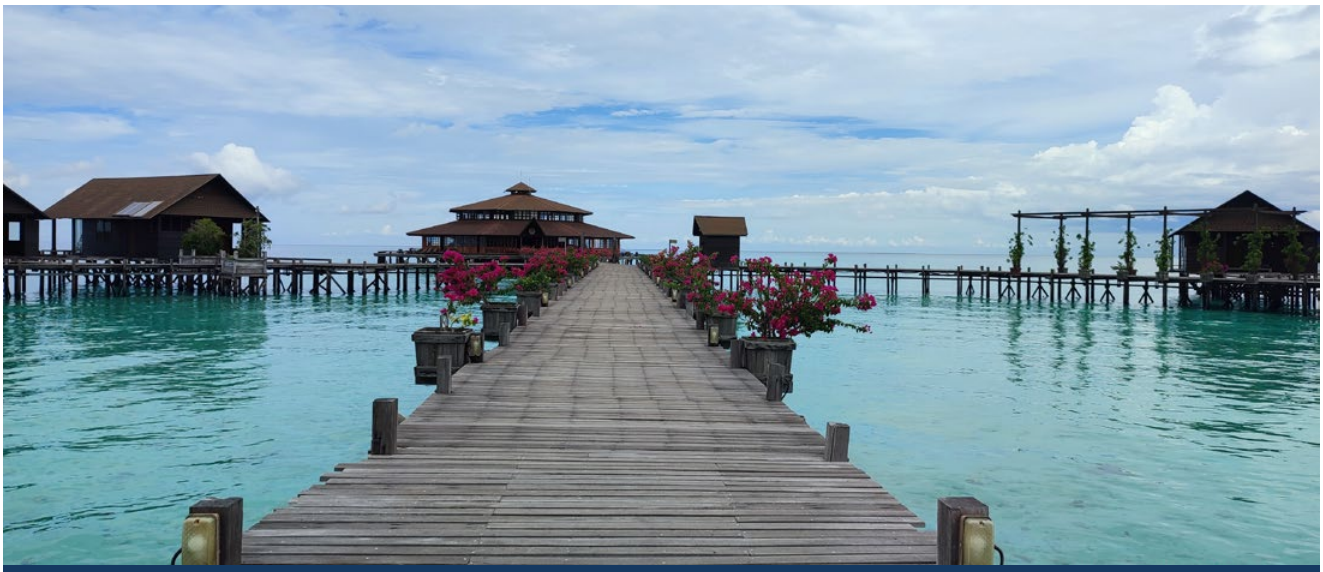
As Question 26 on "cooperation with neighbouring commercial users" and Questions 27 and 28 on "involvement of Indigenous people and local communities in the management decisions" have been identified as common challenges across 12 PAs and 11 PAs, respectively (Figure 5), the sites need to enhance stakeholder engagement effectively, especially in recognising the role of Indigenous peoples and local communities in PA management. Engagement and consultation sessions would be beneficial for the PA management team (Ayivor et al., 2020) and stakeholders to exchange information and build an open relationship. Proactive dialogues with the stakeholders and rightsholders could prevent unnecessary escalation of conflicts or issues and mitigate any reputational and financial risks.

Undertake adaptive management practices

The PA management needs to consider adaptive management (Tony, 2020; Williams, 2011) which can allow for flexibility in addressing any new challenges or threats. Regular evaluation of the current management effectiveness of the site with the use of the METT tool could also be used to develop and adopt adaptive strategies and management (Hockings et al., 2006; Stolton et al., 2021) based on the new challenges or threats that have been identified. An annual review of the sites' METT results would be beneficial to monitor progress of the identified actions to improve management.

Capacity building programmes for PA staff

Capacity building for staff is an essential aspect of enhancing the overall management aspect of the site (Appleton, 2016; Hockings et al., 2006). The analysis of the METT assessment shows that most PAs scored medium (score of 2) for Question 11 (Knowledge and skills), however, this emphasises that there are still some gaps to be addressed for better management of the site. It is crucial for PA staff to undergo trainings and capacity building, including: i) biodiversity monitoring (Appleton, 2016), particularly in enhancing existing monitoring systems or protocols at the site; ii) enforcement activities (Appleton, 2016) by incorporating modern technologies (Dalton et al., 2021); iii) stakeholder management and engagement (Nielsen, 2012), especially in developing and enhancing the necessary skillsets for effective engagement with stakeholders; and iv) Communication, Educational and Public Awareness (CEPA), a skill necessary (Gordon et al., 2021) to optimise engagement with stakeholders.



Sugud Island Marine Conservation Area (SIMCA) © Lavaniadevi G

Staffing optimisation is also crucial in PA management (Appleton et al., 2022; Hockings et al., 2006), especially where there is often a shortage of personnel. Empowering PA staff to be highly skilled and knowledgeable will contribute positively to the overall output and outcomes of the task undertaken, leading to more effective management of the site.

Building a PAME community of practitioners at the national level

There is a need to build a network of PAME practitioners in Malaysia to advocate for the application of management effectiveness assessment at a wider scale for PAs. Such networks are required to i) build the capacity of the staff of different PA managing authorities (at the site-level and headquarters) in conducting the assessment, especially due to the rapid turnover of staff who are transferred to different divisions and sites; ii) support facilitation of the assessment; and iii) provide follow-up support in interpreting and incorporating the findings of the assessment into the management of the site.

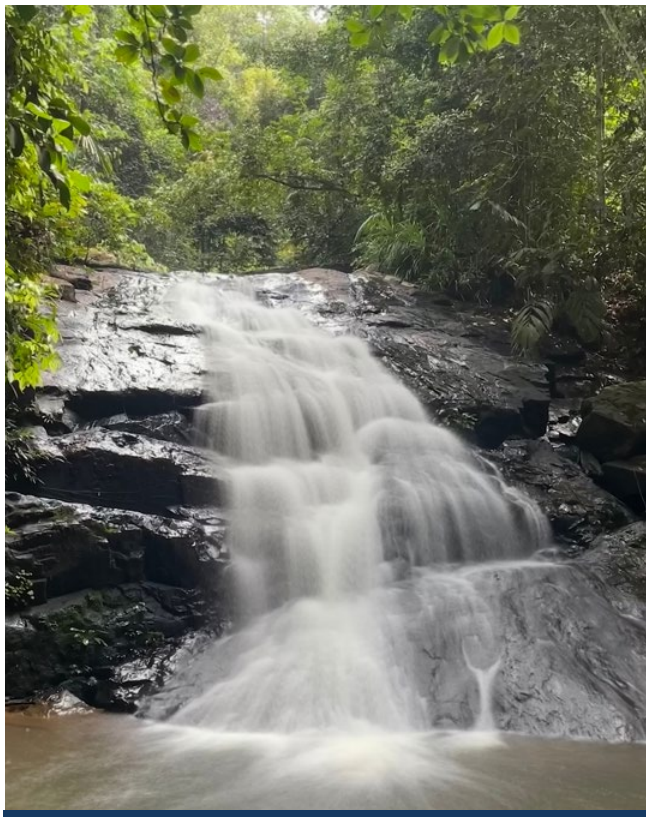
These strategies are focused towards the improvement of PAME and the METT scores in Malaysia, however, it is crucial to also look beyond the country's assessment to contextualise the PAME experience and benefits of METT in other countries in the region. In Southeast Asia, it was found that the PAs that have completed METT were associated with the conservation of more forest cover and carbon stocks (Graham et al., 2021). Similarly, the widespread and repeated usage of METT in Indonesia has shown overall improvement of the METT scores and the management effectiveness of the PAs (Nugraha et al., 2024). These experiences emphasise the importance of undertaking and scaling up efforts in PAME and METT assessments in Malaysia in order to enhance the overall management effectiveness and achieve conservation goals.

Limitation

One potential limitation of this study is that this project had a limited number of study sites with only 16 PAs from across Malaysia, a mere 3 per cent of the total number of PAs in Malaysia, which may impact the findings. We suggest that future studies related to PA management effectiveness assessment in Malaysia incorporate more sites that represent the multitude of ecosystems and biodiversity found here.

Furthermore, there was a noticeable language barrier with the use of English in the METT-4 template and its handbook that may limit the comprehension of the PA staff in understanding and adequately answering the questionnaire. In Malaysia, while both Malay and English are generally used, Malay is the main language used in governmental administration and education, resulting in varied levels of English proficiency among government agencies including the PA management agencies. Although efforts have been taken to adapt and develop a Malaysian METT handbook which provides Malaysian context (Abidin et al., 2022), concerted efforts should be taken to address this language barrier via the development of a bilingual METT assessment template to enable clearer understanding and minimise the risk of misinterpretation of the METT questionnaire.

Another possible limitation of this study is that the self-evaluation of the METT assessment by the PA staff may impact the transparency of the assessment leading to decreased robustness of the evaluation. While METT assessment uses a participatory approach in the



Tengku Hassanal Wildlife Reserve © Munisha Cheng

evaluation, the lack of input from other stakeholders such as the local community and local partners may impact our full understanding of the issues concerning the PA. We suggest that PAME assessments in Malaysia should involve participation from a diverse group of stakeholders to enhance the PAME evaluation and include information and context related to the site from various perspectives.

CONCLUSION

This paper provided a preliminary perspective on establishing the initial status of management effectiveness efforts at the selected site level in Malaysia and the next steps that should be taken in terms of prioritising actions, to improve management or resource allocation that enhance the sites' overall management effectiveness and subsequently, their METT scores. Overall, in this study, the most significant threat within the PAs is natural system modifications. The assessed PAs show tremendous strength in the Planning element, especially in establishing legal status and the appropriate boundaries of the PA. Conversely, the sites are generally weaker in Process elements which indicated a gap in establishing effective implementation of management actions and monitoring practices. The findings from this paper emphasise the importance of having interventions specific to the individual sites when addressing challenges or threats at the site. In general, while PA management agencies in Malaysia have been focusing their efforts on addressing threats and improving overall management effectiveness, the effectiveness of such efforts is relatively not well understood due to the lack of a systematic and structured assessment to track progress of the sites. METT is a useful tool to provide insights into the status of the sites' management efficacy, and therefore, there is an urgent need for the sites to enhance and assess the outcome measurement aspect based on their management practices to determine if the objectives of the site are achieved for the long-term conservation and preservation of biodiversity within the site. However, it is important to note that solely expert-driven METT assessments can be inadequate in encompassing the demands for effective PA management, leading to a need for a robust participatory approach with relevant stakeholders when undertaking PAME assessments.

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SUPPLEMENTARY ONLINE MATERIAL

Supplementary Online Material 1. Detailed study area.

Supplementary Online Material 2. Detailed methodology.

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RESUMEN

La gestión eficaz de las áreas protegidas (AP) es esencial para garantizar la sostenibilidad a largo plazo y la conservación de la biodiversidad y los servicios ecosistémicos. En este estudio, evaluamos la eficacia de la gestión de determinadas AP de Malasia utilizando la Herramienta de Seguimiento de la Eficacia de la Gestión (METT). Las puntuaciones METT se analizaron para los sitios a través de diferentes categorías de gestión de la UICN (Categorías I, II y V). El análisis determinó las variaciones en las puntuaciones globales de la METT y las puntuaciones de los elementos dentro de cada categoría de gestión y entre ellas. Se identificaron los puntos fuertes y débiles comunes en la gestión de los sitios en todas las AP, así como las amenazas más comunes y principales en todos estos sitios, que fueron el «uso y daño de los recursos biológicos» y las «modificaciones del sistema natural», respectivamente. Sobre la base de los resultados, se proponen estrategias para mejorar la eficacia general de la gestión y, en consecuencia, las puntuaciones de la METT, incluyendo la mejora de la investigación y el seguimiento y una sólida participación de las partes interesadas. Los resultados subrayan la importancia de contar con marcos de gestión sólidos y un seguimiento continuo para garantizar la eficacia de la gestión de las AP.

RÉSUMÉ

La gestion efficace des zones protégées (ZP) est essentielle pour assurer la durabilité à long terme et la conservation de la biodiversité et des services écosystémiques. Dans cette étude, nous évaluons l'efficacité de la gestion de certaines aires protégées en Malaisie à l'aide de l'outil de suivi de l'efficacité de la gestion (METT). Les scores METT ont été analysés pour les sites dans les différentes catégories de gestion de l'UICN (Catégories I, II et V). L'analyse a permis de déterminer les variations des scores METT globaux et des scores des éléments au sein de chaque catégorie de gestion et entre elles. Les forces et les faiblesses communes dans la gestion des sites ont été identifiées à travers les AP ainsi que les menaces les plus communes et les plus importantes à travers ces sites qui sont respectivement « l'utilisation et la dégradation des ressources biologiques » et « les modifications des systèmes naturels ». Sur la base des résultats, des stratégies sont proposées pour améliorer l'efficacité globale de la gestion et, par conséquent, les scores METT, y compris avec une recherche et un suivi améliorés et un engagement solide des parties prenantes. Les résultats soulignent l'importance de cadres de gestion solides et d'un suivi continu pour garantir l'efficacité de la gestion des aires protégées.

CATEGORISATION OF SUSTAINABLE-USE PROTECTED AREAS FOR CONTEXT-SPECIFIC CONSERVATION INITIATIVES IN THE AMAZON

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ABSTRACT

Community conservation engages local actors and generates socio-economic gains that promote quality of life whilst protecting the territorial and biodiversity balance in protected areas. However, for conservation efforts of this nature to be effective, the territorial context in which they are situated must be understood and the management structure adequate. In this study, we analysed 134 protected areas that preserve biodiversity and cultural values in the Brazilian Amazon but vary in their management structures and are situated within different threat contexts. Here, we use a management-level indicator and a threat-based territorial context indicator (including deforestation, mining and fire) to classify areas and offer context-specific actions. Based on our classification, we recommend investing in protection and enforcement efforts in areas under greatest threat, as other initiatives will be at greater risk when carried out in these places. Protected areas with high management-level scores can foster innovative community conservation actions, whilst the most deficient ones require investment in basic instruments, such as management plans and the formalisation of management councils. We reinforce the need for comprehensive and up-to-date data on protected areas in the Amazon, especially regarding governance and local organisations, for more informed decision-making by funders, non-governmental organisations and public authorities.

Key words: community conservation, management effectiveness, sustainable use of resources, conservation planning.

INTRODUCTION

Community conservation strategies seek to combine the conservation of biodiversity with the well-being of local peoples (Esmail et al., 2023). This pairing can occur when sustainable activities, such as regulated fishing, ecological tourism and community forest management, are encouraged. Abundant evidence suggests that such practices contribute not only to environmental conservation, but also provide significant socio-economic benefits to communities (Campos-Silva et al., 2021b; Dawson et al., 2021; Oldekop et al., 2016; Zhang et al., 2023).

A systematic review showed that positive outcomes for conservation and socio-economic benefits were more likely when protected areas adopted co-management regimes, empowered local populations, reduced economic inequalities and promoted cultural benefits (Oldekop et al., 2016). Most conservation efforts also deliver positive well-being and conservation outcomes when Indigenous peoples and local communities play a central role in governance, influencing decision-making directly or through local institutions (Dawson et al., 2021). For example, tourism resources benefit communities surrounding protected areas and result in higher levels of wealth and a lower likelihood of poverty, according to Naidoo et al. (2019).

In addition to collaborating in management broadly, community members can be effective defenders of biodiversity when involved in specific conservation actions, as evidenced by the effectiveness of community-protected beaches for the conservation of bird populations (Campos-Silva et al., 2021a) and turtles (Campos-Silva et al., 2018). Despite these benefits, community conservation efforts also face challenges,

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Chico Mendes Extractive Reserve in Acre, Brazil © Neluce

with success tending to be greater in countries with consolidated environmental and democratic governance, and those with greater political stability, transparency and social participation (Fariss et al., 2023). The absence of these criteria can limit the extent of positive and lasting results, which must be considered when planning and executing this type of initiative. In adverse scenarios, the influence of external factors can reduce the impact and effectiveness of these conservation efforts (Coppock et al., 2022) and systemic and advocacy initiatives may be more important in building the foundation on which community actions can thrive (Fariss et al., 2023).

Establishing an adequate management structure within protected areas can facilitate the implementation and/or promotion of socio-economic policies, particularly those benefiting communities in isolated regions (Campos-Silva et al., 2021b; Zhang et al., 2023). However, historically, they have often resulted in conflicts over land tenure and disregard for the rights of local communities and Indigenous peoples (Tauli-Corpuz et al., 2020; Zhang et al., 2023). Moreover, limited management resources in such areas are a world-wide reality (Coad et al., 2019) and when associated with an increase in threats to their conservation can exacerbate social challenges, threatening traditional and sustainable ways of life (Villén-Pérez et al., 2022). Therefore, coupling investment in management and social participation can lead to more effective protected areas both in ecological and social outcomes (Dawson et al., 2021).

Community conservation strategies have been a reality for many years in the Brazilian Amazon (Brondizio et al., 2021), where a large expanse of territory is contained within protected areas, including those aimed at the conservation of both biodiversity and cultural values and the sustainable uses of natural resources (equivalent to IUCN category VI). These areas are key to achieving the Kunming-Montreal Global Biodiversity Framework's Target 3 of protecting 30 per cent of the planet's land and sea for biodiversity (CBD, 2022; Dudley et al., 2022). In the Brazilian Amazon, there are 169 category VI protected areas, with a total area of 59 million hectares (MMA, 2024). However, threats to the conservation of these regions are growing and include roads, agricultural expansion, land grabbing, illegal mining and infrastructure works that generate habitat fragmentation, fires, and intensify climate change (Lapola et al., 2023). To address this, these territories must have adequate

management structures, law enforcement policies and the joint engagement of the government and local communities (Assunção et al., 2019; Schönenberg et al., 2015). In addition, these communities need alternatives for income generation that are not associated with unsustainable economic activities (Naidoo et al., 2019; Terborgh & Peres, 2017). For these community-based efforts to be more effective, they need to be strategically focused, aligning actions within the regional context and conservation objectives of each protected area (Wells & McShane, 2004).

An essential tool for managing protected areas and strategising is the management plan, which serves as the primary planning instrument for Brazilian protected areas (West et al., 2022). National law mandates its creation within the first five years after the establishment of protected areas (Brazil, 2000). The presence of a management plan has been linked to a reduction in deforestation, likely because it requires the establishment of administrative structures and the identification of priority actions (West et al., 2022). However, nearly half of the protected areas in the Amazon lack this instrument, with the proportion rising to approximately 58 per cent within category VI, totalling 98 areas without a management plan (MMA, 2024). Furthermore, these plans are primarily tailored for local planning, with limited consideration given to broader regional influences. Currently, there is no comparable instrument at the area-system level, offering a comprehensive and comparative approach to action and area categorisation.

Herein, we propose a categorisation strategy for context-specific conservation initiatives in protected areas of the Brazilian Amazon, aiming at biodiversity conservation and defence of local communities' ways of life. To this end, we have compiled management and threat-based context indicators in protected areas equivalent to category VI that have communities that reside in them or depend on their resources for subsistence. We selected these areas because their objective is aligned with the combined promotion of conservation benefits and social development. Based on the analysis of these indicators, we classified the areas according to their requirements for carrying out conservation actions and propose guidelines for working in collaboration with local communities.

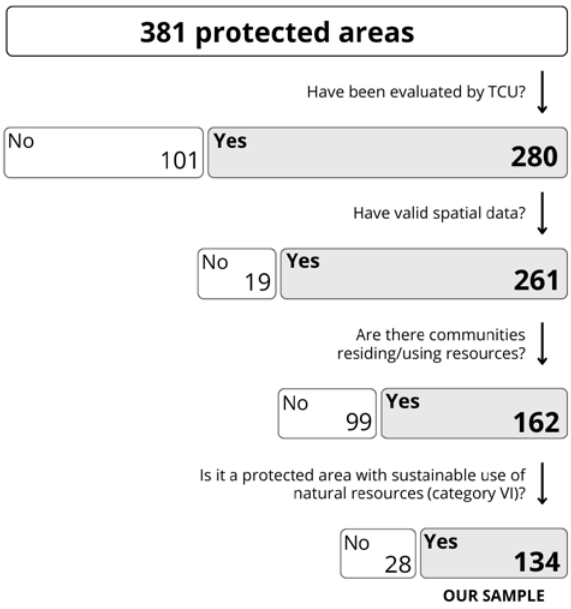

Figure 1. Flowchart of criteria used in the selection of protected areas in the Amazon that make up the present study

METHODS

Study region

According to the National Registry of Conservation Units (CNUC), the Amazon biome in Brazil contains 381 protected areas (updated March 2024; MMA, 2024). Of these, 169 belong to IUCN category VI, which in the Brazilian system consists of National, State and Municipal Forests (hereafter, just Forests), Sustainable Development Reserves (RDS) and Extractive Reserves (RESEX). For our analysis, we selected areas that: a) belong to the Amazon biome; b) are georeferenced in the CNUC; c) belong to IUCN Category VI; d) were evaluated by the Federal Court of Auditors (TCU) in the most recent available audit (2018 to 2019); and e) have communities residing in or using their resources, according to the TCU (Figure 1).

The TCU evaluated the levels of implementation and management of 280 protected areas in the Brazilian Amazon, of which 261 have their boundaries georeferenced in the CNUC and 162 have communities residing in or using their resources. Of these, 134 are category VI areas, which aim to conserve ecosystems and habitats along with cultural values and the use of sustainable natural resources. In addition, we consider the presence of communities in relation to the resources of the protected area as a necessary condition for the development of community efforts. Thus, 134 areas were further analysed, representing 79 per cent of the category VI areas in the Amazon. Among them, 42 are Forests, 70 are RESEXs and 22 are RDSs, according to Brazilian categories. More details of each area are presented in Table S2.

Indicators for Categorisation

To categorise areas, we cross-referenced information from two indicators: the level of management of protected areas and the territorial context. We selected these indicators because they reflect the results of conservation strategies in protected areas and, therefore, should be considered when proposing more effective actions (Dawson et al., 2021; Fariss et al., 2023).

Management level

The Index of Implementation and Management of Protected Areas (Indimapa), a continuous variable from 0 to 3, was used as a proxy for management level. Indimapa was developed by TCU to assess management effectiveness and is based on other methodologies, including RAPPAM (Rapid Assessment and Prioritisation of Protected Area Management) and the METT (Management Effectiveness Tracking Tool), which follows IUCN standards (TCU, 2021). The TCU, a public oversight body, evaluates the effectiveness of government spending in achieving public policies that benefit the population. To assess the impact of protected areas on the national conservation policy, TCU developed the Indimapa tool. Unlike previous methodologies, Indimapa incorporates indicators weighting the socio-environmental results of protected areas and the engagement of local communities in their management, including a specific indicator on community management of resources. Although based on managers' perception, TCU data offers some advantages over other tools as it is collected by an external body and has been applied to all existing protected areas in the Amazon biome, overcoming limitations of other management assessments (Geldmann et al., 2015; Pellin et al., 2022).

Indimapa was first used in the 2014 audit to assess protected areas in Latin America, the Caribbean and Iberia (TCU, 2021). Between 2018 and 2019, a subsequent audit evaluated 2,415 protected areas. Of these, 487 were in Brazil, including 280 in the Amazon (TCU, 2021). The values of the Indimapa index are estimated as the average of 13 indicators, with some not used when they do not apply (e.g. the public-use indicator is not considered in areas without potential for such activity). The indicators assessed are management plan, human resources, financial resources, administrative structure, territorial consolidation, protection, research, biodiversity monitoring, management council, management by traditional and/or local communities, public use, local articulation, and concessions. Each indicator's score is assessed from its classification criteria, either 0, 1, 2 or 3, from the lowest to the highest consolidation, measuring the extent of implementation state defined as ideal within that theme (the criteria are listed in Table S1). This classification is based largely on a questionnaire answered by area managers and by cross-referencing this information with other official data. Materials related to the TCU audit can be accessed at: https://portal.tcu.gov.br/biblioteca-digital/auditoria-coordenada-em-areas-protegidas-2-edicao.htm. See also Supplementary Online Material.

Territorial context

A Territorial Context indicator was developed by aggregating data on the main recognised threats to biodiversity conservation in the Amazon ecosystem. This indicator included: density of fire outbreaks, density of illegal mining sites, average distance from deforested areas greater than 10 hectares, average distance from roads, average distance from logging centres, risk of impact due to drought, proportion of area with mining, and proportion of deforested area. We selected our variables based on previous studies that identified their impact on forest degradation in the Amazon and their availability on a broad scale. Therefore, we included climate change (Silva et al., 2016), timber logging (Lapola et al., 2023), deforestation (Silva et al., 2016), the presence of roads (Pellin et al., 2022), mining (Villén-Pérez et al., 2022) and fire (Lapola et al., 2023). These variables encompass threats both within protected areas, such as fires and mining activities, and in their surrounding areas, considering proximity to threats like deforestation and roads. Additional information about the variables is provided in Tables 1 and S3.

To calculate densities, the number of occurrences of fire outbreaks and mining sites within the protected areas was calculated in units per km². The average distance was calculated by the average of Euclidean distances within the boundaries to deforested areas larger than 10 hectares, roads and logging centres. We omitted deforested areas smaller than 10 hectares, as these very small areas could bias the metric, overestimating the threat of deforestation in cases where there are many small areas dispersed across a region. The risk of impact due to drought was calculated based on the municipal indices that each protected area intersects, weighted by the proportion of the area contained in that municipality. The proportion of mining and deforested areas was given according to the area of the protected area overlapping with mining areas and non-forest areas according to the land use classification. In addition, the original 30-m resolution pixel has been resized to 100-m. For illegal mining, data that was in polygons was transformed into points (centroids). For areas of active mining or in prospection, areas with research authorisation and research request activities were disregarded.

Table 1. Data used in the calculation of the Territorial Context indicator (PC1). (Additional information is provided in Table S3)

Variable	Source	Range	Variable's contribution to PC1 (%)	Correlation (scores) of the variable with PC1
Density of fire hotspots	Instituto Nacional de Pesquisas Espaciais (INPE)	0 – 0.86	2.93	-0.28
Density of illegal mining sites	Rede Amazónica de Informação Socioambiental Georreferenciada	0 – 0.04	0.20	-0.07
Average distance from deforested areas	Projeto MapBiomas	2,328.78 –452,304.83	29.32	0.90
Proportion of protected area that has been deforested	Projeto MapBiomas	0 – 0.10	0.86	-0.15
Average road distance	Instituto Brasileiro de Geografia e Estatística (IBGE), complementadas com dados do Imazon	164.78 – 143,926.58	24.81	0.82
Average distance from logging centres	Imazon	1,297.82 – 827,501.57	26.93	0.86
Impact Risk Index for Drought	Ministério da Ciência, Tecnologia e Inovações	0.18 – 1	10.98	-0.55
Proportion of area with mining	Agência Nacional de Mineração (ANM)	0 – 100	3.97	-0.33

Table 2. Classes defined based on indicators of management level and territorial context, the range of indicator values within each class, and the interpretation of the class's meaning

Management level			Territorial context		
Class	**Range***	**Interpretation**	**Class**	**Range***	**Interpretation**
M1	[0.08, 0.83]	Insufficient	T1	[-3.73, -0.79]	Endangered
M2	(0.83, 1.45]	Limited	T2	(-0.79, 0.874]	Vulnerable
M3	(1.45, 2]	Moderate	T3	(0.874, 2.67]	Stable
M4	(2, 2.58]	Adequate	T4	(2.67, 5.22]	Conserved

*Ranges were defined using Jenks' natural breaks algorithm. A curved bracket '(' or ')' indicates that the value at that end of the interval is not included, while a square bracket '[' or ']' means that the value at that end is included.

We classified the two continuous indicators (management level and territorial context) using Jenks' natural breaks algorithm, that groups data into classes based on breaks in the data distribution, aiming to maximise the differences between classes while minimising the variation within each class (Jenks, 1967). We defined four classes within each indicator, the combination of which culminated in 16 classes named by the combination of two numbers (e.g. T1–M1 or T1–M2) in which the first represents the territorial context (T) and the second the level of management (M). Thus, class T1–M1 groups areas with lower values of context and management, while T1–M4 would be areas with low context values and high management scores (Table 2). Finally, we proposed conservation actions according to these classes, such as the strengthening of management and protection instruments, and the development of new businesses. All analyses were performed using the R software (R Core Team, 2023).

RESULTS

The 134 protected areas are classified according to their level of management and territorial context, represented by the quadrants and colour of the points in Figure 2. Some areas have values close to the thresholds of class definition, so we use classification to facilitate the interpretation of management and context, but we note that these scenarios are more akin to a gradient than exclusive categories.

According to our categorisation proposal, most areas with a conserved territorial context (i.e. classified in class T4) also exhibit an adequate management level; however,

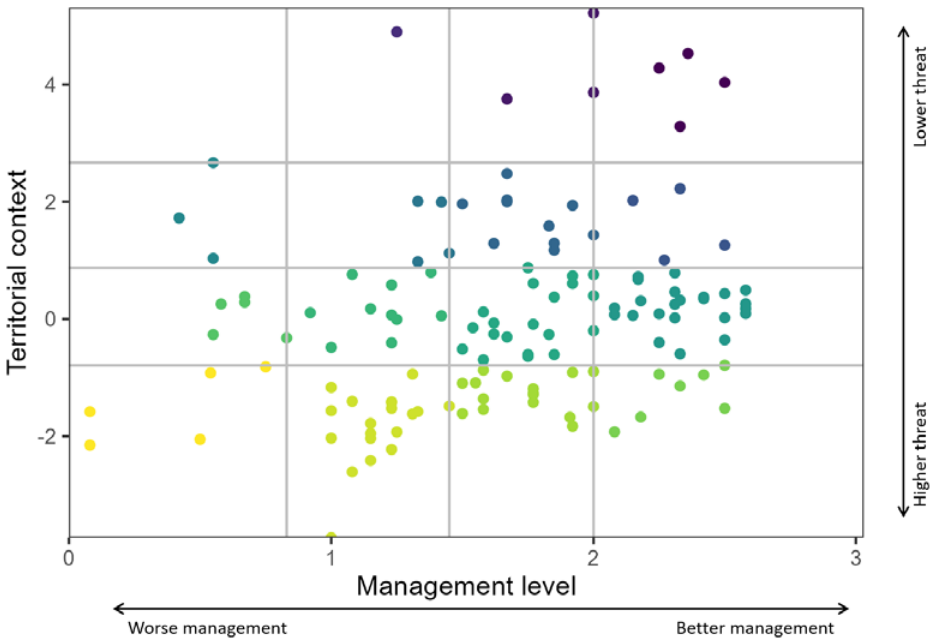

Figure 2. Categorisation matrix of sustainable-use protected areas in the Amazon. The quadrants were defined by the natural breaks in the indicators of management level and territorial context. The scoring gradient of the units according to these indicators indicates the need for conservation actions suggested by the arrows next to the axes.

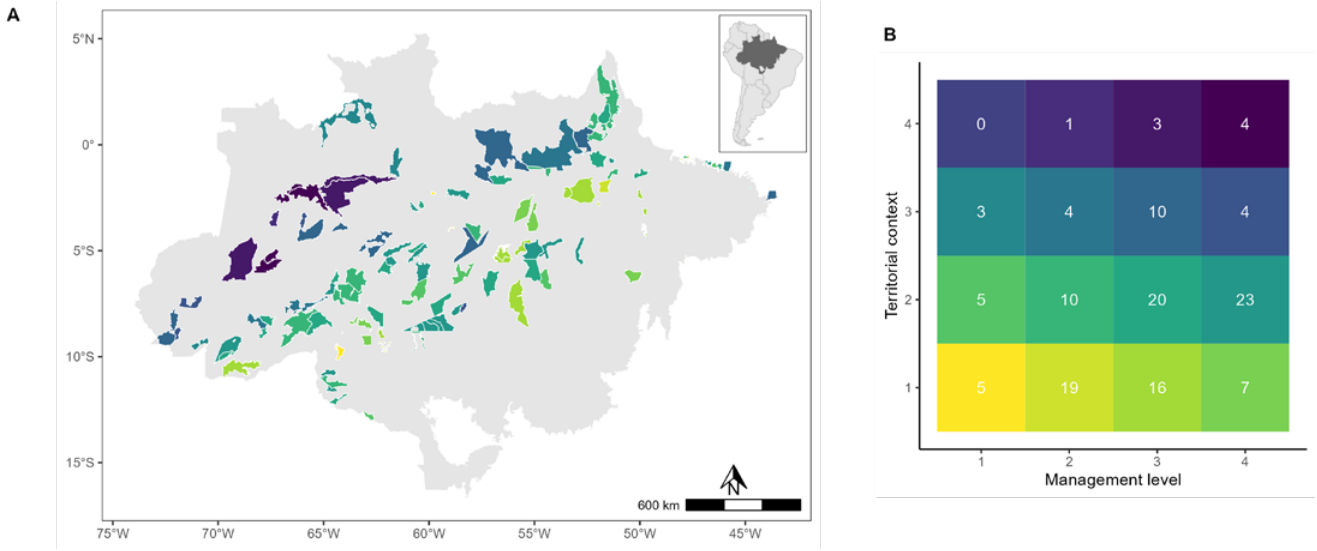

Figure 3. Bivariate map and graph with the frequency of protected areas in the Amazon in each class defined by the management level and territorial context. The classes are identified by the combination of two numbers, the first representing the territorial context and the second the management level. Thus, class T1–M1 groups areas with lower values of context and management, while T1–M4 would be areas with low value for context and the highest management scores, and so on.

this falls within a less frequent category range (top row in Figure 2). The majority of areas concentrate on a limited or moderate level of management, combined with vulnerable and endangered territorial context (Figure 2).

We identified that the protected areas located further south in the biome (in the region known as the 'arc of deforestation' due to its accelerated loss of native vegetation) have very low context scores and vary in their management values, thus forming a gradient of endangered and vulnerable areas (Figure 3). There were no cases of protected area with a conserved context having an insufficient management level (i.e. class T4–M1 is unpopulated, as shown in the frequency graph in Figure 3). Only four areas had both adequate management and conserved context (class T4–M4). Most of the areas fall into vulnerable context classes and adequate and moderate management classes (classes T2–M3 and T2–M4). The list of areas and their respective class and management and context scores are available in Table S2.

DISCUSSION

Our analysis integrates information on local management and threat levels based on the territorial context of protected areas to define actions for conservation and promotion of sustainable uses in these territories. Areas in classes of endangered context (T1–M1, T1–M2, T1–M3 and T1–M4) are more vulnerable to territorial threats and require greater protection and enforcement efforts. The greater environmental vulnerability hinders the implementation of more elaborate management initiatives, as efforts are focused on basic territorial maintenance. It also hinders the implementation of projects for the sustainable use of natural resources, as illegal and predatory uses compete with sustainable activities (Lapola et al., 2023; Terborgh & Peres, 2017). Therefore, these areas require priority action by the government to curb illegal practices by implementing command-and-control initiatives and stimulating sustainable activities through subsidies or payment for environmental services (Assunção & Gandour, 2018). Funders and civil society can support community-based protection efforts, but they will be at greater risk of seeing their projects undermined by predatory and often illegal activities (Tauli-Corpus et al., 2020; Terborgh & Peres, 2017). These areas can benefit from sustainable resource management actions that combine protection with local development, as local communities can improve biodiversity protection against threats, as shown by Campos-Silva et al. (2021a) and Anagnostou et al. (2020).

The relationship between management effectiveness and threat reduction is still poorly understood (Coad et al., 2015), with some cases showing a positive association (Powlen et al., 2021) and others where there is no association (Nolte & Agrawal, 2013; Pellin et al., 2022). In the Amazon, Pellin et al. (2022) highlighted that lower resistance to deforestation was more associated with the accessibility of areas, meaning that the external context was more determinant in their effectiveness as a barrier to threats than their management, as was also found regarding fire outbreaks by Nolte and Agrawal (2013). For instance, most threatened areas are in the deforestation arc, where there is severe pressure from the expansion of the agricultural frontier (Silva et al., 2016). Therefore, in addition to consolidating protected areas, the implementation of complementary public policies, such as satellite monitoring and surveillance, is essential (Assunção et al., 2019). On the other hand, an analysis of the impact of the Amazon Region Protected Areas programme (ARPA) revealed a significant increase in the capacity of supported areas to prevent deforestation, indicating that improving the management of areas may have a long-term effect on enhancing their effectiveness in this regard (Soares-Filho et al., 2023).

Chico Mendes Reserva plant nursery in Acre, Brazil © Neluce

Areas with insufficient management level (T1–M1, T2–M1, T3–M1 and T4–M1) need actions to support the implementation of basic instruments. The implementation of these instruments is a responsibility of the government, but it can benefit from local partnerships to enable processes in the absence of other sources of funding (Andonova & Piselli, 2022). Table S2 lists the Indimapa scores for each of the 13 indicators evaluated. These can be consulted to identify which specific management instrument or initiative to address. Where insufficient management is combined with an endangered context (T1–M1 class), encompassing five areas, there is an urgent need to improve both the implementation and management of these areas while seeking protection against threats. This is the scenario in which the continued maintenance of these areas is most difficult, and where conservation projects need to overcome major challenges to generate change and promote positive environmental and social impacts (Fariss et al., 2023). In these locations, government action is more urgent, both with command-and-control initiatives and investment in the public agencies that manage the areas. Improving both management and context scenario may also bring social and economic benefits to local communities, leading to improved well-being (Naidoo et al., 2019, Oldekop et al., 2016).

The areas where funders and civil society can act most effectively are those characterised by adequate management structure and stable or conserved context (classes T3–M4 and T4–M4). These areas have basic resources that allow leveraging more challenging community conservation strategies, such as entrepreneurship and innovation through socio-environmental businesses. The presence of well-implemented management instruments also allows for the development of more targeted actions, such as the formalisation of fishing agreements (Almeida et al., 2009) or partnerships for forest concessions, defining appropriate sustainability guidelines and monitoring resources use to ensure respect for regeneration limits (Moegenburg & Levey, 2002). Adequate management and a more conserved territorial context are conducive conditions for the adoption of actions that leverage the bioeconomy based on technologies and multisectoral partnerships (Nobre et al., 2016), since the basic priority management conditions have been met.

This study represents an effort to systematise information and present it to support decision-making in a broader territorial context. A specific look at each area is necessary to establish the specific needs to achieve progress. There are, for example, areas that fall into the T1–M3 class (threatened territorial context and good management), but that differ greatly in relation to social organisation. This is the case with the Verde para Sempre and Jamanxim Extractive Reserves, as well as the Chico Mendes Extractive Reserve. The first two possess a structure of grassroots institutions much less active than, for example, the Chico Mendes Extractive Reserve, which exemplifies social organisation, with strong and well-articulated institutions in the territory (pers. obs.). In this sense, we highlight that there is, unfortunately, no systematised information for the entire Amazon biome on aspects associated with governance and social organisation structures, which is a major bottleneck, especially when assessing community conservation actions. Thus, we emphasise the need to generate additional information and assessments on these to improve decision-making.

The management data used also have the limitation of being a snapshot of the evaluation period (2018 and 2019), which may have already changed for some locations. Furthermore, by averaging the 13 indicators, Indimapa assigns equal weight to each of them. However, certain management processes may have a greater impact on the conservation and socio-economic outcomes of the areas. For instance, having a management plan is associated with the ability to curb deforestation (West et al., 2022), while possessing technical and financial resources is linked to maintaining positive population trends (Geldmann et al., 2018). Meanwhile, concession activities or public use may be more associated with promoting socio-economic benefits (Oldekop et al., 2016). Interpreting the management index in an aggregated manner overlooks these differences and we deliberately did it to simplify and analyse the system comprehensively. Another interesting management evaluation methodology that is updated annually is the Management Analysis and Monitoring System (SAMGe), an initiative of the federal management agency of protected areas (ICMBIO, 2023). However, the SAMGe is not yet applied in all areas of the Amazon, so it was outside the scope of this study. Overcoming these bottlenecks are important steps in making more informed conservation decisions.

CONCLUSION

Combining conservation practices with the promotion of quality of life is a strategy that mutually benefits biodiversity and communities living in or near protected areas. For this type of practice to be effective, the definition of areas and actions must be carried out strategically, after understanding the areas' environmental and management context. In this study, we evaluated 134 protected areas in the Brazilian

Rubber Extraction at Chico Mendes Reserve © André

Amazon that have communities residing in or depending on their resources for subsistence and aim to conserve both biodiversity, cultural values, and sustainable use of resources. For these territories to be hubs of sustainable development, management gaps must be overcome. In addition, each of these areas is immersed in distinct territorial contexts that inform the need for inspection and protection initiatives and the investment risk to conservation projects.

In more vulnerable contexts, government must take the initiative for protection and inspection, as well as invest in management bodies when areas have low implementation. In this context, funders and civil society may find it more difficult to establish themselves and projects will be at a greater risk of not delivering lasting benefits. In areas with higher management levels and a more conserved context, we recommend supporting projects related to innovation in resource management and associated community businesses (e.g. forest product chains). These conditions are conducive to the success of these initiatives.

We note that the sample and the data used in our analysis were selected specifically to support decision-making in collaborative conservation projects of Amazonian protected areas. However, we also hope to contribute to more well-informed and locally grounded decisions, based on data and the realities of the region, such as increasing protection in areas at greater risk. To these ends, information generation must be expanded for the qualification of territories, including data on governance, existing community-based organisations and on management. Information must always be up to date and available at the scale of the biome.

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SUPPLEMENTARY ONLINE MATERIAL

Supplementary Online Material 1. Additional indicator tables and a figure.

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RESUMEN

La conservación comunitaria implica a los agentes locales y genera beneficios socioeconómicos que promueven la calidad de vida al tiempo que protegen el equilibrio territorial y de biodiversidad en las áreas protegidas. Sin embargo, para que los esfuerzos de conservación de esta naturaleza sean eficaces, es necesario comprender el contexto territorial en el que se sitúan y contar con una estructura de gestión adecuada. En este estudio, analizamos 134 áreas protegidas que preservan la biodiversidad y los valores culturales en la Amazonia brasileña, pero que varían en sus estructuras de gestión y se sitúan en diferentes contextos de amenaza. Aquí utilizamos un indicador a nivel de gestión y un indicador de contexto territorial basado en las amenazas (que incluye la deforestación, la minería y los incendios) para clasificar las áreas y ofrecer acciones específicas para cada contexto. Basándonos en nuestra clasificación, recomendamos invertir en esfuerzos de protección y aplicación de la ley en las zonas más amenazadas, ya que otras iniciativas correrán un mayor riesgo cuando se lleven a cabo en estos lugares. Las áreas protegidas con puntuaciones altas a nivel de gestión pueden fomentar acciones innovadoras de conservación comunitaria, mientras que las más deficientes requieren invertir en instrumentos básicos, como planes de gestión y la formalización de consejos de gestión. Reforzamos la necesidad de disponer de datos completos y actualizados sobre las áreas protegidas de la Amazonia, especialmente en lo que respecta a la gobernanza y las organizaciones locales, para que los financiadores, las organizaciones no gubernamentales y las autoridades públicas puedan tomar decisiones con mayor conocimiento de causa.

RÉSUMÉ

La conservation communautaire engage les acteurs locaux et génère des gains socio-économiques qui favorisent la qualité de vie tout en protégeant l'équilibre territorial et la biodiversité dans les zones protégées. Cependant, pour que les efforts de conservation de cette nature soient efficaces, le contexte territorial dans lequel ils sont situés doit être compris et la structure de gestion adéquate. Dans cette étude, nous avons analysé 134 zones protégées qui préservent la biodiversité et les valeurs culturelles en Amazonie brésilienne, mais dont les structures de gestion varient et qui sont situées dans des contextes de menace différents. Nous utilisons ici un indicateur de niveau de gestion et un indicateur de contexte territorial basé sur les menaces (y compris la déforestation, l'exploitation minière et les incendies) pour classer les zones et proposer des actions spécifiques au contexte. Sur la base de notre classification, nous recommandons d'investir dans des efforts de protection et d'application de la loi dans les zones les plus menacées, car d'autres initiatives seront plus risquées lorsqu'elles seront mises en œuvre dans ces endroits. Les zones protégées dont le niveau de gestion est élevé peuvent favoriser des actions de conservation communautaires innovantes, tandis que les zones les plus déficientes nécessitent des investissements dans des instruments de base, tels que des plans de gestion et la formalisation de conseils de gestion. Nous insistons sur la nécessité de disposer de données complètes et actualisées sur les zones protégées en Amazonie, notamment en ce qui concerne la gouvernance et les organisations locales, afin que les bailleurs de fonds, les organisations non gouvernementales et les pouvoirs publics puissent prendre des décisions plus éclairées.

LESSONS LEARNED ON GOVERNANCE FROM A GAP ANALYSIS ASSESSMENT IN NAM ET-PHOU LOUEY NATIONAL PARK, NORTHERN LAO PDR

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ABSTRACT

In Southeast Asia, the collaborative management system within government managed protected areas is one of the least well understood fields of protected area management. The large scale of these natural landscapes, the diversity of management issues found within them, and the diversity of actors to be engaged at the different administrative levels make the mechanisms for implementing effective collaborative management unclear. In December 2022, the authors used the IUCN Green List of Protected and Conserved Areas Standard (IUCN Green List Standard), which comprises a set of 17 'Criteria' categorised under four 'Components', accompanied by 50 'Indicators', to conduct a gap analysis assessment in Nam Et-Phou Louey National Park, northern Lao PDR. This paper reviews the findings generated, focusing on 'Good Governance' under Component 1, which comprises three criteria and 16 indicators, focusing on how these actors are mobilised to assist the management of the national park. The application of the 16 indicators broke down the multi-tiered institutional arrangements within Nam Et-Phou Louey National Park into the 'bite-sized' institutional bodies with management mandates within the different administrative levels, and then requested verification documentation to show that these institutional bodies were functional. The paper describes these institutional bodies identified within the multi-tiered collaborative management system of the national park, as well as the importance of the verification documents exchanged between them.

Key words: gap analysis assessment, governance, Green List, multi-tiered collaborative management, Lao PDR, national park, protected area, verification documents

INTRODUCTION

In December 2023, the national protected area system in Lao PDR comprised six national parks, a single species and habitat management area and 18 national protected areas. These protected areas are managed through a collaborative management model. Under these arrangements, the protected area management body manages the reserves in collaboration with the local communities as well as the local administrations; it may be termed 'shared governance' (Borrini-Feyerabend et al., 2013). Within all the protected area categories, the villagers maintain their lands for agriculture, use water for irrigation and drinking, and collect forest products as wild food and pharmacopeia. These traditional rights of the villagers to use their natural resources are prescribed through the Forestry Law (Government of Lao, 2019b). The Decree on Protected Areas (Government of Lao, 2023) also endorses improving the livelihoods of the peoples of various ethnicities, as well as contributing to national socio-economic development. The local communities are prescribed as 'guardian villages' in the Decree. Hence, the better funded national parks are particularly interesting from a collaborative management perspective.

Sustainable financing for the protected area system within the country has been lacking in the last three decades. In 2016, government funding streams to individual national protected areas varied from zero funding to a maximum of US $5,000 per annum (Parr et al., 2019); this predicament has not altered significantly in the last eight years. Understandably, this low level of

funding has immense negative impacts on the number of staff employed within the protected areas, the field activities undertaken, as well as the levels of collaboration and working relations with partners. Only two protected areas have received sustained funding streams over the past 15 years, namely Nam Et-Phou Louey National Park and Nakai-Nam Theun National Park. Both reserves have benefitted from technical assistance, and hence the two reserves are the best managed protected areas in Lao PDR.

The IUCN Green List Standard

The IUCN Green List of Protected and Conserved Areas Standard (IUCN & WCPA, 2017) provides a global benchmark for protected and conserved areas, to assess whether they are achieving successful conservation outcomes through effective and equitable governance and management. The Standard includes globally consistent Components and Criteria, which are supported by Indicators, to measure site performance. It describes a set of 17 'Criteria' categorised under four 'Components', accompanied by 50 'Indicators', for successful conservation in protected and conserved areas. It provides an international benchmark for quality that motivates improved performance and helps achieve conservation objectives. By committing to meet this global standard, site managers seek to demonstrate and maintain performance and deliver real nature conservation results. The global IUCN Green List Standard remains unchanged, until it is reviewed at least every five years, in accordance with the ISEAL Code (ISEAL Alliance, 2014), to ensure that the Standard is continuously improving and consistently providing an international benchmark for quality.

The IUCN Green List Standard is organised into four components of successful nature conservation in protected and conserved areas. The baseline components concern:

- Good governance
- Sound design and planning; and
- Effective management

The Standard is one of the first assessment methodologies that places emphasis on good governance. The three criteria on good governance in the IUCN Green List Standard are described below:

IUCN and the World Commission on Protected Areas (WCPA) (2017). IUCN Green List of Protected and Conserved Areas, Standard Version 1.1., Gland, Switzerland: IUCN.

Under the three above-mentioned criteria, a total of 14 generic indicators are prescribed to assess good governance (see Supplementary Online Material). These indicators are intended to guide evaluating good governance within a protected area.

Nam Et-Phou Louey National Park

Nam Et-Phou Louey was designated as the nation's first national park through Prime Ministerial Decree 35 dated 15 February 2019 (Government of Lao, 2019a). The Ministry of Agriculture and Forestry (2022) issued Agreement No. 4756/DOF on the organisation and activities of the Nam Et-Phou Louey National Park Management Office, dated 18 November 2022. The Nam Et-Phou Louey National Park Management Office (2019) issued Agreement No. 265/NE-PL on the appointment and division of responsibilities of the technical staff in the Nam Et-Phou Louey National Park Management Office, dated 7 October 2019.

The national park protects montane forest and mixed deciduous dry forests. The reserve remains an important area for species of conservation concern, especially its carnivore and primate species, including the endangered or vulnerable White-cheeked Gibbon, Clouded Leopard and Dhole. The national park provides direct ecosystem services to 91 guardian villages (approximately 44,500 individuals) who share land or are contiguous to the national park. To these communities, the park provides land for agriculture, delivers water for irrigation and drinking, wild food and pharmacopeia. The increasing park-based economy provides some employment and source of income to residents.

Criterion 1.1 Guarantee Legitimacy and Voice	There are clearly defined, legitimate, equitable and functional governance arrangements, in which the interests of civil society, rights-holders and stakeholders are fairly represented and addressed, including those relating to the establishment or designation of the site.
Criterion 1.2 Achieve Transparency and Accountability	Governance arrangements and decision-making processes are transparent and appropriately communicated, and responsibilities for implementation are clear, including a readily accessible process to identify, hear and resolve complaints, disputes or grievances.
Criterion 1.3 Enable Governance Vitality and Capacity to Respond Adaptively	Planning and management draw on the best available knowledge of the social and ecological context of the site, using an adaptive management framework that anticipates, learns from and responds to change in its decision-making.

Phati road encroachment © Ben Swanepoel, WCS

A large number of baseline assessments had been conducted regarding the biodiversity values and socio-economic values within the national park such as Wildlife Conservation Society (2016 and 2018), Eshoo (2019), and Foppes and Xayalath (2022). Secondly, the comparatively regular funding streams permitted the recruitment of numerous researchers at various times during the last 15 years on different specialist topics. Thirdly, the ongoing financial and technical support by the Wildlife Conservation Society has permitted a large programme of field activities to be undertaken over the last 15 years, more or less continuously. The Gap Analysis Assessment team had access to many of the existing conservation-related reports and assessments.

METHODOLOGY

The methodology below outlines the various activities undertaken during the gap analysis assessment in Nam Et-Phou Louey National Park.

Interviews with the Nam Et-Phou Louey National Park Management Office, as well as Provincial and District partners

A collection of relevant reports and scientific papers were collected prior to the field work being conducted. A field assessment was conducted from 14–23 December 2022. The Nam Et-Phou Louey National Park Management Office constitutes a professional hub of protected area excellence within the national park management system. Hence, this institutional body was prioritised for collecting data about the status of management within the national park. Interviews were conducted with the staff from each of the five protected area Technical Sub-units; interview duration varied according to the size of their respective field programmes. The staff from the Administration and Finance Unit were also interviewed. The senior management team, comprising the Director and the Deputy Director of the National Park, were interviewed during the last few days of the field assessment, in order for them to receive management feedback from the Technical Sub-units. Interviews lasted 3–7 hours. Key representatives from the Nam Et-Phou Louey National Park Supervisory Committee were also interviewed, including staff from the Houaphanh and Luang Prabang Provincial Agriculture and Forestry Offices as well as the Hiem District Governor's Office. Most of the gaps identified during the assessment were not described in the recently approved Five-Year National Park Collaborative Management Plan (2022–2026) (Department of Forestry, 2021a), or the 10-Year Strategy (2022–2031) (Department of Forestry, 2021b).

Interviews were convened as follows:

(i) the Biodiversity Research and Monitoring Sub-unit (3 hours)

(ii) the Law Enforcement Sub-unit (7 hours)

(iii) the Livelihood Development for Conservation Sub-unit (6 hours)

(iv) the Outreach Sub-unit (2.5 hours)

(v) the Tourism Sub-unit (3 hours)

(vi) the Administration Unit – administration, human resources and planning (3 hours)

(vii) the Administration Unit – finance (1 hour)

(viii) the Senior directors (3 hours)

(ix) Houaphanh Provincial Agriculture and Forestry Office (3 hours)

(x) Luang Prabang Provincial Agriculture and Forestry Office (3 hours)

(xi) Hiem District Office (3 hours).

Questions were chosen, based upon the indicators from the IUCN Green List of Protected and Conserved Areas: Standard Version 1.1 (IUCN & WCPA, 2017), which were the most appropriate for the targeted technical unit staff to answer. The park staff were asked about the current status for a particular management issue and then requested to provide a random sample of a document or agreement, or Minutes, which provided the best verification to the consultant team. WhatsApp groups were formed between the consultants and each of the technical sub-units so that documents could be shared, either immediately or on subsequent requests. In this manner, comprehensive sets of documents were obtained from each unit.

RESULTS

Five of the 16 indicators under the Good Governance component targeted different institutional bodies within different administrative levels within the multi-tiered institutional arrangements found within Nam Et-Phou Louey National Park. The assessment also required verification to show that these institutional bodies were functional. The most significant issues identified on the 'good governance' component were as follows:

(i) Village rights-holders' involvement in park management

The Village Administration is the main institutional body at the village level, as prescribed in the Law on Local Administration (Government of Lao, 2016), and are important partners within the collaborative management system. Within each village, this body formally had 11 members, including two women and three Village Elders, who met monthly. If there were important village issues, they called all the head of households in the village. Greater female participation was promoted in village meetings. It was noted that important technical village documents were endorsed at the district level, reinforcing the working relationship between the villages and the relevant districts (see Supplementary Online Material).

(ii) District working groups in different technical fields

Technical teams were established involving the national park staff from the five individual technical sub-units, together with the relevant district counterparts in all the 10 overlapping districts within the national park. Agreements of co-operation were signed between the National Park Management Office and concerned district agencies – as verification documents. These district technical teams were the key implementing bodies for virtually all the technical field programmes within the national park and the 92 guardian villages (see Supplementary Online Material). Of relevance, these district technical teams have been captured and prescribed in all relevant national protected area regulations, including forest and land use planning, outreach, livelihood development for conservation, and tourism. Of note, there was no district working group established to work on biological research and monitoring; this field of park management functions through a more fluid biodiversity research network, linked to NGOs and academic institutions.

The importance of mobilising district technical teams was overlooked in both the Five-Year Collaborative Management Plan (2022–2026) (Department of Forestry, 2021a) and the 10-Year Strategy (2022–2031) (Department of Forestry, 2021b).

(iii) Provincial Protected Area Committees

Each of the three concerned provinces appointed their own respective National Park sub-committee in mid-2019, through Agreements No. 675/G.KX (Governor Decision of Xieng Khouang Province, 2019), No. 802.G.HP (Governor Decision of Houaphanh Province, 2019) and No. 511.G.LP (Governor Decision of Luang Prabang Province, 2019). However, there was no evidence to suggest that the three provincial protected area committees were meeting regularly, or that they were using the senior management team monthly reports or the district working group technical reports. Their working relationship with the National Protected Area Steering Committee still seemed to be embryonic. Hence there were no operating institutional platforms bringing together key provincial and district representatives to supervise the implementation of the Annual Work Plan and Budget on a regular basis. Ideally, a provincial and district management body designated in each province could (i) supervise the national park human resource issues; (ii) supervise and strengthen the collaborative management partnerships between stakeholders; (iii) provide regular financial oversight over annual work plans and budgets, and (iv) respond to emerging issues, among others.

Monthly meeting chaired by the Director of the National Park © Ben Swanepoel, WCS

(iv) Nam Et-Phou Louey National Protected Area Steering Committee

The current Nam Et-Phou Louey National Protected Area Steering Committee was established in December 2017 (Department of Forestry, 2017) for supervising the management of the entire protected area. The Steering Committee met only once a year, having responsibilities to respond to numerous ongoing management issues occurring over the 400,000-ha protected area landscape. The effectiveness of this Steering Committee was dependent upon the succinct information sets that it received from the field level. Hence, its effectiveness will be strengthened through delegating management responsibilities to the field-based forums operating at the provincial and district level. Of relevance, the three provinces individually formulated agreements on the appointment of the supervisory committee and sub-committee for the management of Nam Et-Phou Louey National Park in 2019 (see No. 802/G.HP. dated 7 July 2019, Governor Decision of Houaphanh Province, 2019), but it was unclear what role these institutional bodies would play, when they meet and whether they institutionally support the Management Office or the Supervisory Committee.

(v) Issue-specific task forces or working groups

An Advisory Committee was established for supervising the management of the Phati Road immigration and settlement problem in 2020. This was a specific working group established to deal with an emerging issue and prominent threat to the national park. The Governor of Houaphanh Province (2020b) approved an Agreement No. 411/G.HP. for establishing an "Advisory Committee and Secretariat for the resolution of land speculation linked to cattle raising and livestock within Nam Et-Phou Louey Total Protection Zone (Phati Road), dated 7th May 2020". The committee "was directed to monitor the Phati Road settlement involving four villages". From field surveys conducted in 2018 and village interviews in 2019, the Nam Et-Phou Louey National Park Management Office recorded 172 families from the villages of Ban Xone Neua, Ban Najak, and Ban Huay Muey in Xone District and Ban Huay Ma in Xam Neua District to be raising livestock inside the Total Protection Zone. These families were reported to be raising 1,194 cattle, 577 buffalos, 225 goats and 16 horses in the Total Protection Zone along the road. From field surveys employing a quadcopter drone and unannounced 'field-house' visits in 2018, 30 livestock field-houses were recorded. A field-house was counted as a single structure or a cluster of structures for part-time human habitation for the sake of looking after livestock.

Monthly management team meetings and reporting, including financial matters

The Senior Management Team of the national park constituted one of the most important institutional bodies within the collaborative management system of the national park. It comprised the Director, the two Deputy Directors, the Head of Administration, the Heads of the five Technical Sub-units and a representative from the Hiem District Administration. This team of expert

Table 1: Some indicative relationships between the multi-tiered technical and administrative institutional bodies, some key verification documents and the indicative hierarchy of timing of meetings and reports

Technical groups	Blended technical and administrative working groups	Some indicative verification reports	Indicative hierarchy on timing of meetings and reports
-	Interprovincial Protected Area Committee	Annual reports	Annually
-	Provincial Protected Area Committee	Quarterly protected area reports	Quarterly
-	Issue-specific Working Group	Special issue reports	Quarterly or monthly
Senior park management team	-	Park management monthly report	Monthly
-	District Working Groups	SMART field reports Village land use plans Conservation agreements	Monthly
-	Village Administrations	Village meetings and reports	Monthly or more frequently

protected area practitioners convened monthly staff meetings on a regular basis to guide adaptive management of the site. For example, four meetings were convened between September 2022 and December 2022. The Minutes of Meetings of these monthly meetings summarised the activities undertaken as well as the emerging management issues, and could be considered verification documents for park management. The monthly reports did not mention 'Action Points'. Furthermore, the financial staff were segregated from these monthly staff meetings. Separate meetings were convened between the Park Director and the financial sub-unit personnel on monetary matters.

DISCUSSION

The significance of generating verification documents to ensure collaborative management and facilitate effective decision-making

The use of the 16 indicators on 'Good Governance' within the IUCN Green List Standard broke down the multi-tiered institutional arrangements within Nam Et-Phou Louey National Park into the 'bite-sized' institutional bodies found within the different administrative levels and with management mandates (Parr et al., 2023). Equally significantly, the IUCN Green List methodology then required verification that these institutional bodies were functional. The gap analysis assessment methodology revealed that the multi-tiered collaborative management system was dependent upon key datasets – in the form of verification documents – to become functional and effective. Foremost amongst these key verification documents was the national park monthly report, generated from the monthly meetings of the senior park management team. Nam Et-Phou Louey National Park generated a reasonable monthly report. It may be fair to say that the 'monthly report' carries as much weight in directing management in developing countries as the five-year management plan.

Other key verification documents which assisted management decision-making comprised the reports generated by the district working groups. These technical verification documents comprised camera trapping reports, monthly enforcement summaries, village land use plans, village conservation agreements, among others. These key verification documents needed to be distributed to representatives within higher administrative levels within the multi-tiered collaborative management system. However, the assessment found no evidence that this structured distribution was taking place, or being monitored. Undoubtedly, these documents could strengthen district, provincial, interprovincial and national support for the national park and the resolution of management issues, and for financial sustainability. Borrini-Feyerabend and Hill (2015) stated that governance analysis should deal with who makes decisions and how, but also with how actors and decisions connect and relate with other actors and decisions in society.

Salafsky et al. (2019) refer to the growing interest in evidence-based conservation, with a slant towards project application. Evidence-based conservation should also be promoted in the good governance of national parks and the management of natural resources, by the concerned civil society, rights-holders and stakeholders themselves. The good governance stakeholders need to introduce evaluation methodologies to confirm, or dispute, the validity of the content of these verification

documents. Ultimately, if conservation as a discipline is going to become more evidence-based, then we collectively need to improve how evidence is generated, accessed and ultimately used by practitioners along a shared theory of change. Within the Green List Standard indicators, these key verification documents are often referred to as 'mechanisms'.

Village level organisations

The Village Administrations held regular meetings on natural resource issues. However, these issues were rarely reported to the National Protected Area Management Office. Most village representatives prepare notes of village meetings in their personal notebooks. Most frequently, important village issues relating to national park management were captured in documents and reports prepared by the district working groups.

District working groups as work-horses for implementing field-based collaborative management

In Nam Et-Phou Louey National Park, the gap analysis assessment revealed that district working groups were significant 'work-horses' in delivering the field programmes. These district working groups comprised the national park staff from the different technical sub-units from the National Park Management Office formally teaming up with district counterparts who shared overlapping professional mandates. These working groups had all been provided with technical assistance to strengthen their respective capacities. Moreover, virtually all these working groups were formally designated through local administration legislation. Within Nakai-Nam Theun National Park, district 'technical teams' were also identified as the work-horses for the delivery of the field programmes (Parr & Sylavong, 2022). District agreements have been formulated between the Nakai-Nam Theun National Park Office and the concerned districts on village land use planning, outreach, and livelihood development for conservation and tourism. There were also district agreements for some aspects of interagency law enforcement, including the District-Wildlife Enforcement Networks.

The establishment and functioning of district technical teams in other protected areas within Lao PDR are scarce. One major constraining factor is the absence of established Management Offices. For example, Hin Nam No National Park only established a Management Office in 2021; prior to this they only had a few permanent staff (Department of Forestry, 2022). The park established three technical teams/technical working groups on tourism, biodiversity/law enforcement, and outreach and awareness raising in 2019. Consequently, the chairs of these district working groups comprised the Head of the District Information and Culture and Tourism (office) for the tourism programme, the Head of the District Agriculture and Forestry Office for law enforcement and the Head of the Lao National Front for Construction for the outreach programme. This suggests that the district counterparts may have received higher levels of training and work experience, and thus had higher capacities compared to the national park staff, who are supposed to be the leading expertise for implementing the national park field programmes.

The creation of district working groups has several critical benefits. These working bodies increase the number of personnel, permit capacity building and mentoring by skilled national park staff. More pertinently, it permits budget sharing by engaged district administrations, and increases conservation impacts in the respective field programmes. The mechanism goes a long way towards socialising protected areas within the broader protected area landscape. Some examples of protected area management working groups operating in mainland Southeast Asia were described by Parr et al. (2013). However, the groups described were from different administrative levels.

Empowering (provincial and interprovincial) protected area committees

The assessment found inconclusive evidence that the three provincial protected area committees were functioning effectively, or even convening regular meetings. This could have been a consequence of requiring instructions from higher authorities as to when to convene meetings, capacity limitations, funding limitations, among others. Many protected area committees have been established within the protected area system within Lao PDR, as well as more broadly within Southeast Asia. While there seems to be a focus on the membership of these committees, and the number of meetings to be convened by a committee during the course of a year, there appears to be little consideration on the volume of information to be deliberated over. These datasets may also guide which government agencies are best placed to implement the follow-up actions.

Merits of establishing dedicated task forces to tackle serious emerging management issues

The concept of establishing dedicated working committees within a national park to tackle specific emerging major threats to the integrity of the reserve, seems a highly efficient form of delegating responsibilities and workloads amongst the stakeholders.

Village engagement © Ben Swanepoel, WCS

The Governor of Houaphanh Province established an Advisory Committee to resolve land speculation linked to cattle and livestock raising along the Phati Road in May 2020. (involving some 400 households) (Governor of Houaphanh Province, 2020). During the discussions with the national park director, the merits of establishing a district level law enforcement working group and district-level socio-economic working group under this task force were being debated. These dedicated task forces were established elsewhere in the protected area system within Lao PDR. In Nakai-Nam Theun National Park a dedicated committee was established to monitor gold-mining activities in four villages in Khamkeut District, Bolikhamxay Province in May 2021 (Governor Decision of Bolikhamxay Province, (2021).

The working committees should be established to respond to particular issues that require dedicated management attention. These working committees should be established, organise meetings and be dismantled, according to management demands. In the Philippines, a Cultural and Tribal Affairs Committee was established in Mount Kitanglad Range Natural Park to evaluate and review (i) ancestral domain and land claims within the reserve; (ii) tenurial instrument issues related to the members of the Indigenous Cultural Communities and the tenured migrants; (iii) cultural and tribal conflicts settlements; and (iv) the tribal cultural values programme (Parr, 2017). The committee then made recommendations for Protected Area Management Board (PAMB) Executive Committee action. A Tenured Migrant Committee was established to address management issues and concerns of the duly registered tenured migrants within the protected area. The committee also endorsed/recommended whether a tenured migrant community will be issued with a tenurial instrument, depending on the validity and qualifications.

Technical assistance on strengthening governance mechanisms

The tiered management arrangements within Nam Et-Phou Louey National Park constitute a highly complicated collaborative management system comprising the senior park management team, several tiers of blended technical and administrative stakeholders, as well as issue-specific working groups. The capacity of the members of the collaborative management system would benefit from dedicated technical support and monitoring to attain good governance. Currently, this is one of the most poorly understood aspects of collaborative management in Lao PDR, and one of the most important components in the Green List methodology.

CONCLUSIONS

Component 1 on 'Good Governance' in the IUCN Green List, comprising the three Criteria and 16 Indicators, was particularly valuable. The indicators assisted in identifying the institutional bodies within the multi-tiered collaborative management system within Nam Et-Phou Louey National Park as well as the verification documents required for information exchange to render the system more effective.

The importance of the verification documents was identified as critical for information exchange between the different institutional bodies within the multi-tiered collaborative management arrangements. Notable documents comprised the monthly reports prepared by the senior park management team, as well as the technical reports prepared by the district working groups (e.g. law enforcement reports, village land use plans, and conservation agreements). Without these reports, the higher-level institutional bodies had no information sets from which to make informed management decisions. Often, conservationists refer to natural resource management committees as dysfunctional; the need for analysing the use of critical verification documents may be part of the answer.

District working groups seemed particularly valuable institutional bodies for delivering the field programmes. They have the advantage of being a strong body of personnel with capacity for delivering sustainable field programmes.

The mandates of the Provincial Protected Area Committees established in Lao PDR should be reviewed in relation to the monthly report, and anticipated verification documents. These responsibilities might include supervision of: (i) the national park human resources issues; (ii) strengthening the collaborative management partnerships between stakeholders; (iii) providing regular financial oversight of the annual work plans and budgets, and (iv) respond to emerging issues, among others.

The merits of establishing issue-specific working groups for tackling emerging threats was also recognised. These ad-hoc working groups should be mobilised for tackling serious management issues and major threat issues like population growth, uncontrolled encroachment or tackling influential persons.

There appeared to be a hierarchy in the general timing of meetings, corresponding to the pyramid of management responsibilities, and information needs.

The hierarchy of institutional bodies – from village level up to national level – should be expected to be present in most other areas of natural resource management,

School outreach conducted by district working group
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including community forestry, community wetland management, coastal resources management as well as other conservation topics such as illegal wildlife trade. The identification of the verification documents should be identified for these natural resource management issues which feed the respective multi-tiered management systems (if appropriate). Clearly further research on good governance is required.

RECOMMENDATIONS

The Gap Analysis Assessments conducted for all Green List sites should be reviewed within the region, in order to compare the multi-tiered institutional arrangements prescribed in a selection of protected areas. It would be further beneficial to identify the highest priority verification documents which would assist protected area management in developing countries.

The format for the national park monthly reports within the region/developing countries should be reviewed, strengthened and then formally endorsed.

The functioning of protected area committees within the region/developing countries should be monitored in relation to priority verification documents, and particularly the monthly reports for the protected areas.

The merits of establishing and maintaining district technical working groups and issue based working groups to tackle serious emerging threats should be encouraged and evaluated.

Technical support on strengthening good governance in the national parks and other reserves would consolidate understanding on the institutional bodies and the information exchanged between them. This topic is one of the most poorly understood aspects of collaborative management in Southeast Asia.

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SUPPLEMENTARY ONLINE MATERIAL

Supplementary Online Material 1. 14 generic indicators prescribed to assess good governance.

Supplementary Online Material 2. Important technical village documents at the district level.

Supplementary Online Material 3. Indicators on governance.

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RESUMEN

En el Sudeste Asiático, el sistema de gestión colaborativa dentro de las áreas protegidas gestionadas por los gobiernos es uno de los campos de la gestión de áreas protegidas que menos se conocen. La gran escala de estos paisajes naturales, la diversidad de cuestiones de gestión que se encuentran en ellos y la diversidad de actores que deben participar en los diferentes niveles administrativos hacen que los mecanismos para aplicar una gestión colaborativa eficaz sean poco claros. En diciembre de 2022, los autores utilizaron el Estándar de la Lista Verde de Áreas Protegidas y Conservadas de la UICN (Estándar de la Lista Verde de la UICN), que comprende un conjunto de 17 «Criterios» clasificados en cuatro «Componentes», acompañados de 50 «Indicadores», para llevar a cabo una evaluación de análisis de deficiencias en el Parque Nacional de Nam Et-Phou Louey, al norte de la RDP Lao. El presente documento examina las conclusiones generadas, centrándose en la «Buena Gobernanza» dentro del Componente 1, que comprende tres criterios y 16 indicadores, centrados en cómo se movilizan estos actores para ayudar a la gestión del parque nacional. La aplicación de los 16 indicadores desglosó las múltiples estructuras institucionales del Parque Nacional de Nam Et-Phou Louey en órganos institucionales con mandatos de gestión en los distintos niveles administrativos y, a continuación, solicitó documentación de verificación para demostrar que estos órganos institucionales funcionaban. El documento describe estos organismos institucionales identificados dentro del sistema de gestión colaborativa a varios niveles del parque nacional, así como la importancia de los documentos de verificación intercambiados entre ellos.

RÉSUMÉ

En Asie du Sud-Est, le système de gestion collaborative au sein des zones protégées gérées par le gouvernement est l'un des domaines les moins bien compris de la gestion des zones protégées. La grande échelle de ces paysages naturels, la diversité des questions de gestion qui s'y posent et la diversité des acteurs à impliquer aux différents niveaux administratifs rendent les mécanismes de mise en œuvre d'une gestion collaborative efficace peu clairs. En décembre 2022, les auteurs ont utilisé la Norme de la Liste verte des aires protégées et conservées de l'UICN (Norme de la Liste verte de l'UICN), qui comprend un ensemble de 17 « Critères » classés en quatre « Composantes », accompagnés de 50 « Indicateurs », pour mener une analyse des lacunes dans le Parc national de Nam Et-Phou Louey, dans le nord de la RDP Lao. Ce document passe en revue les résultats obtenus, en se concentrant sur la « bonne gouvernance » dans le cadre de la composante 1, qui comprend trois critères et 16 indicateurs, en se concentrant sur la façon dont ces acteurs sont mobilisés pour aider à la gestion du parc national. L'application des 16 indicateurs a permis de décomposer les dispositions institutionnelles à plusieurs niveaux au sein du parc national de Nam Et-Phou Louey en organes institutionnels de taille réduite ayant des mandats de gestion aux différents niveaux administratifs, puis de demander des documents de vérification pour montrer que ces organes institutionnels étaient fonctionnels. Le document décrit ces organismes institutionnels identifiés dans le système de gestion collaborative à plusieurs niveaux du parc national, ainsi que l'importance des documents de vérification échangés entre eux.

SHORT COMMUNICATION

ENHANCING ENVIRONMENTAL CONSERVATION THROUGH GUIDED TOUR BUSES: INSIGHTS FROM TAIJIANG NATIONAL PARK

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ABSTRACT

High visitor numbers in protected areas can create traffic problems that impact on the environmental protection. In Taijiang National Park, a tour bus project 'Taijiang Fun Tour' was introduced to mitigate various environmental problems caused by private cars. This study evaluates the project's environmental benefits, and those of the various bus routes in the park, in reducing CO_2 emissions. The Mangrove route only achieved a CO_2 reduction in 2023, likely due to post-COVID-19 tourism recovery. In contrast, the Black-faced Spoonbill route consistently showed reductions in CO2 emissions, attributed to higher per trip passenger numbers replacing more private cars, better road conditions, and longer distances between attractions, that enabled higher bus speeds and lower CO_2 emissions per unit time. While it is unsurprising that CO_2 reduction is significantly influenced by passenger numbers and bus speeds, the results of this study could be used by TJNP to enhance the benefits from bus use. Starting in 2024, TJNP will optimise routes and implement additional measures to encourage low-carbon transportation.

Keywords: sustainable tourism, transportation management, alternative transportation options, visitor impact mitigation, CO_2 reduction

INTRODUCTION

Private cars provide flexibility and convenience, allowing visitors to travel at their own pace and access remote areas. However, they also lead to significant traffic congestion, parking issues and increased carbon dioxide emissions (Monz et al., 2016; Newton et al., 2020). These adverse effects are especially problematic in protected areas such as Taijiang National Park (TJNP) in Taiwan, where preserving the environment is essential for maintaining its wetland ecosystem and cultural heritage. Reducing carbon dioxide emissions in national parks can contribute to mitigating climate change impacts and protecting natural and cultural resources (Gonzalez, 2020). In this context, buses, including route buses, shuttle buses and tour buses, offer numerous advantages over private cars. They help reduce traffic congestion, reduce emissions and can be more energy-efficient (Anderson et al., 2015; Ko & Song, 2019). Buses following fixed routes can manage visitor flow and minimise habitat disturbance (Lawson et al., 2011). Additionally, tour buses enhance the visitor experience by providing guided tours, educating visitors about the park's natural and cultural resources (Pettengill et al., 2012).

However, replacing private cars with buses does not resolve all environmental and management issues. Buses can bring large groups of visitors at once, potentially causing ecological and social impacts due to sudden spikes in visitor numbers (Monz et al., 2016). Consequently, route buses that do not control where and when visitors get on and off might not be the best solution for national parks or other protected areas. Shuttle buses can effectively replace private cars by reducing traffic congestion and emissions (Lawson et al., 2011; Pettengill et al., 2012). However, the TJNP headquarters prefers to actively share conservation messages and outcomes during visitor visits, which may not be as easily achieved with simple shuttle buses. To address this, the guided tour bus project 'Taijiang Fun Tour' was launched in 2020, aiming not only to mitigate traffic and emissions but also to augment visitor

education on conservation efforts. This initiative aims to enhance the visitor experience through efficient transportation and educational tours, promoting sustainable tourism and conservation efforts within the park. By highlighting the reduced stress from driving and parking, enhanced sightseeing opportunities, and the availability of knowledgeable tour guides (Collum & Daigle, 2015; Newton et al., 2020), the project can attract more visitors to use the bus service (Ko & Song, 2019). Additionally, well-planned itineraries can save time and effort for visitors interested in exploring the park's mangrove and bird habitats. This study focuses on the project's environmental function, specifically the reduction of carbon dioxide emissions during its operation. This now includes tour bus emissions in TJNP's current carbon accounting but also forms part of the ecosystem services inventory, essential for garnering social support and encouraging public participation in climate change adaptation efforts.

MATERIALS AND METHODS

Site description

Taijiang National Park (TJNP), located on the southwestern coast of Taiwan (Figure 1), spans 40,731.31 hectares, including 5,090.21 hectares of land and 35,641.10 hectares of marine area (TJNP Headquarters, 2017). This park preserves a unique wetland ecosystem, featuring Chigu Lagoon, fishponds, mangrove forests, salt marshes and mudflats. Historically, the region's early ports and waterways facilitated international trade, remnants of which still exist. Coastal communities traditionally engaged in fishing and sea salt harvesting, an important part of the region's heritage. TJNP supports vital ecosystems, including habitats for the endangered Black-faced Spoonbill (*Platalea minor*). Conservation efforts have garnered significant attention, and the park promotes public involvement through tours and environmental education activities. Despite a network of meandering roads, the park lacks comprehensive public transportation, leading visitors to rely on private vehicles, causing traffic congestion and parking issues during peak times. Effective management strategies are needed to mitigate these impacts.

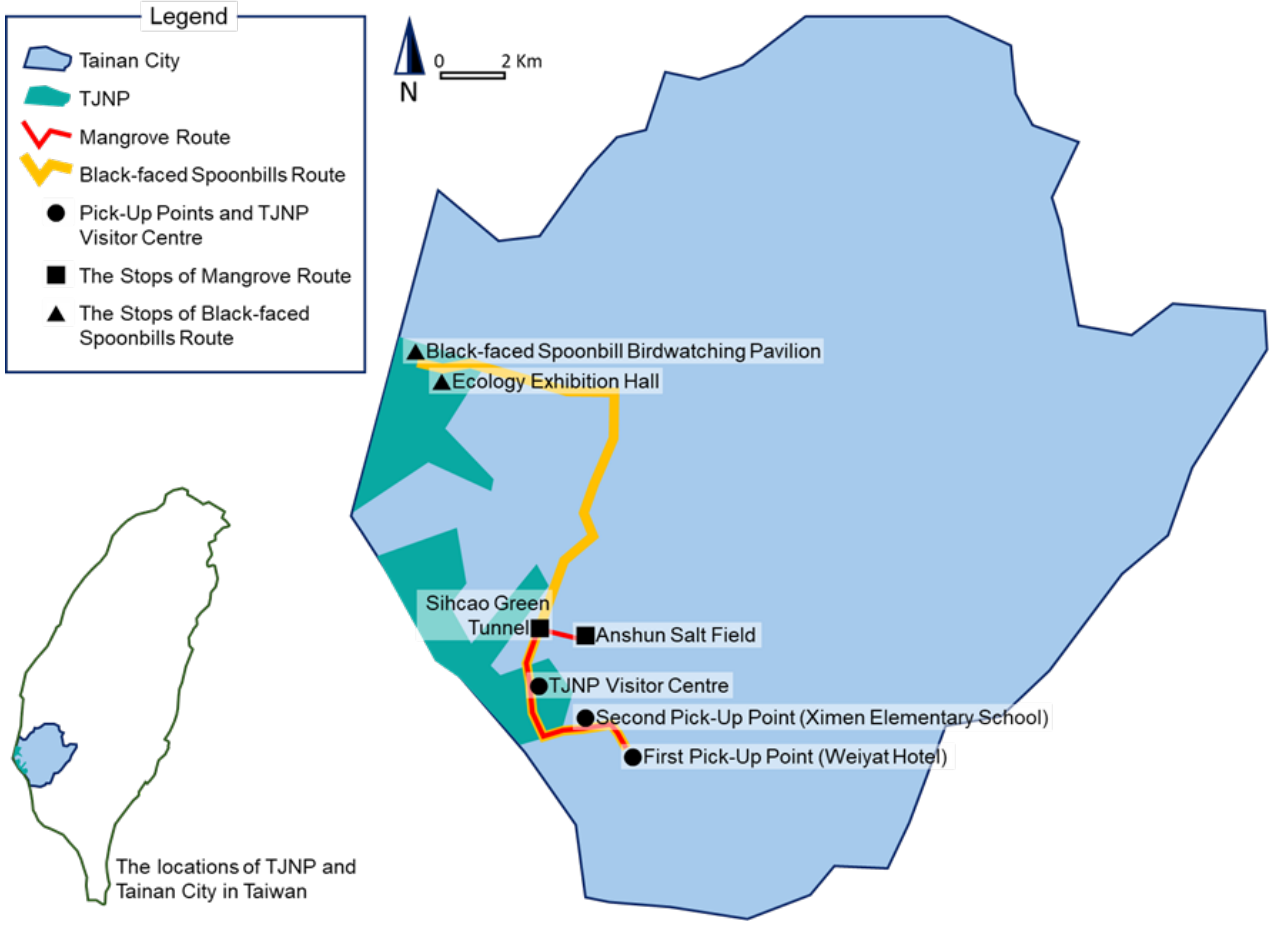


Figure 1. Location of TJNP and Taijiang Fun Tour routes

Taijiang Fun Tour Visitors at Anshun Salt Field © Taijiang National Park

Taijiang Fun Tour project

To mitigate the impact of private cars, TJNP launched the Taijiang Fun Tour bus project. The service features the Black-faced Spoonbill route in autumn and winter, and the Mangrove route in spring and summer (Figure 1). Dedicated tour guides enhance the visitor experience. Buses operate on selected weekends, with two departures daily from a hotel near TJNP, offering four-hour tours. Initially planned to start in early 2020, the service adapted to COVID-19 by starting the Mangrove route in May 2020, reducing capacity to 20 passengers per bus, with assigned seating, enhanced sanitation and contingency plans. Despite restrictions, demand was high and feedback was positive. From 2023, operations stabilised, and passenger limits were lifted. The Mangrove route proceeds to Anshun Salt Field, followed by a boat trip through Sihcao Green Tunnel, and ends at the TJNP Visitor Centre. The Black-faced Spoonbill route goes to the Birdwatching Pavilion, the Ecology Exhibition Hall, and ends at the Visitor Centre. In 2023, the Ecology Exhibition Hall was under renovation, extending the stay at the birdwatching pavilion. Actual operation conditions were adjusted according to weather and the availability of attractions and this study's analysis is based on normal operational conditions.

Data collection and analysis

Data collection included recording the number of trips, visitor numbers, and the estimated reduction in car trips and CO_2 emissions from the tour bus operation. The study analysed data from the Mangrove and Black-faced Spoonbill routes over different years. For details on the data collection methods and specific calculations, see Supplementary Online Material 1 to 3. Distances were calculated using Google Maps to determine routes for both the bus and private cars. Travel times for the bus were based on typical operating conditions, while times for private cars were derived from Google Maps (2024). Average speed was calculated by dividing travel distance by travel time, influenced by road conditions, traffic and parking access. CO_2 emissions during idling were calculated using reasonable waiting times for boarding and alighting. Emissions reductions were based on the average number of passengers per bus and the corresponding decrease in private car use. The 2019 Traffic Construction Project Economic Benefit Evaluation Manual (2021 updated version) by the Institute of Transportation, Ministry of Transportation and Communications, Taiwan (2021), was used as a reference. This manual provides tables for CO_2 emissions calculated by distance (g/km) and time (g/s). The time-based calculation method was adopted to account for emissions during idling.

Table 1. Summary of Taijiang Fun Tour route operations and CO_2 emission comparisons (2020–2023)

Route	Year	Number of Trips	Number of Passengers	CO_2 Emission Reduction (kg)	Ratio of Bus to Car CO_2 Emissions
Mangrove Route	2020	46	742	-222.25	115.87%
	2021	14	157	-197.57	166.67%
	2022	52	246	-1,370.28	395.07%
	2023	36	1155	910.23	58.25%
Black-faced Spoonbill Route	2020	12	243	222.95	67.76%
	2021	72	1274	814.10	77.55%
	2022	48	607	-146.89	108.50%
	2023	30	671	645.31	63.11%

RESULTS

Route operations and carbon dioxide emissions analysis

The Taijiang Fun Tour's Mangrove and Black-faced Spoonbill routes have specific stops detailed in Supplementary Online Materials. For example, the Mangrove route includes a 10-minute stop at the first pick-up point, followed by a 2.4-km drive to the second pick-up point, then a 6.5-km drive to Anshun Salt Field. Emissions during idling were calculated using the dynamic CO_2 emission coefficient of 2.139 g/s, leading to an idling emission of 3,209 g. The driving emissions for the Mangrove route were calculated using a coefficient of 7.6496 g/s for speeds around 14 km/h, totalling 32,074 g. The combined emissions for the Mangrove route were approximately 35,282 g, compared to 5,663 g for a private car. The Black-faced Spoonbill route, depending on the years, emitted approximately 39,048 g (2020–2022) and 36,804 g (2023), compared to 8,537 g and 7,822 g for a private car.

Comparison between Taijiang Fun Tour and private cars

The overall CO_2 emissions for the bus routes and private cars were compared to determine the effectiveness of the guided bus tours. Table 1 summarises the operations and CO_2 emission comparisons for the Taijiang Fun Tour routes from 2020 to 2023. The Mangrove route, for example, replaced an estimated 247.33 car trips in 2020, resulting in a total CO_2 emission of 1,622.98 kg for the bus compared to 1,400.73 kg for private cars, showing a higher emission for the bus. In 2023, however, the Mangrove route replaced 385 car trips, reducing emissions by 910.23 kg, with the bus emitting only 58.25 per cent of the CO_2 compared to private cars. The Black-faced Spoonbill route generally showed better CO_2reduction, with bus emissions being about 60–70 per cent of those from private cars in 2020, 2021 and 2023, although in 2022, the bus emissions slightly exceeded those of the private cars.

DISCUSSION

The results of this study highlight the varying effectiveness of the Taijiang Fun Tour routes in reducing carbon dioxide emissions. In Table 1, analysis showed that the Mangrove route achieved CO_2 reduction only in 2023, likely due to the post-COVID-19 tourism recovery which increased passenger numbers. On the other hand, the Black-faced Spoonbill route consistently demonstrated better CO2 reduction across multiple years. This improvement is attributed to higher per-trip passenger numbers, which effectively replaced more private cars, as well as the longer distances between attractions and better road conditions allowing for higher bus speeds and lower CO_2 emissions per unit time. The influence of passenger numbers and bus speeds on CO_2 reduction aligns with the evaluation method used in this study, indicating that optimising these factors could further enhance the environmental benefits of the tour bus project.

Firstly, the Taijiang Fun Tour's ability to reduce carbon dioxide emissions depends heavily on careful route planning and the strategic placement of pick-up and drop-off points. Ensuring that a significant portion of the journey occurs on faster segments of the route is crucial. Starting from 2024, moving the starting points of the half-day Mangrove and Black-faced Spoonbill routes to Tainan Railway Station and planning the routes to prioritise travel on less congested, wider roads will help maintain a consistent speed. Although buses will still stop at secondary pick-up points if there are reservations, the overall route will be optimised to ensure faster segments make up a significant portion of the journey. This adjustment is expected to enhance the overall emissions reduction effect. Continuous monitoring and analysis of passenger numbers and trip data will be necessary to evaluate the environmental benefits accurately.

Traditional salt-making tools at Anshun salt field © Taijiang National Park

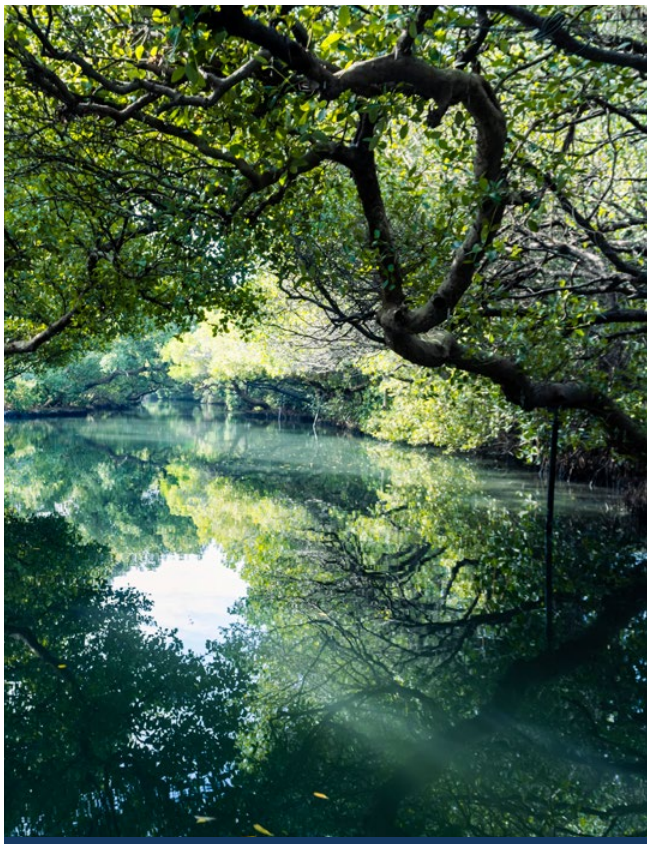
Secondly, visitor satisfaction is a critical component of the project's success. The Taijiang Fun Tour not only aims to reduce emissions but also to promote TJNP's conservation goals. Providing a high-quality visitor experience through well-managed itineraries, professional explanations of attractions, and engaging activities such as birdwatching and sea salt harvesting is essential. These experiences offer educational value and enjoyment that are not attainable through self-driving tours, thus encouraging more visitors to opt for the bus service. By focusing on both environmental benefits and visitor satisfaction, the project can achieve its dual goals more effectively.

Thirdly, the effectiveness of bus services in reducing carbon emissions can be enhanced by integrating additional measures. At TJNP, the 2024 adjustment of pick-up points aims to make it more convenient for visitors arriving by train to directly access the bus service. The nearby availability of public bicycles, shared electric scooters and hotel-provided bicycles allows visitors to seamlessly connect with the Taijiang Fun Tour. Other measures such as replacing fuel-powered buses with electric ones, providing priority bus lanes or giving buses priority over private cars in the park, and improving infrastructure for pedestrians and bicycles are essential strategies. As indicated by the results in Table 1, in certain years the bus routes did not achieve CO_2 reductions, such as in 2020 and 2021 for the Mangrove route. By adopting these additional measures, it is possible to mitigate such inconsistencies and enhance the overall environmental benefits. Protected areas in different regions can adopt similar tailored solutions to offer visitors more comprehensive transportation alternatives.

Moreover, diversifying recreational activities can further enhance sustainable transportation in parks. Increasing the variety of tour bus itineraries, such as integrating bus trips with small boat journeys or offering options for human-powered vessels like kayaks and paddleboards, can enrich the visitor experience and reduce reliance on traditional motorised transport. This holistic approach balances visitor experience with diverse transportation options, catering to different visitor preferences while reinforcing the intrinsic value of protected areas.

CONCLUSION

Future guided tour bus projects in TJNP and other protected areas can enhance their effectiveness by incorporating comprehensive route planning, strategically positioning pick-up and drop-off points, and integrating sustainable transportation options such as electric buses and public bicycle systems. These initiatives not only reduce carbon emissions but also provide broader environmental benefits,



Sihcao Green Tunnel © Taijiang National Park

Bird watching pavilion © Taijiang National Park

such as improving air quality in the park, minimising habitat disturbance and improving visitor flow management. To maximise outcomes, recreational activities aligned with conservation goals should be included, promoting eco-friendly transportation while enriching visitor experiences. Additionally, these projects present opportunities to enhance conservation education and cultural engagement, fostering stronger connections between visitors, local communities and the environment.

Future research could explore differences in visitor experiences between guided bus tour users and private car users, helping park authorities prioritise actions and allocate resources for long-term sustainability. While challenges such as funding limitations or infrastructure upgrades may arise, they also provide opportunities for innovation in sustainable transportation. Furthermore, investigating the economic benefits for local communities and businesses, along with reductions in environmental pressures like noise and parking, would strengthen conservation partnerships. The insights from TJNP offer valuable lessons that can be adapted to other protected areas globally, providing a model for achieving environmental, social and economic sustainability.

ACKNOWLEDGEMENTS

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SUPPLEMENTARY ONLINE MATERIAL

Supplementary Online Material 1. Taijiang Fun Tour Mangrove route analysis and dynamic CO_2 emission estimation (2020–2023).

Supplementary Online Material 2. Taijiang Fun Tour Black-faced Spoonbill route analysis and dynamic CO_2 emission estimation (2020–2022).

Supplementary Online Material 3. Taijiang Fun Tour Black-faced Spoonbill route analysis and dynamic CO_2 emission estimation (2023).

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RESUMEN

El elevado número de visitantes en las zonas protegidas puede crear problemas de tráfico que repercuten en la protección del medio ambiente. En el Parque Nacional de Taijiang se introdujo el proyecto de autobús turístico «Taijiang Fun Tour» para mitigar diversos problemas ambientales causados por los coches particulares. Este estudio evalúa los beneficios ambientales del proyecto, y los de las distintas rutas de autobús del parque, en la reducción de las emisiones de CO_2. La ruta del Manglar sólo consiguió reducir las emisiones de CO_2 en 2023, probablemente debido a la recuperación del turismo tras el COVID-19. Por el contrario, la ruta de la Espátula Carinegra mostró sistemáticamente reducciones en las emisiones de CO_2, atribuidas a un mayor número de pasajeros por viaje en sustitución de más coches privados, mejores condiciones de las carreteras y distancias más largas entre las atracciones, que permitieron mayores velocidades de los autobuses y menores emisiones de CO_2 por unidad de tiempo. Aunque no es sorprendente que la reducción de CO_2 se vea influida significativamente por el número de pasajeros y la velocidad de los autobuses, los resultados de este estudio podrían ser utilizados por TJNP para mejorar los beneficios del uso del autobús. A partir de 2024, TJNP optimizará las rutas y aplicará medidas adicionales para fomentar el transporte bajo en carbono.

RÉSUMÉ

Le nombre élevé de visiteurs dans les zones protégées peut créer des problèmes de circulation qui ont un impact sur la protection de l'environnement. Dans le parc national de Taijiang, un projet de bus touristique « Taijiang Fun Tour » a été mis en place pour atténuer les divers problèmes environnementaux causés par les voitures particulières. Cette étude évalue les avantages environnementaux du projet et ceux des différentes lignes de bus dans le parc, en termes de réduction des émissions de CO_2. La route de la mangrove n'a atteint une réduction de CO_2 qu'en 2023, probablement en raison de la reprise du tourisme après le projet COVID-19. En revanche, la ligne de la Spatule à face noire a constamment montré des réductions d'émissions de CO_2, attribuées à un plus grand nombre de passagers par voyage remplaçant plus de voitures privées, un meilleur état des routes, et des distances plus longues entre les attractions, qui ont permis des vitesses de bus plus élevées et des émissions de CO_2 plus faibles par unité de temps. S'il n'est pas surprenant que la réduction des émissions de CO_2 soit influencée de manière significative par le nombre de passagers et la vitesse des bus, les résultats de cette étude pourraient être utilisés par TJNP pour améliorer les avantages de l'utilisation des bus. À partir de 2024, TJNP optimisera les itinéraires et mettra en œuvre des mesures supplémentaires pour encourager les transports à faible émission de carbone.

LANDSCAPE APPROACHES FOR THE 30X30 TARGET: POTENTIAL APPLICATIONS AND PRACTICAL RECOMMENDATIONS

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ABSTRACT

Landscape approaches have been recognised as an effective solution for reconciling conservation and developmental demands at local scales. Though suitable in various contexts of human–nature interactions, their application is increasingly considered in relation to area-based conservation. Target 3 (30x30 Target) of the Kunming-Montreal Global Biodiversity Framework (KM-GBF) specifically calls for protected areas, other effective area-based conservation measures (OECMs) and Indigenous and traditional territories to be "integrated into wider landscapes and seascapes and the ocean". This short communication pursues three objectives. First, we suggest various area-based conservation settings where a landscape approach can be applied. Second, we discuss how characteristic features and strengths of landscape approaches can be leveraged to support Target 3. Lastly, we provide practical recommendations for enabling their effective operationalisation.

Keywords: area-based conservation, integrated approach, multifunctional land- and seascapes

LANDSCAPE APPROACHES TO AREA-BASED CONSERVATION

Post-2020 area-based conservation requires a new set of implementation tools (Bakarr, 2023; Gurney et al., 2023). There is a need for more people-centred approaches (engagement of Indigenous peoples and local communities (IPLC), emphasis on sustainable livelihoods and social equity), integrated strategies to tackle cross-sectoral challenges and their impacts (biodiversity conservation, climate change, food security and others), and participatory and inclusive processes with a clear monitoring of outcomes (Esmail et al., 2023; Neyret et al., 2023). A whole-of-system approach to conservation is also required to ensure supply of ecosystem functions and services as well as connectivity between multiple sites. In the context of forests and forestry, for example, a mosaic of protected areas and other managed lands may be needed to encompass a full range of ecosystem functions (Dudley et al., 2006).

Since the early 2010s, landscape approaches as integrative, adaptive and participatory strategies to address competing socio-economic and environmental objectives in the context of multifunctional land- and seascapes have been gaining prominence (Arts et al., 2017; Karimova & Lee, 2022; Reed et al., 2016). Though more commonly applied outside of protected and conserved areas (Nishi & Yamazaki, 2020), landscape approaches can also be leveraged to accommodate the socio-ecological complexity of area-based conservation. For example, Dudley (2024) highlights landscape approaches as one of the potent solutions for stemming biodiversity loss. Moreover, Target 3 (the 30x30 Target) of the Kunming-Montreal Global Biodiversity Framework (KM-GBF) stipulates the need for protected areas, other effective area-based conservation measures (OECMs) and Indigenous and traditional territories to be "integrated into wider landscapes and seascapes and the ocean" (CBD, 2022).

In this paper, we offer a framework for applying a landscape approach to area-based conservation. There are several questions that guide our commentary. First, where does a landscape approach fit in an area-based

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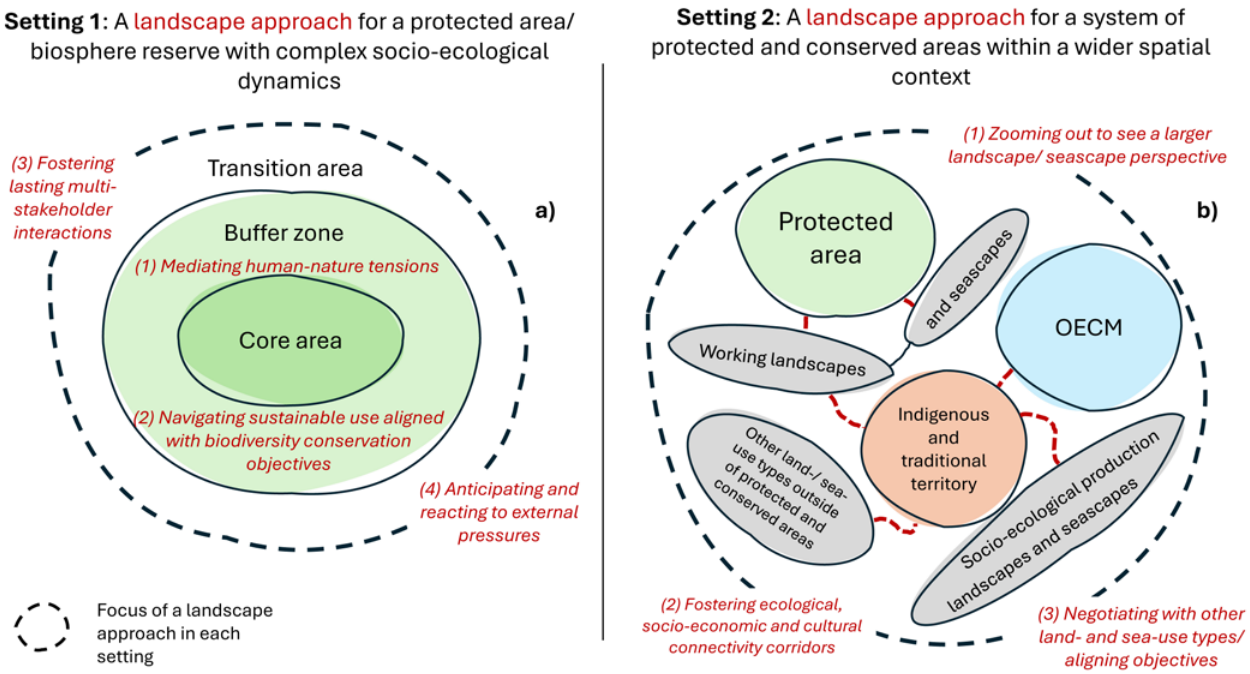

Figure 1. Examples of landscape approaches for various area-based conservation settings: (a) for a biosphere reserve or single protected area within a wider landscape; (b) for a system of protected and conserved areas within a wider landscape/seascape matrix

conservation context? Second, how can the strengths of landscape approaches be leveraged to support Target 3? Third, what should we be mindful of for their effective operationalisation? We use landscape approaches as an overarching term that refers to integrated landscape and seascape approaches and other synonymous concepts (Arts et al., 2017; Karimova & Lee, 2022; Reed et al., 2016).

LANDSCAPE APPROACHES IN AN AREA-BASED CONSERVATION CONTEXT

A landscape is a result of interactions between natural and cultural entities within a defined geographic space (Jones, 2003; Phillips, 1998). We thus view the notion of integration into "wider landscapes, seascapes and the ocean" (CBD, 2022) as not only addressing the ecological integrity, functionality and connectivity of protected and conserved areas with their surrounding lands and waters, but also as the need for inclusion of socio-economic and cultural components into integrated management of the sites. In other words, when looking at Target 3 through a landscape lens, what we see is a complex socio-ecological system that requires a holistic and balanced approach. This means that application of a landscape approach in an area-based conservation context can be useful in various types of settings, examples of which are shown in Figure 1.

As shown in the first setting, a landscape approach can address the need for integrated, adaptive and participatory management of protected areas and biosphere reserves with inherently complex socio-ecological dynamics (Figure 1a). A landscape approach to area-based conservation can help to (1) mediate human–nature tensions along the boundary of core areas and buffer zones (e.g. human–wildlife conflicts); (2) understand the root causes of unsustainable use activities (e.g. poaching of wildlife and illegal logging) and navigate sustainable use activities aligned with biodiversity conservation objectives (e.g. foraging for medicinal plants based on traditional ecological knowledge and community-based ecotourism); (3) foster and maintain ongoing and lasting multi-stakeholder interactions for the long-term management of a site, including mutual benefits for biodiversity and local livelihoods; and (4) predict and react to external pressures (e.g. cropland expansion or infrastructural developments) (Johnson, Karantha & Weinthala, 2018; Meng et al., 2023).

The second larger and more complex setting focuses on connectivity and multifunctionality of protected areas, OECMs and Indigenous and traditional territories within their wider landscapes and seascapes (Figure 1b). In this setting, a landscape approach can (1) ensure that the plan for a single site takes into account and integrates with the wider spatial setting (especially in the context of small-size protected and conserved areas); (2) foster ecological, socio-economic and cultural connectivity between stand-alone protected and conserved sites located in close proximity to each other (e.g. through sustainable production corridors or wildlife movement corridors);

Biodiversity conservation and sustainable use in a socio-ecological production landscape and seascape, Xinshe Village, Hualien County, Taiwan: a) eco-friendly cultivation of indigo plant (*Indigofera tinctoria*); b) community-based conservation of Gray-taek Crab (*Geothelphusa cinerea*) © Kuang-Chung Lee

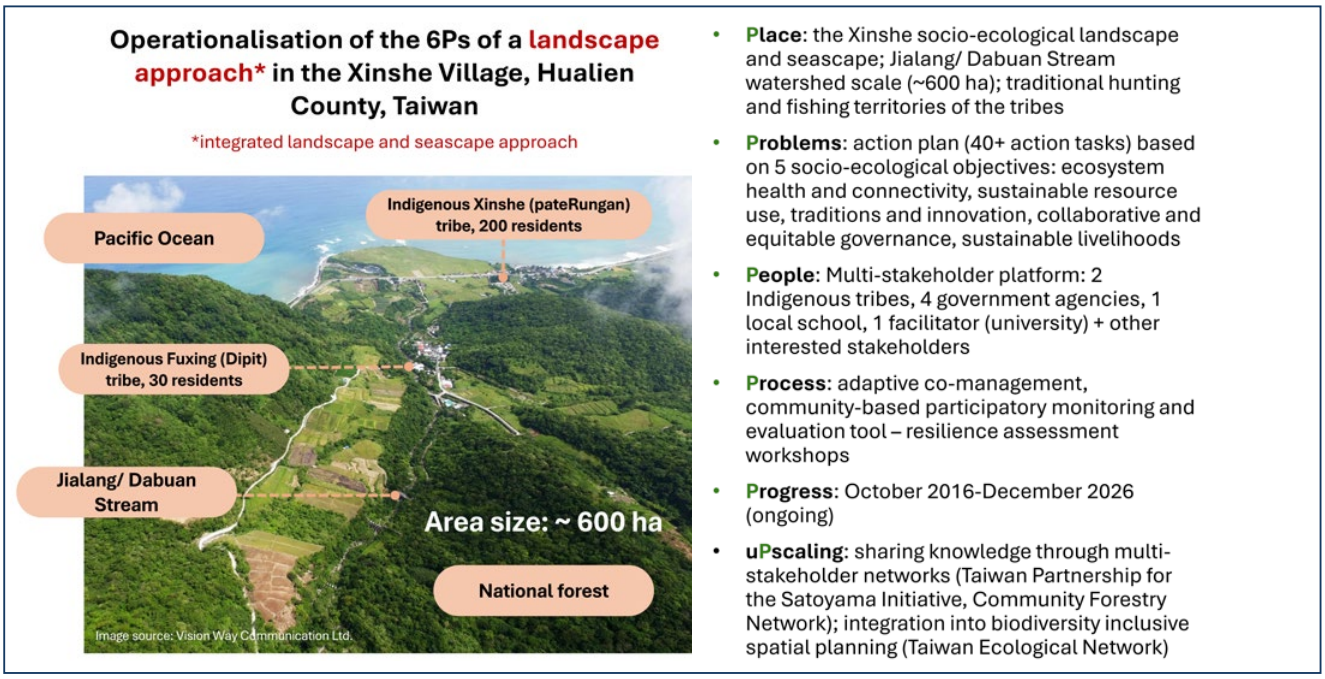

Figure 2. Example of the 6Ps operationalisation in the context of a socio-ecological production landscape and seascape in Xinshe Village, Hualien County, Taiwan.

and (3) negotiate and align biodiversity conservation and sustainable management objectives with other land- and sea-use types present in the area (e.g. working landscapes and seascapes, socio-ecological production landscapes and seascapes). Such a systems approach to conservation is also well aligned with Target 1 (spatial planning) and Target 2 (ecosystem restoration) of the KM-GBF (CBD, 2022).

With the understanding of where the landscape approaches can be applied and what they can help to achieve, we next look at how it can be done.

THE 6PS OF THE LANDSCAPE APPROACHES TO SUPPORT TARGET 3

Building on our practical experience in facilitating landscape approaches in socio-ecological production landscapes and seascapes in Taiwan and drawing on relevant literature (Minang et al., 2015; Sayer et al., 2013; Scheyvens et al., 2017; Suit et al., 2021), we outline six strategic domains (the 6Ps) for operationalisation of landscape approaches in area-based conservation: place, problems, people, process, progress and upscaling. We explain their relevance to Target 3 below and provide a case study illustration in Figure 2.

Place – *ecologically representative, multifunctional and well-connected*. Landscape approaches operate within specified geographic and geo-cultural boundaries, defined by one or more territorial markers: natural barriers, administrative boundaries, traditional territories, settlement patterns and others (Suit et al., 2021). As ecosystem-based approaches, they take account of the integrity, multifunctionality and interconnectedness of various ecosystem types within a landscape/seascape and interlinkages between them (e.g. forest, stream, farmlands and intertidal zone in Figure 2). This feature can support appropriate and context-sensitive zoning for a single protected and conserved area (Figure 1a) and biodiversity inclusive spatial planning across several sites (Figure 1b). Various relational and cultural values, such as ancestral memory and connection with lands and waters, also play an important role in shaping the sense of Place.

Problems – *sustainable use with conservation outcomes*. Landscape approaches aim to address complex nexus issues in an integrated way. Such issues may include biodiversity conservation, production activities (e.g. farming, aquaculture, agroforestry), income generating opportunities (tourism and market access), land and coastal development, disaster risk reduction, climate adaptation and others (Chen et al., 2023; Minang et al., 2015). Through various consultative and participatory processes (e.g. multi-stakeholder workshops), landscape approaches can help to identify existing problems and elicit priority tasks for collaborative action in different contexts in a timely manner (Figure 1).

People – *equitably governed*. Landscape approaches promote participatory and multi-stakeholder arrangements focused on social equity, negotiations and collaborative governance. They take into consideration the diversity of actors and their often-competing interests and agendas – IPLC, government, private companies, NGOs, academia and others. A skilfully facilitated multi-stakeholder platform is the main engine that powers a landscape approach (Karimova & Lee, 2022). Jointly developed action plans based on division of resources and responsibilities, including financial, institutional and human capital, guide operationalisation. Various area-based conservation settings can benefit from this people-centred approach.

Process – *effectively conserved and managed*. In addition to all other characteristics, a landscape approach is first and foremost an adaptive and collaborative management process of balancing trade-offs and synergies. It consists of planning, implementation, monitoring and evaluation, and adjustment stages. Landscape approaches use a variety of monitoring and evaluation tools, such as, for example, community-based assessment of socio-ecological resilience (Karimova, Yan & Lee, 2022; Lee et al., 2020). These experiences can be leveraged to support the social aspect of management effectiveness, embracing a diversity of values and knowledge types to ensure the emphasis on sustainable livelihoods and social equity in area-based conservation (Gurney et al., 2023).

Progress – *long-term conservation outcomes*. Landscape approaches are generally designed for

People-centred approach to issue identification and monitoring in a socio-ecological production landscape and seascape, Xinshe Village, Hualien County, Taiwan © Kuang-Chung Lee

Landscape approach as a part of biodiversity-inclusive spatial planning in Fengbin Township, Hualien County, Taiwan © Kuang-Chung Lee

medium (five to six years) to long-term (10 years and more) periods. This distinguishes them from short-term (two to three years) project-based interventions that are often dependent on external funding cycles. In the future, adaptive capacity and resilience to newly emerging challenges and opportunities will be crucial for achieving the long-term conservation outcomes of Target 3. Working alone or in combination with other relevant approaches to area-based conservation (e.g. Indigenous and community conserved areas, ICCA), a landscape approach can help to ensure these dynamic and adaptive qualities in various settings (Figure 1).

Upscaling – *integrated into wider landscapes, seascapes and the ocean*. As indicated in Target 3 and demonstrated in Figure 1 (b), various approaches to area-based conservation can (and should!) coexist within an interconnected system of wider landscapes and seascapes. The upscaling characteristic of landscape approaches can help to strategically position site conservation efforts within wider geographic and socio-ecological contexts. This may be accomplished by sharing knowledge within extended stakeholder networks and integration of site conservation efforts into biodiversity-inclusive spatial planning at regional and national scales (Figure 2). Other forms of scaling (out and deep) may be explored as well (Moore, Riddell & Vocisano, 2015).

READ THE INSTRUCTIONS BEFORE USE

Landscape approaches can assist us in making "biodiversity conservation a far stronger part of land, water and sea management policies" (Maxwell et al., 2020). As with any guiding framework, however, there are several important requirements for effective operationalisation.

- A careful understanding of site-specific settings (Figure 1) and estimation of required inputs and desired outcomes is critical. Landscape approaches generally do not require high financial investments but do rely on substantial input of time and human resources. To ensure an effective and lasting operationalisation of the 6Ps, the initiators of the approach need to foresee possible challenges well in advance and be prepared to adapt to uncertainties. This will help prevent abrupt termination of a landscape approach mid-process.
- Skilful facilitation of landscape approaches is key to their success. They do not happen on their own, but need to be initiated, supported and carried out by responsible actors. Mediators, also known as boundary brokers or bridging stakeholders, play an essential role when dealing with conflict situations (e.g. core and buffer zone conflict management), evaluating strategic priorities for integration of a site into a wider landscape network, or fostering connectivity pathways across sites. There is a need for further capacity development and knowledge exchange in this regard.
- An appropriate weaving of landscape approaches into existing conserved and protected area plans and

practices is highly recommended. Though the 6Ps are a useful framework for structuring the implementation of landscape approaches, they need to be implemented in a way that takes account of site-specific features and challenges. Moreover, the 6Ps resonate with other area-based conservation methods, including collaborative approaches, adaptive co-management and participatory monitoring. Such similarities need to be aligned and built upon to generate value-added management outcomes.

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RESUMEN

Los enfoques paisajísticos se han reconocido como una solución eficaz para conciliar las exigencias de conservación y desarrollo a escala local. Aunque son adecuados en diversos contextos de interacción entre el hombre y la naturaleza, su aplicación se considera cada vez más en relación con la conservación basada en áreas. La Meta 3 (Meta 30x30) del Marco Global de Biodiversidad Kunming-Montreal (KM-GBF) pide específicamente que las áreas protegidas, otras medidas efectivas de conservación basadas en áreas (OECM) y los territorios indígenas y tradicionales se «integren en paisajes terrestres y marinos más amplios y en el océano». Esta breve comunicación persigue tres objetivos. En primer lugar, sugerimos varios entornos de conservación basados en áreas en los que puede aplicarse un enfoque paisajístico. En segundo lugar, analizamos cómo pueden aprovecharse los rasgos característicos y los puntos fuertes de los enfoques paisajísticos para apoyar la Meta 3. Por último, ofrecemos recomendaciones prácticas para permitir su aplicación efectiva.

RÉSUMÉ

Les approches paysagères ont été reconnues comme une solution efficace pour concilier les exigences de conservation et de développement à l'échelle locale. Bien qu'elles conviennent à divers contextes d'interactions entre l'homme et la nature, leur application est de plus en plus envisagée dans le cadre de la conservation par zone. L'objectif 3 (objectif 30x30) du cadre mondial pour la biodiversité Kunming-Montréal (KM-GBF) demande spécifiquement que les zones protégées, les autres mesures efficaces de conservation par zone (OECM) et les territoires autochtones et traditionnels soient « intégrés dans des paysages terrestres et marins plus vastes et dans l'océan ». Cette courte communication poursuit trois objectifs. Tout d'abord, nous suggérons divers contextes de conservation par zone où une approche paysagère peut être appliquée. Ensuite, nous examinons comment les caractéristiques et les points forts des approches paysagères peuvent être mis à profit pour soutenir la cible 3. Enfin, nous fournissons des recommandations pratiques pour permettre leur mise en œuvre effective.

RECOMMENDATION ON OECM ASSESSMENT: CONSIDER INCLUDING THE LEVEL OF FRAGMENTATION OF THE LARGER TERRITORIAL UNIT

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ABSTRACT

To meet the objectives of the Global Biodiversity Framework (GBF) Target 3 to effectively conserve and manage at least 30 per cent of terrestrial, inland water, coastal and marine areas by 2030, the number of high-quality sites that are important for biodiversity will need to increase. Other Effective Area-based Conservation Measures (OECMs) are increasingly recognised globally and are expected to play a significant role towards meeting GBF Target 3. Following a decision adopted by the Conference of the Parties to the Convention on Biological Diversity (CBD) in 2018, the assessment of new OECM candidate sites can be achieved by applying an IUCN site-level tool published in 2023 based on eight criteria. The criteria do not specify a minimum size for OECM candidate sites. Here we suggest that the CBD Parties consider a metric on the fragmentation level of an OECM candidate site's larger territorial unit to help define the minimum size of this site, and we apply the metric to a case study in the EU. We believe this would be a realistic and practical approach and would give incentives for CBD Parties to assess potential new OECM sites even in highly fragmented territorial units.

Keywords: effective mesh size method; Nomenclature of Territorial Units for Statistics (NUTS3); unfragmented functional units for *in-situ* conservation; Global Biodiversity Framework (GBF) Target 3

RATIONALE

Areas outside protected areas may contribute to the effective in-situ conservation of biodiversity, and for this reason the Convention on Biological Diversity's (CBD) 2011–2020 Strategic Plan recognised OECMs as a way to deliver effective and long-term *in-situ* conservation of biodiversity (CBD, 2010). OECMs are expected to contribute to the achievement of several targets of the 2030 Global Biodiversity Framework (GBF), especially Target 3 (Jonas et al., 2024a), particularly in the context of emerging landscape approaches to conservation (CBD, 2020).

Since 2018, some Parties to the CBD have designated OECMs, and, as of November 2024, a total of 6,484 marine, inland water or terrestrial OECM records from 15 countries have been globally reported (UNEP-WCMC & IUCN, 2024). At the national level, a country may recognise an individual site which qualifies as an OECM after going through an assessment process which complies with the CBD's definition (CBD, 2018) and meets a published set of criteria (Jonas et al., 2023; Jonas et al., 2024b). In this IUCN site-level tool, the minimum size of an OECM site was not specified, although it was explained that "a site's size and configuration should, as far as possible, be appropriate for managing and maintaining its important biodiversity values". Previously, IUCN-WCPA (2019) outlined that OECMs "should be of sufficient size to achieve the long-term *in-situ* conservation of biodiversity, including all ecosystems, habitats and species communities for which the site is important. 'Sufficient size' is highly contextual and is dependent on the ecological requirements for the persistence of the relevant species and ecosystems."

To make progress towards GBF Target 3 and advance the OECM agenda, we propose that an additional metric should be considered by the CBD Parties to determine the

General view of the Usabelartza wetland complex in Andoain (Gipuzkoa), dominated by transitional peat bogs and reed beds. This wetland is included in group III (unprotected) of the wetlands of the PTS for wetlands (site code, B1G1-05). Due to its characteristics, size and environmental values, it would be one of the candidates to become an OECM site according to our recommendation
© Joseba Garmendia Altuna

Table 1. The five main categories of metrics for level of landscape fragmentation (Betts, 2000).

Main categories of metrics for level of landscape fragmentation	Description of landscape metrics	References
Habitat area/ landscape composition metric	Area of different habitat types	Betts (2000)
	Number of categories in a map and the area associated with each, proportion of each class relative to the entire map, and diversity	Gustafson (1998)
Patch size metric	Patch size frequency distributions	Betts (1999)
	Patch size standard deviation, variance and median	McGarigal and McComb (1995); Baskent and Jordan (1995)
Edge metric	Edge effect	Laurance and Yensen (1991); Didham and Ewers (2012)
Landscape configuration metric	Nearest neighbour statistics	McGarigal and McComb (1995); Baskent and Jordan (1995); Hargis et al. (1998)
	Proximity index to measure patch isolation	Hargis et al. (1998)
	Isolation: measure of landscape configuration	Baskent and Jordan (1995)
	Contagion to measure landscape configuration	Li and Reynolds (1993)
	Network connectivity	Forman (1998)
	Effective mesh size method (m_{eff})	Jaeger (2000)
	Lacunarity analysis of landscape patterns	With and King (1999)
Patch shape metric	Patch elongation	Forman (1998)

minimum size of an OECM candidate site. We propose that its value should be relative to the level of fragmentation of the larger territorial unit where this site is located, as, *de facto*, plots of land are likely to be on average smaller within highly fragmented territorial units. The close relationship between the minimum size of a conservation area and the level of fragmentation of its larger territorial unit is rooted in the notion of the ability of two individuals of an animal species to find each other, therefore allowing interactions (Jaeger, 2000). This is essential for the long-term *in-situ* conservation of biodiversity (IUCN-WCPA, 2019). Regarding metrics for level of landscape fragmentation, five main categories have been described (Betts, 2000) and are summarised in Table 1.

CASE STUDY AND DISCUSSION

We considered a territorial unit according to the European 'Nomenclature of Territorial Units for statistics' (NUTS) – a hierarchical system divided into three levels of territorial units (EUROSTAT, 2024). Among the metrics in Table 1, we chose as an example the 'effective mesh size method' (m_{eff}) (Jaeger, 2000) which is independent of the size of the territorial unit and can be compared between units of different sizes. A single mesh represents the minimum level of unfragmented area and is defined as an "area that is accessible when beginning to move from a randomly chosen point inside a landscape without encountering anthropogenic barriers such as transport routes or built-up areas" (EEA, 2022). Data on the average number of meshes per km² in each NUTS3 was publicly available (EEA, 2018).

In Table 2, we selected three countries with different fragmentation levels (EEA, 2022): Malta (highest fragmented EU country), Finland (lowest fragmented EU country) and Spain (mid-level fragmented EU country). Then, for Malta we selected a NUTS3 with the highest number of meshes per km², for Finland – a NUTS3 with the lowest number of meshes, and for Spain – a NUTS3 with a medium number of meshes (EEA, 2018). We

Oblong-leaved sundew (*Drosera intermedia* Hayne): Endangered on the Basque Country Red List and as Near Threatened at European level. The most significant populations in Gipuzkoa are found in wetlands in protected areas, some of them being very close to unprotected wetlands which could potentially provide extended habitats for the survival of this species. Therefore, the correct management of these unprotected wetlands would increase the probability of survival of this species at a regional level © Joseba Garmendia Altuna

calculated the average area of a single mesh in each of these NUTS3 and rounded it up to 10^{-2}.

Still using m_{eff} as an example of the metrics listed in Table 1, the average area of a single mesh may be calculated

Table 2. The average area of a single mesh in three different EU NUTS3, as of November 2024

EU Country	NUTS3 code	NUTS3 name	Number of meshes per km²	Average area (in ha) of a single mesh	Average area rounded up to 10^{-2} (in ha) of a single mesh
Malta	MT001	Malta	17,965	0.0056	0.01
Spain	ES212	Gipuzkoa	2,261	0.0442	0.05
Finland	FI1D7	Lappi	17	5.8823	5.89

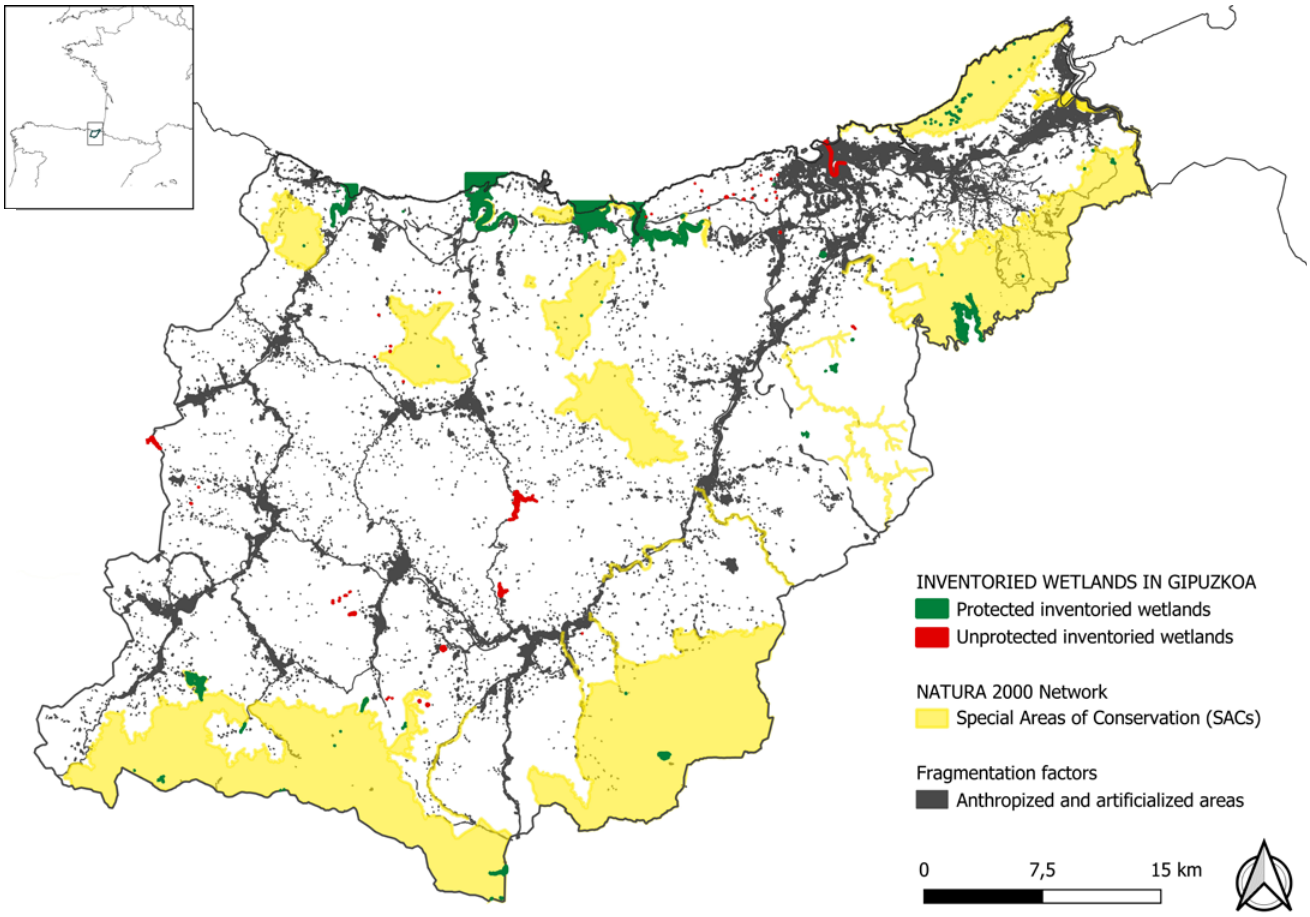

Figure 1. Map of the distribution of inventoried wetlands in Gipuzkoa and their relationship with protected areas and fragmentation factors. Anthropic barriers in Gipuzkoa favour the fragmentation of wetland ecosystems by dividing the territory and hindering connectivity between wetlands.

for worldwide territorial units, where fragmented land datasets based on m_{eff} values are available at global scale (see for example Romanillos et al., 2024).

Metrics based on the fragmentation level of an OECM candidate site's larger territorial unit are important to consider where large ecosystems have already been transformed, as habitat fragments can deliver *in-situ* conservation. From Table 2, if the eight criteria of the IUCN site-level tool are fulfilled for an OECM candidate site (e.g. ES212 – Gipuzkoa, Figure 1), an additional metric such as the average area of a single mesh for that particular NUTS3 (in this case: 0.05 ha) could be considered to set the minimum size of an OECM candidate site. In this same territorial unit of Gipuzkoa, 48 mini-wetlands are located outside protected areas and listed as "unprotected inventoried wetlands lacking management and regulatory instruments" (Basque Country, 2024). These mini-wetlands are essential for amphibian and aquatic species which require unfragmented functional units. Twenty-three (23) of these mini-wetlands have a size of at least 0.05 ha (i.e. 47.91%) and could become OECM candidate sites after a positive screening

Emperor dragonfly (*Anax imperator* Leach, 1815): largest species of hawker dragonfly in Europe and widely distributed. Although it is not considered endangered, it is a good indicator of the presence and quality of small wetlands in Gipuzkoa, essential for the conservation of the biodiversity associated with them © Iñaki Mezquita Aranburu

Common midwife toad (*Alytes obstetricans* Laurenti, 1768): species of amphibian endemic to Europe (listed on the Appendix II of the Berne Convention and on Annex IV of the EU Natural Habitats Directive). Although it has a wide distribution and tolerates anthropization well, the fragmentation of the habitat affects the viability of its populations at a local and regional level. The availability of small wetlands is essential for the development of its life cycle © Iñaki Sanz-Azkue

for the criteria of the IUCN site-level tool. This number would rise to 42 (i.e. 87.5%) if adjacent mini-wetlands smaller than 0.05 ha are aggregated into a mesh of at least 0.05 ha. Consequently, if unprotected and unfragmented (i.e. at least the size of a single mesh) functional units become OECM candidate sites following the OECM criteria screening, their governance and management may be improved to deliver *in-situ* conservation objectives.

CONCLUSION

For OECMs, the effective mesh size method represents an example of a metric that can determine the size of unfragmented functional units for *in-situ* conservation, along with other methodologies (Table 1). Applying this metric together with the IUCN site-level tool could help designate new OECM candidate sites even in highly fragmented territorial units.

For the identification of OECM sites, we recommend CBD Parties consider a metric of the "fragmentation level of the larger territorial unit" to be used in conjunction with the IUCN site-level identification tool. As a prerequisite, an analysis of each metric method (e.g. effective mesh size vs. others) should be performed. We believe that failing to apply this metric may prevent countries with highly fragmented territorial units from ever designating OECM candidate sites. As a result, this may have an adverse effect on (i) *in-situ* conservation as the governance and management of such functional units would not benefit from the OECM designation and (ii) advancing both the OECM agenda and GBF Target 3 worldwide.

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RESUMEN

Para cumplir los objetivos de la Meta 3 del Marco Mundial para la Biodiversidad (GBF) de conservar y gestionar eficazmente al menos el 30% de las zonas terrestres, de aguas interiores, costeras y marinas para 2030, será necesario aumentar el número de lugares de alta calidad que son importantes para la biodiversidad. Las Otras Medidas Eficaces de Conservación basadas en Áreas (OECM, por sus siglas en inglés) son cada vez más reconocidas en todo el mundo y se espera que desempeñen un papel significativo en el cumplimiento del Objetivo 3 del GBF. Tras una decisión adoptada por la Conferencia de las Partes en el Convenio sobre la Diversidad Biológica (CDB) en 2018, la evaluación de nuevos sitios candidatos a OECM puede lograrse aplicando una herramienta de la UICN a nivel de sitio publicada en 2023 basada en ocho criterios. Los criterios no especifican un tamaño mínimo para los sitios candidatos OECM. Aquí sugerimos que las Partes del CDB consideren una métrica sobre el nivel de fragmentación de la unidad territorial más grande de un sitio candidato a la OECM para ayudar a definir el tamaño mínimo de este sitio, y aplicamos la métrica a un estudio de caso en la UE. Creemos que éste sería un enfoque realista y práctico y que incentivaría a las Partes en el CDB a evaluar posibles nuevos sitios OECM incluso en unidades territoriales muy fragmentadas.

RÉSUMÉ

Pour atteindre l'objectif 3 du cadre mondial pour la biodiversité (CMB), à savoir conserver et gérer efficacement au moins 30 % des zones terrestres, aquatiques intérieures, côtières et marines d'ici à 2030, il faudra augmenter le nombre de sites de haute qualité importants pour la biodiversité. Les autres mesures de conservation efficaces par zone (OECM) sont de plus en plus reconnues au niveau mondial et devraient jouer un rôle important dans la réalisation de l'objectif 3 du GBF. À la suite d'une décision adoptée par la Conférence des parties à la Convention sur la diversité biologique (CDB) en 2018, l'évaluation de nouveaux sites candidats aux OECM peut être réalisée en appliquant un outil de l'UICN au niveau du site, publié en 2023 et basé sur huit critères. Les critères ne spécifient pas de taille minimale pour les sites candidats à l'OECM. Nous suggérons ici que les Parties à la CDB considèrent une métrique sur le niveau de fragmentation de l'unité territoriale plus large d'un site candidat à l'OECM pour aider à définir la taille minimale de ce site, et nous appliquons la métrique à une étude de cas dans l'UE. Nous pensons qu'il s'agit d'une approche réaliste et pratique qui inciterait les parties à la CDB à évaluer de nouveaux sites OECM potentiels, même dans des unités territoriales très fragmentées.

BOOK REVIEW

Etosha Pan to the Skeleton Coast. Conservation histories, policies and practices in North-west Namibia – Edited by Sian Sullivan, Ute Dieckmann and Selma Lendelvo

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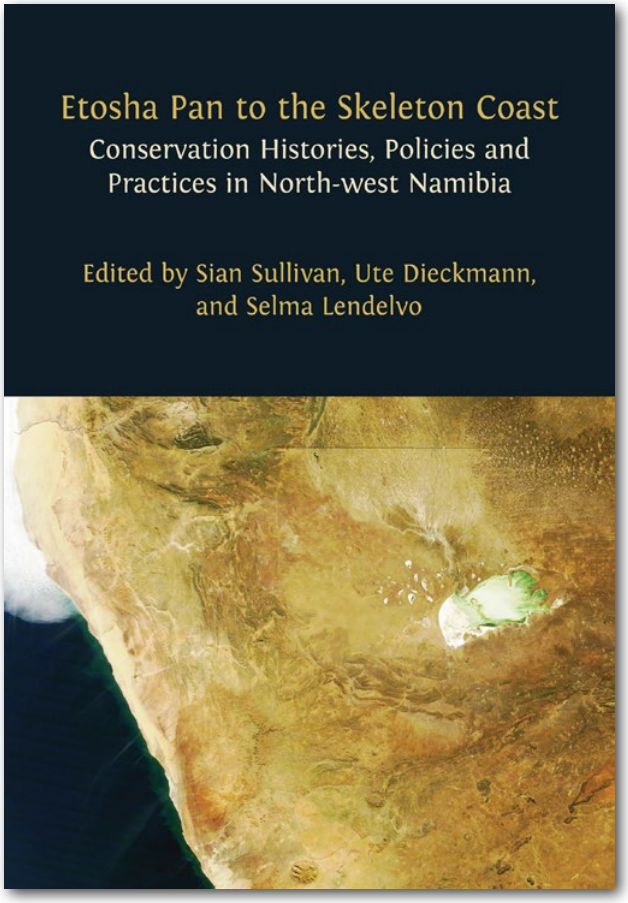
Anyone familiar with or having an interest in Namibia's environmental and wildlife protection history, and its impacts on current practices and inhabitants, will enjoy this wholistically structured book. Indeed, anyone seeking to finely balance the needs of protecting landscapes, wildlife diversity, and the rights and cultures of Indigenous peoples, often historically neglected in colonial park and protected area proclamations, will find *Etosha Pan to the Skeleton Coast* an insightful read. The book is derived from the Etosha-Kunene Histories research project, with excerpts from the associated online workshop held in July of 2022, and highlights some of Namibia's internationally celebrated nature protection initiatives, such as community-based natural resources management. Throughout the book you find occasional QR codes associated with figures that link to interviews and cultural videos from the project, adding a more interactive and immersive element to the story.

This book uses modern orthography and local language terms for the names of people and places, including the click consonants of the Khoekhoegowab language spoken by many of Etosha-Kunene's inhabitants. A helpful guide to the symbols used and their pronunciations is provided at the beginning of the book, although Anglophone speakers such as myself still struggle in this department (even with first-hand exposure to the Khoekhoegowab language). I nonetheless applaud the use of traditional languages to identify local areas that are so often, and easily, referred to by their Europeanised names, as this gives the reader a real sense of a driving message throughout this book: local people's identity and belonging matter in how we approach protected area management. Historical, and even current, land and wildlife protection policies have almost severed traditional nature, human and beyond-human



connections to these lands. This work brings to the forefront the impact of such policies on current social and conservation efforts.

Etosha Pan to the Skeleton Coast delves into the history of North-west Namibia's protected area and conservation policies and practices from the pre-colonial era to the independent Namibia of today. It is contributed to by a diverse and balanced mosaic of 27 authors from both Namibia and abroad, and wonderfully edited by Sullivan,

Dieckmann and Lendelvo. At 592 pages (549 of text), the nineteen mostly scientific-paper structured chapters are broken into five parts, each focusing on a different aspect of the Etosha-Kunene region and its history, implications and current impacts on the environment, wildlife and the lives of the local inhabitants. Well-known Namibian researchers and conservationists such as Philip Stander are highlighted in the chapters, and how well-planned community involvement is shaping an often more positive wildlife and land conservation story.

The first part focuses on the pre-colonial to post-independence histories and conservation actions of the Etosha-Kunene region and park proclamations. Principally, how the European mindset of resource exploitation and the drive to neatly compartmentalise their world effectively laid the groundwork for Namibia's modern parks. The second part delves into how both national and internal politics have and continue to shape conservation practices and local acceptance of conservation laws on resettled and redistributed lands of the Etosha-Kunene landscape. Of particular interest in this section is how social hierarchies were expected of, and at times imposed on, local communities to help govern their mobility and access to resources within protected landscapes, and how this system has been fundamentally controlled by powerful community players to capitalise their self-interests. Part three brings the ecologies of the Etosha-Kunene into focus, primarily the iconic wildlife and how past policies and land ownership, including physical barriers such as fences and the veterinary 'Red Line', continue to impact species integrity and the fine balance of this often harsh and arid landscape.

Part four looks at the histories of the drier and more remote north-west areas of the Skeleton Coast National Park and its current tourism concessions. It considers how locals view the national parks in this area and how different generations are seeing and investing value in the parks' existence. Turning to the San community of the Etosha National Park, we are guided through their dynamic stories and hardships in this area by documented oral histories and interviews. The final part has a focus on the unique desert adapted lions and how their continued monitoring and conservation is placed in the hands of experienced and dedicated local game guards (lion rangers) and the integration of technology to help alleviate human–lion conflict.

The book's focus on developing and improving conservation practices that aims to jointly protect wildlife and landscapes and to empower and support local people is not only relevant to Namibia but can be applied globally as well. The writing is structured in a research report format, incorporating maps, data figures and reference lists, yet it reads like a storybook and is easy to follow making it difficult to put down mid-chapter. It would serve well as an academic case study text from which current and future protected area practitioners and policymakers can learn. At the same time, I highly recommend that this book finds its place on coffee tables throughout Namibia and in guest lodges as its easy reading and historical content will no doubt be of great interest to a broad audience.