PARKS

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Developing capacity for a protected planet

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protected planet

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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IUCN-WCPA's Best Practice Protected Area Guidelines are the world's authoritative resource for protected area managers. Involving collaboration among specialist practitioners dedicated to supporting better implementation in the field, they distil learning and advice drawn from across IUCN. Applied in the field, they are building institutional and individual capacity to manage protected area systems effectively, equitably and sustainably, and to cope with the myriad of challenges faced in practice. They also assist national governments, protected area agencies, nongovernmental organisations, communities and private sector partners to meet their commitments and goals, and especially the Convention on Biological Diversity's Programme of Work on Protected Areas.

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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 fulfill 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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EDITORIAL

Marc Hockings, Managing Editor

This has been an unusual year by any measure. In the last issue of this journal in November 2019, a number of the papers looked forward to 2020 as an important year for biodiversity. The World Conservation Congress in Marseille, the 15th Meeting of the Convention on Biological Diversity and the development of a post-2020 Global Biodiversity Framework were all seen as signature events. We now know these will not happen during this year.

As an Australian, the year began with alarm as we witnessed catastrophic fires that swept across much of the country. At one time, there were major fires burning in New South Wales, Victoria, South Australia, Western Australia and Tasmania - stretching across the country from east to west and testing fire response capacity in Australia to the limit. More than 17 million hectares were burnt and 21 per cent of the forest area in mainland Australia was affected in the 2019/2020 bushfire season. Scientists estimate that more than 1.25 billion animals were killed - an estimate that excludes fish, frogs, bats and insects. In New South Wales alone, 154 protected areas had more than 50 per cent of their area impacted by the fires. On the Australian Government's estimates, at least 113 animal species require urgent management intervention to prevent extinctions and to assist recovery of species which had a large proportion of their range impacted by the fires.

A Royal Commission into National Natural Disaster Arrangements was established in response to the extreme bushfire season of 2019-20 which resulted in loss of life, property and wildlife and environmental destruction. This is just the most recent in what have been a long series of enquiries into bushfires in Australia. Issues around forest management and conservation will be key aspects of the enquiry. Interestingly, the terms of reference for the current enquiry require the Commissioners to examine "any ways in which the traditional land and fire management practices of Indigenous Australians could improve Australia's resilience to natural disasters". We will watch this space with interest.

Even before the fires had been fully extinguished, this national catastrophe was followed by the emergence of the truly global catastrophe of the COVID-19 pandemic. The effects of this pandemic on human lives lost, human health and on global, national and local economies are still emerging but it is clear that this zoonosis has changed the world as we know it for billions of people.

A special Editorial Essay in this issue addresses the impacts and implications of COVID-19 for protected and conserved areas. These are 'first words' not 'last words' on this topic. WCPA is establishing a Task Force on COVID-19 to continue work on this critical issue for protected areas. Clearly much more will be written about the implications of COVID-19 for nature and nature conservation in coming months and years and we are considering the possibility of publishing a special issue of this journal on this topic in future.

This issue includes eight other papers, drawing authorship from 14 countries across five continents. Topics are typically diverse, ranging from issues of protected area training, financial management for protected areas, payment for ecosystem services, rangers' perceptions of their career and working conditions, species conservation in karst landscapes, practical guidance on the application of the landscape approach to opportunities for protected areas to contribute to the coming UN Decade on Ecosystem Restoration.

As Editor, it is pleasing to see the growing number and quality of submissions to the journal and the continuing diversity of authorships and topics. There are also some editorial changes to acknowledge. This is the last issue containing papers that were managed by Sarah Casson. A change in her job responsibilities means that she has had to step back from the volunteer role in managing submissions to *PARKS*. I thank her for her sterling contribution while I have been Editor. At the same time, I also welcome on board two new co-editors to the journal; Professor Pamela Wright from Canada and Dr Jonas Geldmann from Denmark and I look forward to working with them on future editions.

EDITORIAL ESSAY: COVID-19 AND PROTECTED AND CONSERVED AREAS

Marc Hockings[1]*, Nigel Dudley[2], Wendy Elliott[3], Mariana Napolitano Ferreira[4], Kathy MacKinnon[5], MKS Pasha[6], Adrian Phillips[7], Sue Stolton[2], Stephen Woodley[8], Mike Appleton[9], Olivier Chassot[10], James Fitzsimons[11,12], Chris Galliers[13], Rachel Golden Kroner[14], John Goodrich[15], Jo Hopkins[16], William Jackson[17], Harry Jonas[18], Barney Long[9], Musonda Mumba[19], Jeffrey Parrish[20], Midori Paxton[21], Carol Phua[22], Raina Plowright[23], Madhu Rao[24], Kent Redford[25], John Robinson[26], Carlos Manuel Rodríguez[27], Trevor Sandwith[28], Anna Spenceley[29], Candice Stevens[30], Gary Tabor[31], Sebastian Troëng[14], Sean Willmore[17] and Angela Yang[32]

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ABSTRACT

The COVID-19 pandemic is having a dramatic impact on the global community; on people's lives and health, livelihoods, economies, and behaviours. Most zoonotic disease pandemics, including COVID-19, arise from the unsustainable exploitation of nature. This special editorial provides a snapshot of how protected and conserved areas around the world are being impacted by COVID-19. For many protected and conserved areas, negative impacts on management capacity, budgets and effectiveness are significant, as are impacts on the livelihoods of communities living in and around these areas. We provide a commentary on how effectively and equitably managed systems of protected and conserved areas can be part of a response to the pandemic that both lessens the chance of a recurrence of similar events and builds a more sustainable future for people and nature. We conclude the editorial with a Call for Action for the rescue, recovery, rebuilding and expansion of the global network of protected and conserved areas.

Key words: COVID-19, coronavirus, pandemic, protected areas, conserved areas, one health approach, call to action

INTRODUCTION

The COVID-19 pandemic, caused by the SARS-CoV-2 virus (Zhou et al., 2020), is changing almost everything. It is first and foremost a deep human tragedy, which has already killed hundreds of thousands of people and altered the lives of billions. It is having dramatic impacts on the global economy (Maliszewska et al., 2020; McKibbin & Fernando, 2020). It has thrown many assumptions about our future into doubt and has created a collective moment for contemplation about the future. We are only just beginning to understand its implications for humanity and our relationship with nature. The origins of most zoonotic disease pandemics and epidemics, such as COVID-19, lie in a breakdown in

that relationship, arising from an unsustainable exploitation of the natural world (Patz et al., 2004). The implications of this unprecedented event, and of the human responses to it, are therefore profound. They raise fundamental questions about the ways in which humanity impacts nature, for example through the destruction of ecosystems, the unsustainable consumption of wildlife and the illegal wildlife trade.

At this critical time, we assert that effectively and equitably managed networks of well-connected protected and conserved areas[1], by maintaining the ecological integrity of natural ecosystems, provide one of the most important ways in which to strengthen and repair the relationship between people and the natural systems on which they depend. Of course, protected and conserved areas cannot address all the issues around COVID-19 and the natural world. However, they are both highly impacted and do offer important solutions.

This special editorial first provides a global commentary on how protected and conserved areas, both on land and in the oceans, are being impacted by COVID-19. We then present some scenarios outlining what possible futures they might face. We conclude with a Call for Action. We plan to use this Call for Action to open a wider discussion and to build on and refine this proposal. We hope many countries and sectors will be ready to work together to develop these ideas and support the necessary action. This will ensure that protected and conserved areas play an important role in a resilient planetary recovery from COVID-19, advancing human and economic health and well-being.

SETTING THE SCENE

It is now well recognised that the exploitation of wild species and wild places, deforestation, uncontrolled expansion of agriculture, intensification of farming, and infrastructure development have increased and modified the interface between people and wildlife, and thus created a 'perfect storm' for the spillover of diseases from wildlife to people (Plowright et al., 2017; Faust et al., 2018). These zoonotic diseases – diseases that originate in animals and are transmitted to humans – can more easily become epidemics or pandemics due to our hyper-connected global societies and transportation systems. Maintaining the ecological integrity of nature through protected and conserved areas is critical to halting biodiversity loss and can contribute to reducing the risk of zoonotic spillover.

Protected and conserved areas safeguard nature while at the same time providing food and water security, disaster risk reduction, climate mitigation and adaptation, and innumerable cultural, spiritual and health values (Dudley et al., 2010). Despite growing recognition of these benefits, they are often undervalued and not sufficiently supported by the policy and resources needed for effective conservation. How protected and conserved areas are treated during and after the COVID-19 pandemic will have major implications for nature and for humanity's reliance on nature; they should be a central part of the move towards greener economies.

The current pandemic and its aftermath could undermine decades of conservation effort. But this crisis could also offer an opportunity to transform the economic approach that has led to this situation, and to forge green, inclusive policies for a sustainable recovery. It could be used to build a far more positive future for these places and thus improve the prospects for human well-being everywhere.

The idea that we need a "One Health" approach runs through this text. One Health recognises that the health of humans, animals and ecosystems are interconnected (Aguirre et al., 2002; Cook et al., 2004). It applies a coordinated, collaborative, multidisciplinary, trans-boundary and cross-sectoral approach to address risks that originate at the animal–human–ecosystem interface. The adoption of a One Health approach is increasingly urgent as the accelerating human footprint on the natural world increases the risks of further zoonotic disease spillover. As nations develop plans to reinvigorate their economies post-COVID-19, we encourage the incorporation of a One Health approach, thereby ensuring an economic recovery that avoids further environmental degradation, reduces the risk of further zoonotic outbreaks and helps build a more resilient future. Effectively and equitably managed networks of protected and conserved areas, both terrestrial and marine, should be a crucial part of this approach.

COVID-19 AND PROTECTED AND CONSERVED AREAS – WHAT WE KNOW SO FAR

Relationship between protected and conserved areas and zoonoses

Wildlife serves as the origin for over 70 per cent of all zoonotic emerging diseases (Jones et al., 2008), with the rest coming from livestock. Wildlife, like humans and their domestic animals, carry thousands of naturally occurring viruses and microbes. Most are harmless, but a few have the potential to cause disease in their host populations, and some can cross the species barrier. As human numbers have grown and the resulting human footprint on the planet has expanded (O'Bryan et al.,

2020), the opportunities for more contact between wildlife and humans have increased. Almost half of zoonotic emergence events are driven by land use change and associated activities (Keesing et al., 2010). More frequent contacts make it more likely that potential pathogens will jump from wildlife to humans (and, in some circumstances, from humans to wildlife). Some of these spillover events have led to the spread of pathogens in epidemic and pandemic proportions, such as HIV-AIDS (which has killed over 30 million people[2]), Ebola virus disease, SARS, MERS and avian flu; such too is the case of COVID-19 (Anderson et al., 2020).

The large-scale conversion and transformation of natural ecosystems, including land use change caused by food production, facilitate the 'spillover' of pathogens from wildlife to human populations (Allen et al., 2017; Patz et al., 2004; Karesh et al., 2012). The ecological condition of an area may either buffer or facilitate pathogen shedding within reservoir host species, and between them. Human actions within and around natural forests and other ecosystems that disturb wildlife species and their ecology may lead to greater pathogen shedding and facilitate contact spreading (Johnson et al., 2020).

Well-designed and managed networks of protected and conserved areas help to maintain intact natural habitats and ecological integrity (Geldmann et al., 2013). Where protected areas are being established, or exist, alongside intensively used land, it is important to minimise edges, separate intensive land uses and wildlife, and manage for healthy functioning ecosystems. An awareness of disease dynamics should become a feature in the design and management of protected and conserved areas in the future.

Impacts of COVID-19 on protected and conserved areas

We are only just beginning to understand the impact of the COVID-19 pandemic on protected and conserved areas, but there are already many indications of the direct impacts at site level, the future challenges and the emerging policy implications.

Economic impacts from loss of tourism

Wildlife and nature tourism are major contributors to economic activity around the world. Before the pandemic, researchers estimated that the world's protected areas received roughly eight billion visits per year, generating approximately USD 600 billion per year in direct in-country expenditure and USD 250 billion per year in consumer surplus (Balmford et al., 2015). A 2019 estimate puts the direct value of wildlife tourism at USD 120 billion or USD 346 billion when multiplier effects are accounted for, and it generated 21.8 million jobs (World Travel and Tourism Council, 2019). This income has virtually stopped as a result of COVID-19: a recent survey of African safari tour operators found that over 90 per cent of them had experienced declines of greater than 75 per cent in bookings and many indicated they had no bookings at all, thus affecting local employment[3]. With more than 16 million people directly or indirectly employed in tourism within the African region, the impact is immense. Community-based conservation areas in particular provide income support for families through a share in tourism-derived income. The Mara Naboisho Conservancy in Kenya, for example, provided the main cash income for over 600 Maasai families; this has now disappeared with the cessation of tourism[4].

Local community guides earned income by taking tourists on walks through the Mara Naboisho Conservancy — income that has now ceased as a result of the pandemic © Marc Hockings

In addition, many communities living near protected areas benefit from a share of tourism revenues; for example, those living around the mountain gorilla parks in Rwanda, Uganda and Democratic Republic of the Congo benefit from a proportion of park fees (Maekawa et al., 2015). This important source of revenue for communities will be hard hit (Spenceley, in prep.). In some cases, the economy of entire towns – such as Hoedspruit adjacent to Kruger National Park in South Africa – has come to a standstill after the shutdown of the adjacent protected area[5]. Communities depending on tourism adjacent to Costa Rican protected areas and Galapagos National Park, Ecuador are similarly affected[6]. This loss of income from tourism is unlikely to be short-lived: a study by Global Rescue and the World Travel and Tourism Council (2019) found that the average time from impact to economic recovery of tourism following disease outbreaks was 19.4 months.

The dangers of relying on international tourism to sustain conservation have been recognised for a long time, and there are some moves to support communities to become more resilient and less dependent on this source of revenue[7]. However, for protected and conserved areas that do rely heavily on this kind of income, the pandemic has exposed their vulnerability and demonstrated that local economies are equally exposed (Spenceley, in prep).

Direct, site-level impacts on protected and conserved areas

Protected and conserved areas have been impacted negatively in many ways. Management effectiveness may be reduced through budget and staff cuts. The Indigenous peoples and local communities that depend on these areas may find their economies badly disrupted and their livelihoods threatened. Pressures on biodiversity and ecosystems may then grow as people turn to alternative sources of subsistence and income. This in turn undermines the functioning of ecosystem processes and services within and around sites, causing a further negative cycle of impacts on people.

Direct ecological impacts – The potential for zoonotic diseases to have devastating impacts on wildlife populations has been well documented. Chimpanzees and gorillas are highly susceptible to respiratory viruses (Gibbons, 2020). In one study area in the Congo, about 5,000 gorillas are estimated to have died from Ebola virus in 2002–2003 (Bermejo et al., 2006). In the Atlantic Forests in Brazil, many thousands of non-human primates – as well as hundreds of people – died as a result of an outbreak of yellow fever (Dietz et al., 2019). Early indications are that dozens of species of non-human primates are likely to be susceptible to the virus causing COVID-19 (Melin et al., 2020). This is a particularly high risk for non-human primates like mountain gorillas that are habituated, and thus in regular contact with humans. A disease outbreak could be devastating for this still fragile subspecies and the ecosystem in which it plays a crucial role. It would also destroy the mountain gorilla tourism sector that currently funds the management of all mountain gorilla protected areas, as well as many other protected areas in their range countries, and provides crucial revenue sharing income for surrounding communities. Stringent contingency plans, including the complete closure of tourism, are being developed to avoid transmission of the virus[8]. On the positive side, there are reports of benefits for sensitive wildlife species in protected areas because of reduced human activity (Corlett et al., 2020), but such benefits are likely to be ephemeral once restrictions of human movement are rolled back.

Management and enforcement impacts – The operational capacity of most protected and conserved areas has been affected to some extent by COVID-19, although many countries are only just beginning to feel impacts as the virus spreads around the world. Often, the immediate response has been to reduce staff activity and vital management services, including ranger patrols. Reduced revenue and budgets for parks agencies may threaten employment for some park management staff in the future[9]. Travel restrictions have made it difficult for some rangers to get to work, for example in Ecuador half of all its rangers are thus affected[10]. Colombia is maintaining ranger activities but providing appropriate equipment to protect their health while also relying more on technology such as drones[11]. Rangers who were in the field at the time of the lockdown may now be unable to get home, or may be kept on duty to avoid the risk of rotating in additional staff (e.g. in Rwanda[12]): so they are held apart from their families for a prolonged period during this already stressful time. In other protected and conserved areas, management activities are operating at a lower intensity because of newly imposed expenditure constraints and cuts in staff numbers; or staff may be operating on reduced incomes (e.g. in Rajasthan, India, frontline staff have had a 30 per cent cut in their salaries for a three-month period[13]). In Brazil, at least one third of IBAMA, the Brazilian Environmental Agency, field operatives are close to 60 years of age or have medical conditions, making them more vulnerable to serious consequences from COVID-19 so they are not being sent on enforcement operations[14]. The significance of this is all the greater now that deforestation levels are peaking again in the Amazon and the next fire season is just

starting[15]. In some countries, rangers have been diverted to tasks that are part of the COVID-19 response, such as delivering aid and food to local communities, helping manage roadblocks and spraying inhabited areas with disinfectant[16].

In places where tourism revenue directly contributes to salaries and operations, ranger numbers and field operations have been cut, resulting in reduced enforcement capacity, and the abandonment or postponement of monitoring and routine management tasks[17]. This impact on employment may be especially severe in community conservancies and privately protected areas that depend heavily on tourism to pay staff salaries[18].

There are reports of increased poaching (both subsistence and commercial) and illegal resource extraction in countries such as Cambodia[19], India[20], Costa Rica[21] and southern and eastern Africa[22]; a tenfold increase in illegal logging is reported in Tunisia[23]. In Nepal, more cases of illegal extraction of forest resources, such as illicit logging and harvesting, took place in the first month of lockdown (514 cases) than in the entire previous year (483 cases)[24]; although data on poaching does not show a marked increase, an elephant and three critically endangered gharials were poached within the first 10 days of the lockdown. Moreover, six musk deer were killed in Sagarmatha National Park, in one of the worst recent cases of wildlife poaching in the region[24]. On the other hand, there are reports of significantly reduced poaching of rhinoceros in Kruger National Park and other protected areas in South Africa due to lockdown and travel restrictions[25]. It is important to note that hard data on poaching trends during the lockdown are not yet widely available.

There may well be differences among types of illegal exploitation. For example, high value transnational trafficking may be temporarily declining because of the lockdown and travel restrictions[26], whilst poaching for bushmeat, encroachment for grazing[27] or illegal fishing in marine protected areas may be increasing. In the Seychelles[28], Fiji[29], Indonesia, the Philippines and Hawai'i[30], there are reports of increasing fishing pressure in marine protected and conserved areas, which is encouraged by a reduced management presence. Lockdowns and travel restrictions along with reduced employment and livelihood opportunities mean local communities are increasingly depending on subsistence harvesting and foraging, which could potentially lead to overharvesting. This can be exacerbated when people return to their home communities from urban areas.

People have changed their behaviour in response to the pandemic. "Stay home — stay safe" sign in Dyfi Biosphere Reserve, Wales © Nigel Dudley

Visitation impacts – Protected and conserved areas in many parts of the world have been partially or completely closed to visitors as part of more widespread controls over the movement of people within and between countries. This means reduced visitor-related work for some sites, but increased visitor pressures on those remaining open[31]. A global picture of the extent of such closures is not yet available but, by way of example, World Heritage sites have been wholly closed to visitors in 72 per cent of the 167 countries with listed sites and remain fully open in only 10 per cent of these countries[32]. Many protected area systems have closed completely, while others have closed camping and day-use facilities, while keeping some hiking trails open[33].

Resource management impacts – Many activities, while important for conservation, are not deemed essential under some governments' guidelines which aim to discourage the movement of people over long distances[28]. As a result, park authorities may be less able to respond quickly to fires[34] or incidents of human–wildlife conflict, potentially resulting in increased hardship to communities and reduced tolerance to wildlife. Concerns for staff well-being also mean that work that is not considered immediately essential and which cannot be undertaken while physically distancing or without protective clothing, is not taking place[35]. This includes some types of scientific research and resource management which may be time-critical for effective conservation (Corlett et al., 2020). For example, following the catastrophic fires in Australia in late 2019 and early 2020, recovery planning has been disrupted by the COVID-19 restrictions[36], and researchers cannot undertake survey and monitoring work that will be vital to the effective recovery of more than 100 threatened

animal species requiring urgent intervention to prevent extinction. In Cape Verde, personnel undertaking cat eradication on the island of Santa Luzia have had to be evacuated because of COVID-19 restrictions, putting at risk the success of the reintroduction of the Critically Endangered Raso lark (*Alauda razae*)[37]. On the World Heritage-listed Gough Island in the South Atlantic, COVID-19 caused the postponement for at least a year of a major programme to control introduced mice that kill up to two million seabirds breeding on the island[38]. Research programmes in a group of private protected areas in Namibia have been temporarily shut down because of travel restrictions affecting researchers and a lack of funds derived from tourism[18]. Where managers of privately protected areas live at some distance from their protected or conserved areas (e.g. absentee landholders; Selinske et al., 2019), they may be less able to undertake critical management tasks or procure contractors for this purpose.

Social and community impacts – Indigenous people and local communities living in and around protected and conserved areas are extremely vulnerable to pandemics. They often live far from urban centres and have communal and sometimes nomadic lifestyles. This can lead to limited access to information and medical services[39], which are important in the context of novel viruses. The immunological profile of Indigenous populations can also differ from those of the majority populations living in the same region. Response to a new virus and disease may therefore be unexpected and even deadlier among such minority groups (Mesa Vieira et al., 2020). Many Indigenous communities fear a repeat of the devastation wrought by measles and other infectious diseases (Amigo, 2020). These risks may be exacerbated where the government response to the spread of COVID-19 is weak[40]. While a common response is to try to close off remote communities from outside visitors, a reduced management presence in protected and conserved areas can encourage illegal resource exploiters who can bring the virus with them into these otherwise isolated communities[41].

Many vulnerable, rural and marginalised communities dependent on income from small and medium-sized enterprises associated with protected and conserved areas are in danger of losing jobs and incomes[42]. In Nepal, the closure of Mount Everest's trekking and climbing has affected employment in local communities and Sherpas who had stockpiled supplies to support the high season have been left with no visitors to sell them to[43]. All around the world, the collapse of international and domestic tourism means that jobs are lost, salaries are cut, benefits and incomes disappear[44].

Policy challenges at national and regional levels

Many countries are taking on significant deficit financing to support their populations and businesses while they restrict activity to control the spread of COVID-19; many developed countries are committing more than 10 per cent of their GDP to this effort[45]. Governments are also reviewing their spending priorities in light of these radically changed budget positions. In some countries, operational budgets of environment (and other) departments are being reallocated to the pandemic response[46].

As governments seek to re-energise economies for a post-COVID-19 world, arguments for rolling back environmental protections are gaining traction, including provisions that would newly authorise or expand extractive industries and infrastructure in protected and conserved areas. Such 'emergency' rollbacks provide limited opportunity for public engagement. They are being proposed or enacted in a large number of countries, including in the United States[47], Greece[48], Canada[49], Malaysia[50], Albania[51], Brazil[52] and Kenya[53]. Such legal efforts to downgrade the protection given to protected areas, to reduce their size or even to de-gazette them entirely (Mascia & Pailler, 2011) will encourage deforestation, fragmentation and ecosystem disruption that are a major risk factor for the emergence of infectious zoonotic diseases.

Opportunities for a new focus on protected and conserved areas as global solutions

The responses from governments to COVID-19 have shown an unprecedented level and speed of policy and legislative action. At the same time, there have been dramatic changes to societal behaviour in reaction to this global pandemic. Can such resolve be applied to other global crises?

The source and spread of the disease could lead to some long-ignored environmental issues finally being recognised and resolved. For example, targeted bans on traded high-risk wildlife species would reduce the risk of further zoonoses, as well as having significant conservation benefits[54,55], although policies on trade will necessarily be nuanced by country and region.

Furthermore, the pandemic has focused the attention of the world on the connection between healthy nature and human health and well-being, and highlighted how reliant we are on nature, particularly for our mental health. In an increasingly urbanised world, parks are the gateway to nature for many of the world's population

Parks are a natural solution that can help secure human health and well-being; bushwalking in the Ovens River region, Alpine National Park, Victoria © Parks Victoria

and are a natural solution for securing human health and well-being. Nature can have therapeutic effects for people suffering the effects of social isolation. The mental health benefits derived from time spent in nature will also translate into economic benefits, such as avoided health care costs (Buckley et al., 2019; MacKinnon et al., 2019). In particular, urban parks and protected areas are becoming a lifeline for physical and mental health (Mell, 2020; Surico, 2020); this increased usage and interest could have additional benefits for protected and conserved areas and green space more generally.

The increased debt being accrued by governments is a significant impact of this pandemic. Yet there is an opportunity here for conservation organisations to work with governments and their debt holders to restructure debt through Debt for Nature swaps, thus using debt repayment to help finance nature protection. Debt restructuring such as the recent marine debt-for-nature swap, or 'Blue Bond', established in the Republic of Seychelles by The Nature Conservancy, the World Bank and the Seychelles Conservation and Climate Adaptation Trust[56], can help governments restructure mounting debt accruing during this time of economic crisis, yielding benefits for national economies as well as for nature. Trust Funds are another mechanism for long term financing for the management of both protected areas and indigenous territories[57,58]. A carbon tax with part of the revenue directed to protected area management such as that of Colombia is a further example of diversified funding (Barbier et al., 2020). Similarly, REDD+ payments can provide financing for protected areas as exemplified by Alto Mayo Protected Forest in Peru[59].

Most importantly, COVID-19 could spur the global community to a determination to address the other global crises of climate change and biodiversity loss, including through a heightened focus on protected and conserved areas. There is an extensive and robust body of scientific knowledge to help target investment on the most valuable ecosystems for the simultaneous pursuit of carbon sequestration, biodiversity and economic goals. There is significant policy opportunity to 'mainstream' and integrate nature protection into economic planning[60] as well as human health priorities. The potential for restoration of protected and conserved areas could provide a major boost to the UN's Decade on Ecosystem Restoration which is due to begin next year (Dudley et al., 2020). Nature protection should be seen as critical to sustainable economic growth and human

health – two priority issues that will dominate the global recovery agenda.

COVID-19 AND PROTECTED AND CONSERVED AREAS: EMERGING SCENARIOS

Based on the impacts, challenges and opportunities discussed above, we propose three potential scenarios for how the pandemic will impact protected and conserved areas and the role they could play in society's recovery.

Scenario 1: A return to normal

Under this scenario, the world learns to adapt to COVID -19 and strives to return to the old model of economic growth. There are scientific breakthroughs in the treatment of the virus and an effective vaccine is developed and shared globally. Although there is an economic recession of 1–3 years, there is a return to pre -COVID-19 levels of tourism and government support for protected and conserved areas. Support for conservation from NGOs and foundations also recovers. From a conservation perspective, we are in the same situation as before the pandemic, as described by the Intergovernmental Panel on Biodiversity and Ecosystems Services report (IPBES, 2019), where the challenges of biodiversity loss and climate change remain largely unaddressed. This means the global biodiversity outlook is still dire and we have lost time in actioning a post-2020 agenda under the Convention on Biological Diversity (CBD). There will still be significant underfunding for existing and new protected and conserved areas, and biodiversity will still be in decline, with up to one million species facing extinction (IPBES, 2019).

Scenario 2: A global economic depression and decline in conservation and protection

Under this scenario, the global pandemic lasts longer, or is more deadly than forecast. High levels of unemployment and shuttered businesses mean lower taxes for governments. There is a global economic depression, which results in a dramatic decline in all sources of conservation funding. Many people in urban areas lose their jobs and return to their rural home communities, thereby increasing pressure on natural resources. Tourism continues to be dramatically reduced and those protected and conserved areas and communities that rely on tourism revenues are starved of funds. Support from conservation NGOs and foundations decreases sharply with declining donations in contracting economies.

Globally most governments adopt massive stimulus packages to restart economies, but with a single focus on job creation. Environmental regulation is weakened, and conservation spending reduced. Nations look inward and political and financial support for international and multilateral institutions declines. Protected and conserved areas around the world are even more underfunded and there are few resources for the management or expansion of the protected areas estate, making areas more vulnerable to illegal activities. Indigenous and community conservation areas come under increased pressure for resource exploitation. Without effective management, human–wildlife interactions in and around protected and conserved areas become more problematic and more people and wildlife suffer. The work of the United Nations, inter-governmental bodies and the major international NGOs becomes increasingly marginalised.

At the same time, restrictions on economic development activities in protected and conserved areas are lifted, allowing more opening up of wilderness areas for extractive use and infrastructure development, and conversion to agriculture or other land uses. There is significant pressure in many countries to degrade or de-gazette protected and conserved areas. Biodiversity declines even more rapidly than before the pandemic, ecosystem services are lost and there is an emergence of more zoonotic diseases that drive other pandemics, spiralling into dangerous feedback loops. All this occurs in a world that fails to act on climate change.

Scenario 3: A new and transformative relationship with nature

Under this scenario, the pandemic results in significant changes in humanity's perception of our planet and our relationship to nature. Nations share a dramatic pandemic experience together, resulting in a shared bond with the planet and with each other. There is a new appreciation that the global pandemic is a result of the way consumer-driven societies are degrading and misusing nature. The central role governments have played in leading a societal response to a global crisis raises the importance of the collective in human consciousness. The pandemic raises global under-standing of the two intertwined major crises: climate change and biodiversity loss[61]. There is a new appreciation of the value of clear water and blue skies that have been an incidental benefit of the global pandemic shutdown. Science and its role in helping solve human problems have risen to the fore. The pandemic promotes a collective understanding of the immensity of the biodiversity and climate challenge, showing that transformative change is possible.

Oil prices fail to recover much, reducing profitability of the industry and creating the opportunity to shift away from fossil fuels. Under this scenario, governments and

Parque Nacional Zona Marina del Archipiélago de Espíritu Santo, Gulf of California, Mexico © Marc Hockings

their citizens see an unprecedented opportunity for the world to transition to a new, nature-friendly and climate-friendly future, including the protection and restoration of enough healthy natural land and sea to sustain all life on Earth.

While economic recovery will still be a global priority, it will be a green economic recovery. As governments seek to reboot their economies after COVID-19, vast sums of money will be invested. Nations decide to use this as a once-in-a-generation opportunity to correct the course of economic development towards more sustainable outcomes. Economists, central bankers and finance ministry staff from around the world have already identified natural climate solutions and rural support for ecosystem restoration as policies that will generate both economic multiplier effects and climate benefits (Hepburn et al., 2020). Increased investment in restoration would both help reverse degradation in protected areas and help re-establish connectivity outside and amongst protected areas. Such an investment strategy would put protected areas and conserved areas at its heart.

This scenario results in dramatic conservation actions by countries, ambitious new plans under the CBD and the United Nations Framework Convention on Climate Change, and an agreed global plan to help nature recover. International institutions are properly funded for the task. Natural or nature-based solutions involving protected and conserved areas and ecological restoration are seen as the preferred response to a range of human challenges, from biodiversity loss to carbon storage and sequestration, and from disaster risk reduction to improving human physical and mental well-being. Human populations get better at living with wildlife and reducing conflict. Healthy nature, stewarded in protected and conserved areas, is the backbone of a recovering planet, with diversified funding sources, including but not limited to sustainable tourism. Encouragingly, leaders from many parts of the planet, notably the European Union, Costa Rica, Finland, New Zealand and Canada, have already signalled their intention to embrace this opportunity in their recovery plans.

COVID-19 AND PROTECTED AND CONSERVED AREAS: A CALL FOR ACTION

Neither scenario 1 nor 2 offers a bright future for humanity. Scenario 3 is the only sustainable pathway and this Call for Action is a contribution to its delivery. The Call is made up of three elements: core principles, actions and a commitment from the IUCN's World Commission on Protected Areas. As the impacts of the pandemic evolve and are better understood, additional action may be needed by a range of stakeholders, including governments, the private sector and civil society.

Core principles to guide us

The COVID-19 pandemic has highlighted the urgent need to change the relationship between people and the natural environment, especially in the case of protected and conserved areas. A response to the current pandemic should be based on the following principles:

Principle 1: COVID-19 is a symptom of the wider environmental crisis arising from unsustainable economic processes which lead to the abuse of nature, including the degradation and fragmentation of natural ecosystems and the high-risk wildlife trade. Any response strategy needs to address all aspects of this environmental degradation, and include mechanisms which can contribute to combatting them, such as effectively and equitably managed networks of protected and conserved areas.

Principle 2: We must commit to and act to achieve a healthy, sustainable planet. This requires a One Health approach which crosses the human–animal–ecosystem interface, and for the global community to make the conservation of nature a central part of its responsibilities. An integrated response from all sectors – environment, health, finance, food, business and civil society – must become the norm, both now and over the longer term.

Principle 3: Protected and conserved areas provide broad benefits to society, but these are now under severe stress due to our societal response to COVID-19. Protected and conserved areas safeguard nature, but also protect us from the dangers of climate change and provide livelihoods and enhanced well-being, income, clean water, clean air and green spaces for everyone's physical and mental health. However, the current situation is placing enormous stress on many of these areas, and the collective response of relevant actors in the short, medium and long term will be crucial in determining their future.

Three phases of action

We call on the global community to come together for the rescue, recovery, and the rebuilding and expansion of the global network of protected and conserved areas. By global community, we mean governments at all levels and all relevant sectors, civil society and business.

1. Rescue: an immediate emergency response to cushion the shock from COVID-19

Maintain and invest in essential services: There is an urgent need to ensure the well-being of the protected and conserved area governance and management authorities, namely the managers, rangers, staff and volunteers. It may be necessary to control access to protected areas to minimise the risk of local communities, visitors and staff catching the virus. Special attention should be given to Indigenous peoples and local communities who are managing these sites or living around them. In many cases, this will include income support, as well as personal protection from the impacts of COVID-19.

Draw up and implement emergency plans: Operational levels of management and enforcement must be maintained or even enhanced in protected and conserved areas to achieve a level of effectiveness that sustains biodiversity and ecosystem services, and reduces the risks from human–wildlife conflict. Emergency protection plans should be drawn up and implemented to address poaching threats and other negative consequences of the pandemic. Such plans are vital where wildlife is likely to be susceptible to the pandemic, in particular non-human primates.

Provide emergency funding: Many protected and conserved areas that have seen major drops in income will need emergency financial support (along the lines of existing bailout packages for airlines, small businesses, etc.) to protect nature and to support the human populations that depend on these areas. Emergency funding plans should include support for the well-being and the food security of vulnerable communities managing, or living in or near, protected and conserved areas.

Maintain monitoring: Existing monitoring systems should be maintained wherever possible. New monitoring programmes should be developed to assess impacts of COVID-19 on, for example, visitor numbers, patrolling effort, human–wildlife interface, levels of resource harvesting, human–wildlife conflict, well-being of communities and ecosystem services. Monitoring of local fisheries and mariculture/aquaculture, as well as monitoring, control and surveillance measures for commercial fisheries, should be maintained to assist in the recovery, restoration and resilience of many marine and coastal protected and conserved areas.

Maintain existing laws: During and after this pandemic, national and regional governments should refrain from postponing, weakening or terminating environmental laws, regulations and initiatives, including those that affect natural ecosystems and protected and conserved areas.

2. Recover: a plan to overcome the damaging effects of COVID-19

Promote the health benefits of these areas: Moving past the immediate pandemic outbreak, it will be important to recognise and promote the role of protected and

conserved areas in sustaining human physical and psychological health, especially after a long period of lockdown or enforced isolation. Protected and conserved areas that allow visitation should aim to reopen where disease risks permit, using appropriate social or physical distancing rules.

Integrate health into recovery plans for these areas: Policies, management plans and practices need to be reviewed in order to reduce the risk of future zoonotic transmission. This means support for an integrated One Health strategy that examines and measures ecological integrity, wildlife health and public health needs in and around protected and conserved areas.

Create the foundation for sustainable finance: National economic recovery plans should include measures for the conservation and restoration of nature. International support will be needed for lower and middle-income nations. Any recovery strategy should recognise that many protected and conserved areas have been chronically underfunded, and that the world needs more of these areas with better levels of management rather than merely a return to pre-pandemic conditions. Support can take many forms, including direct economic stimulus through policies and sustainable finance options that generate economic multiplier effects. Where possible, the aim should be both to benefit protected and conserved areas and address climate change using natural solutions and support for ecosystem restoration.

Adopt a sustainable and equitable recovery: Restored and increased funding should ensure the re-establishment of conservation services and systems in protected and conserved areas, including rebuilding resource management programmes, re-employing furloughed staff and supplying back pay. It should support Indigenous peoples and local communities, women and youth living in and around these areas. Lasting conservation success can only be built on equity and benefit sharing.

Restore management capacity: Many protected and conserved areas are critically short of management capacity, and managers now face new challenges.

Large, well-connected, and well-managed protected and conserved areas will be an important element of rebuilding; Okavango Delta, Botswana © Marc Hockings

Capacity building is therefore needed in the management of protected and conserved areas, especially in sustainable financing, disaster preparedness, and integrated wildlife and human health approaches.

Avoid harm: Plans for restoration and new protected and conserved areas should apply a "Do No Harm" approach to ensure that economic recovery efforts do not support activities that threaten the environment or the well-being of Indigenous peoples and local communities.

3. Rebuild Stronger, starting now: a strategy to put protected and conserved areas on a more secure and effective trajectory

Help avoid a new pandemic: As part of a One Health approach, there is an urgent need to identify areas where there is a high risk of the emergence of zoonotic diseases and target these areas for integrated land-use planning and implementation. This should include the establishment of integrated monitoring systems for early detection of, and response to, emerging infectious diseases events. This will require improved collaboration between the environment, health, agriculture and land-use sectors.

Address wildlife trade from protected and conserved areas: Protected and conserved areas are a major source of animals taken from the wild, legally and illegally. In response to COVID-19, China temporarily banned the consumption of and trade in meat from most species of terrestrial wildlife, and there have been many calls to ban or restrict various forms of trade in wildlife more broadly. However, the context of wild meat consumption varies greatly around the world, and there may be unintended consequences of blanket bans. Strategies and plans for dealing with this issue in protected and conserved areas must be sophisticated and based on careful assessments of the local contexts and likelihood of unintended negative impacts.

Rights-based approaches: This time of change is also the moment to engage local communities and Indigenous people in more effective and equitable partnerships, and for governments to recognise and protect Indigenous peoples' rights to sustainable self-determination and effective conservation in their territories and in pursuing their own pathways to conservation and climate action. Increased funding is needed to support local communities in their efforts to sustain and rebuild livelihoods through the development of sustainable and resilient enterprises.

Innovative funding: Biodiversity is a global public good and biodiversity conservation should be funded as such. Innovative and diversified approaches are needed to ensure more resilient models of finance and management for protected and conserved areas, and dependent communities, so that they can better withstand future shocks and sustain the ecological resource base. The conservation of protected and conserved areas should be mainstreamed into every nation's central policies and decision frameworks for the production and consumption of resources. Greater investment in protected and conserved areas, and in communities as their effective stewards, would be a worthwhile insurance against future zoonotic diseases.

Set aspirational funding targets: The global community needs to be far more ambitious in terms of funding for nature, including protected and conserved areas. While developing a specific international target for funding the conservation of biodiversity will of course require research and negotiations between countries, the next Conference of Parties of the Convention on Biological Diversity could develop a target figure and promote it through the UN General Assembly. The internationally agreed target for development assistance – that economically advanced countries should aim at a net amount of 0.7 per cent of gross national product[62] – is a model that should be considered for conservation for the post-2020 Biodiversity Framework.

Strengthen the international framework for protected and conserved areas: Global treaties, notably the Convention on Biological Diversity and the UN Framework Convention on Climate Change, are fundamental in moving to a truly sustainable planet. In light of the effects of the COVID-19 pandemic, governments now need to come together under both Conventions to strengthen protected and conserved areas, so that these places can play their role in preventing future pandemics and building a recovery that benefits people and nature. A High Ambition Coalition for the upcoming Conference of the Parties of the Convention on Biological Diversity, including France, Germany and Costa Rica, is advocating for at least 30% of land and waters under protection by 2030.

WCPA commitment

The World Commission on Protected Areas (WCPA) will establish a Task Force to collect and analyse information on the impacts of COVID-19 on protected and conserved areas which will link with other work on COVID-19 by IUCN[63]. With others, we will develop, refine and promote the Call for Action. As global leaders on

protected areas[64], WCPA will develop principles and good practice for protected and conserved areas across the three phases of the response to the pandemic – rescue, recovery and rebuilding. In 2021, we will take these ideas to global policy meetings, including the IUCN World Conservation Congress, the Convention on Biological Diversity and the UN Framework Convention on Climate Change. We will collaborate on this agenda with other members of the IUCN family and promote a One Health approach to maintaining healthy ecosystems to governments, sectoral ministries, companies, human rights groups and others.

ENDNOTES

[1]*Protected area* follows the IUCN definition (Dudley, 2008). *Conserved area* is used here as an informal term to describe "areas sustaining ecological integrity and/or effective in situ conservation of nature" (Jonas & Jonas, 2019). Conserved areas include but are not limited to 'other effective area-based conservation measures' (IUCN-WCPA, 2019).

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[55]https://newsroom.wcs.org/News-Releases/articleType/ArticleView/articleId/14066/End-the-Trade-New-Coalition-Invites-Global-Community-to-Take-a-Stand-Against-Future-Pandemics.aspx

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[57]https://www.conservation.org/about/global-conservation-fund

[58]https://www.moore.org/article-detail?newsUrlName=first-trust-fund-for-brazil-s-kayapó-to-protect-vast-swath-of-amazon-rainforest

[59]https://www.ecosystemmarketplace.com/articles/disney-helps-dreams-come-br-true-in-peru-s-alto-mayo-forest/

[60]https://www.fin24.com/Opinion/opinion-the-road-to-sas-recovery-is-green-20200514-2

[61]https://www.economist.com/leaders/2020/05/21/countries-should-seize-the-moment-to-flatten-the-climate-curve

[62]UN General Assembly resolution A/RES/2626(XXV) of 24 October 1970 states (para. 43): "Each economically advanced country will progressively increase its official development assistance to the developing countries and will exert its best efforts to reach a minimum net amount of 0.7 percent of its gross national product … by the middle of the Decade."

[63]https://www.iucn.org/resources/covid-19-resources and https://civicrm.iucn.org/civicrm/mailing/view?reset=1&id=1644

[64]https://www.iucn.org/theme/protected-areas/resources/best-practice-guidelines

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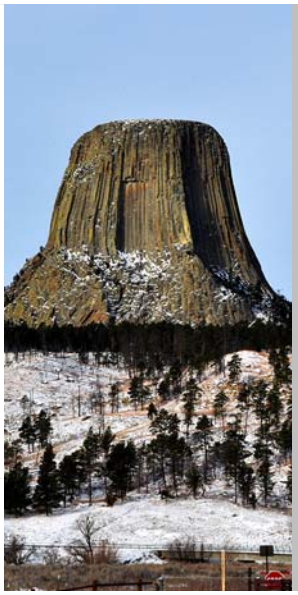
RESUMEN

La pandemia del COVID-19 está repercutiendo de manera dramática en la comunidad mundial, en la vida y la salud de las personas, en sus medios de subsistencia, en sus economías y en sus comportamientos. La mayoría de las pandemias de enfermedades zoonóticas, incluida la del COVID-19, surgen de la explotación no sostenible de la naturaleza. Este editorial especial ofrece una instantánea de cómo las áreas protegidas y conservadas de todo el mundo están siendo afectadas por el COVID-19. Para muchas áreas protegidas y conservadas, los impactos negativos en su capacidad de gestión, su presupuesto y su eficacia son significativos, al igual que las repercusiones en los medios de subsistencia de las comunidades que viven en esas áreas y sus alrededores. Ofrecemos un comentario sobre la capacidad de los sistemas de áreas protegidas y conservadas, gestionados de manera eficaz y equitativa, para formar parte de una respuesta a la pandemia que disminuya las posibilidades de que se repitan acontecimientos similares, y se construya un futuro más sostenible para las personas y la naturaleza. Concluimos el editorial exhortando a la acción para el rescate, la recuperación, la reconstrucción y la expansión de la red mundial de áreas protegidas y conservadas.

RÉSUMÉ

La pandémie de COVID-19 a un impact dramatique sur la communauté mondiale, sur la vie et la santé, les moyens de subsistance, les économies et les comportements. L' origine de la plupart des pandémies de zoonoses, dont la COVID-19, provient de l'exploitation non durable de la nature. Cet éditorial spécial donne un aperçu de la façon dont les aires protégées et conservées dans le monde sont affectées par la COVID-19. Pour de nombreuses aires protégées et conservées, les impacts négatifs s'avèrent importants au niveau de la capacité de gestion, les budgets et l'efficacité, tout comme les impacts sur les moyens de subsistance des communautés vivant dans et autour de ces zones. Nous fournissons un commentaire sur la façon dont les systèmes gérés et équitables des aires protégées et conservées peuvent faire partie d'une réponse à la pandémie, en réduisant à la fois les risques de récurrence d'événements similaires et en construisant un avenir plus durable pour les habitants et la nature. Nous concluons l'éditorial par un appel à l'action pour le sauvetage, la récupération, la reconstruction et l'expansion du réseau mondial des aires protégées et conservées.



UNDERGRADUATE CURRICULA IN THE USA, CANADA, NEW ZEALAND AND AUSTRALIA: ARE WE MISSING THE MARK ON INDIGENOUS PEOPLES AND PARKS?

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ABSTRACT

Indigenous peoples' rights increasingly demand the attention of government agents, including protected area managers in the CANZUS states (Canada, Australia, New Zealand and the USA). Park/Indigenous relations are a fundamental job competency for CANZUS park employees. This exploratory research draws on the curricula of 391 university major programmes to quantify the extent to which CANZUS university programmes in natural resources management, park management and allied fields might prepare aspiring CANZUS park employees to work with Indigenous peoples; I conclude the programmes generally fail to do so. Zero American park management majors in the study require Indigenous-focused coursework. In the Commonwealth countries, 52 per cent of park management programmes do so. Only 6 per cent of American natural resources management majors require such coursework, versus 45 per cent in the Commonwealth countries. This calls attention to an urgent need to improve aspiring park employees' understanding of how their work intersects with Indigenous peoples and settler-colonialism.

Key words: Indigenous, Canada, United States, Australia, New Zealand, Curriculum, Undergraduate, Training, Education

INTRODUCTION

As a key issue animating contemporary protected area management, the relationships between park managers and Indigenous peoples are especially important in settler states such as Canada, Australia, New Zealand and the USA (CANZUS). The United Nations Expert Mechanism on the Rights of Indigenous Peoples and the Special Rapporteur on Indigenous Rights have highlighted the need for the World Heritage Committee to respond to Indigenous concerns vis-à-vis state-run protected areas in particular (Disko & Tugendhat, 2014). Some scholars suggest a majority of the world's protected areas have been created on Indigenous people's traditional territory (Borrini-Feyerabend et al., 2004). Park managers have routinely forcibly removed Indigenous peoples from their territory for conservation (Brockington & Igoe, 2006; Dowie, 2011). Thus, unresolved issues of Indigenous sovereignty present park managers with challenges, such as:

- Working with Indigenous peoples regarding their cultural materials;
- Interpreting both Indigenous and settler heritage;
- Safeguarding sacred sites;
- Ethical inclusion of Indigenous knowledge within park management practices; and
- Responding to Indigenous aspirations to participate in park management.

This exploratory paper examines the inclusion of Indigenous-focused courses in undergraduate major programmes regarding protected area management in the CANZUS countries. I make three broad assertions in this paper. First, protected area managers' work with Indigenous peoples is a cornerstone job function and essential in their training. Second, I argue that course catalogues are valid indicators for evaluating what a programme teaches as 'fundamental'. Finally, I argue that the programmes included here, but especially the park management majors, generally fail to prepare students for working with Indigenous peoples.

NOTES ABOUT LANGUAGE

I use the terms 'major' and 'degree programme' interchangeably to refer to the entire slate of courses a student takes to earn an undergraduate degree. I use the terms 'course' and 'class' in the American sense; in New Zealand, for example, a 'course' is called a 'paper'. I use the phrase 'general education' (GE) to refer to a set list of courses from which all students on a campus must choose a certain number (sometimes referred to as a 'common core'). I only discuss American GE programmes; they are relatively uncommon in the other three countries.

I use the United Nations Permanent Forum on Indigenous Issues' (n.d.) definition of 'Indigenous' in this paper. Generally, this refers to those who "self-identify" as Indigenous and are "accepted by the community as their [the community's] member" (UN Permanent Forum on Indigenous Issues, n.d., p. 1), regardless of their legal status or recognition by CANZUS governments. I intentionally capitalise 'Indigenous' in all uses. While I recognise that not all non-Indigenous people in settler nations are voluntary settlers (e.g. descendants of enslaved people), I broadly use 'settler' and 'settler-colonist' to refer to the non-Indigenous population of the CANZUS states.

To vary word choice, I use 'park' and 'protected area' interchangeably. The International Union for Conservation of Nature (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" (Borrini-Feyerabend et al., 2013a, p. i) and recognises four major governance types. This paper is primarily concerned with types A (governance by government) and B (shared governance) within the IUCN governance matrix (Borrini-Feyerabend et al., 2013a). That said, the imperatives of working with Indigenous peoples also extend to privately-governed protected areas.

LITERATURE REVIEW

Park managers and Indigenous peoples interact across a variety of issues, including co-management, land tenure disputes, traditional/Indigenous knowledge use, sacred site management and the interpretation of Indigenous heritage. As Indigenous peoples demand greater control over parks within their traditional territories, co-management – the sharing of power among multiple actors – is increasingly common. Co-management can be defined as shared access to the resource, but not ultimate management power (Milholland, 2008); negotiation of management activities (Borrini-Feyerabend et al., 2013b); a way to balance resource protection with local needs (Thomlinson & Crouch, 2012); or an interim means of resource management preceding return of the resource to its traditional owners (Royal Commission on Aboriginal Peoples, 1996). Yet, particularly as practised in Canada, where the minister responsible for Parks Canada maintains final decision-making powers over co-managed Parks Canada sites, co-management does not meaningfully threaten the underlying settler/Indigenous power dynamic.

While exact numbers are unknown, estimates for the number of people evicted to create parks range from the low millions worldwide to 14 million in Africa alone (Brockington & Igoe, 2006; Dowie, 2011). In places where parks have not summarily removed Indigenous peoples off their land, tenure problems remain. The literature is rich with conversations about the intersection of parks and land tenure disputes (Agrawal & Redford, 2007; Sandlos, 2005, 2008, 2014).

Another locus of park/Indigenous interactions is the use of Indigenous knowledge to augment park management efforts (Houde, 2007; Jones et al., 2010; Nadasdy, 1999). One definition of Indigenous knowledge is as a relationship with and a process of learning about Creation (McGregor, 2004). It is place-based and context-specific, grounded in a process of ongoing learning and living (McGregor, 2004, 2009; Nadasdy, 1999). To paraphrase McGregor (2004), it is not something one has, Indigenous knowledge is something one does. Thus, it differs from Western epistemologies.

Approaching Indigenous communities to learn from them and then applying this knowledge in management efforts is a seemingly good thing that recognises and benefits from the longstanding relationship Indigenous peoples have with the non-human world. Attempts by agencies to engage with Indigenous knowledge within park management are laudable but should be viewed with caution, as such efforts are complicated by the need to navigate two epistemologies. Additionally, efforts to leverage Indigenous knowledge must first recognise Indigenous rights and traditional governance systems. Unless attention is given to underlying settler-colonial power dynamics (Nadasdy, 1999), Indigenous knowledge use by park managers may lead to misappropriation and/or serve only to reinforce park agencies' authority.

Two final aspects of the park/Indigenous relationship are worth mentioning. First, well-documented controversies over how to accommodate Indigenous

spiritual practices in parks run the gamut from disagreements about visitor access to agency actions that impinge upon Indigenous religions (McKercher et al., 2008; Tsosie, 2014). Park managers must be equipped to address these challenges. Recent work in this area includes Verschuuren and Brown (2019).

Second, Indigenous peoples are increasingly exercising control over their traditional territory through Community Conserved Areas (CCAs; Borrini-Feyerabend et al., 2004; Zurba et al., 2019), Other Effective Conservation Measures (OECMs; Jonas et al., 2014; MacKinnon et al., 2015) and Indigenous Protected Areas (IPAs). CCAs are regions "voluntarily conserved by Indigenous peoples and local and mobile communities through customary laws or other effective means" (Borrini-Feyerabend et al., 2004, p. xv) , while OECMs are places that have the same practical effect of conserving biodiversity but are not part of a formal protected area regime (Jonas et al., 2014).

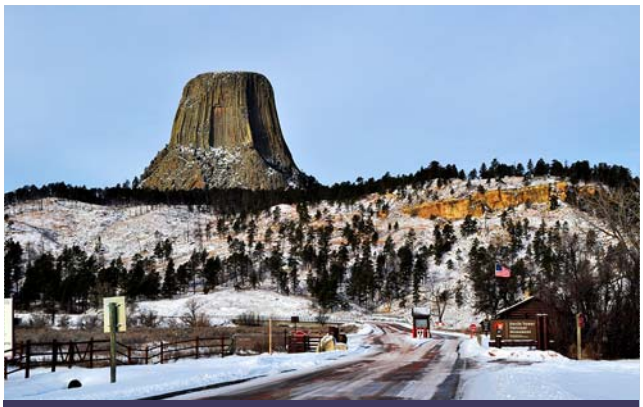
I want to give particular attention to Indigenous Protected Areas, for under the IUCN definition of IPAs, IPAs necessarily involve the state and this paper is primarily concerned with state-run and jointly-managed protected areas (Borrini-Feyerabend et al., 2004). IPAs reimagine parks as institutions governed by and responsive to Indigenous peoples. A form of "reterritorialization in the form of conservation enclosure" (Carroll, 2014, p. 36), IPAs are a tangible means for Indigenous peoples to exert sovereignty. Canada's 2018 federal budget included C$ 1.3 billion (approximately US$ 1 billion) for conservation efforts and "puts Indigenous people in charge of protecting land" (Galloway, 2018, para. 1) with dedicated funding for IPAs. In Australia, IPAs started in 1997 (Ross et al., 2009) and are a source of "pride in what has been achieved in a short time and with a small government investment" (Szabo & Smyth, 2003, p. 151). Szabo and Smyth (2003) also note the significant advantages Indigenous peoples see in Australian IPAs, including "getting Traditional Owners back on country…transferring knowledge between generations and strengthening languages…re-establishing traditional burning practices…providing training and employment…[and] promoting renewed interest about caring for the country" (p. 151). IPAs face challenges, such as the IUCN's official description of IPAs as "government designated protected area where decision making power, responsibility and accountability are shared between governmental agencies and other stakeholders" (Borrini-Feyerabend et al., 2004, p. xv). Such a characterisation, through its explicit inclusion of the state, falls short of meaningfully threatening latent settler-colonial power structures. Nevertheless, IPAs (particularly in Australia; Langton et al., 2014), are at least partially succeeding at centring and affirmatively supporting Indigenous rights and aspirations.

In sum, protected area managers and Indigenous peoples interact across a wide variety of issues. The park/Indigenous relationship is not confined to discrete geographies within the CANZUS states; this is a broad, dynamic relationship worthy of the same level of attention as one might give to other topics more commonly recognised as fundamental to the field. The remainder of this paper is an initial attempt to determine if CANZUS universities address this relationship as such.

METHODS

Many ways exist to begin a career in protected area management. Majors as diverse as park management, natural resources management and environmental studies all might qualify one for an entry-level position within a park (US Office of Personnel Management, 2016). Consequently, it can be difficult to identify which programmes to include when thinking about protected area employees' university education. One possible solution would be to restrict the study only to degrees that are expressly 'park management'. This, however, would be inappropriate as it would exclude many majors that qualify one for work within parks, such as natural resources management.

I began by identifying universities for consideration in this study (described below). Then, I reviewed each university's list of majors, screening for majors encompassing park management, natural resource management and related fields. When deciding if a specific programme should be in the study, I read through its description in the university's academic regulations and looked at the list of courses required for



Devil's Tower National Monument, USA. How can the academy prepare students to manage Indigenous sacred sites within protected areas? Notice the American flag – a visual manifestation of settler claims to Sioux territory. © U.S. National Park Service

the major. For each programme, I looked for a breadth of courses to signal the major would prepare students to work with the full complexity of natural resource and social science issues present in protected areas. To qualify for the study, majors had to demonstrate particular relevance to protected area management, regardless of their title. This means that I may have included some programmes but not others with the same title. I believe that consistency in asking if each programme offers a broad base of courses on the myriad issues present in park management, rather than a specialisation in one discipline, may help to overcome the inherent problems in a subjective approach.

For majors not specifically called 'park' or 'natural resources' management, I sorted them into one of these two categories based on their relative mix of social versus natural science courses. I believe this distinction is necessary because, again, a wide variety of degrees qualifies one to work in parks. I wanted to capture this diversity in the study while avoiding a category of 'other' (i.e. neither strictly park nor natural resource) programmes.

For the United States, I used the National Center for Education Statistics/Integrated Postsecondary Education Data System (IPEDS, US Department of Education, n.d.) to identify bachelor-degree-granting institutions. I filtered for universities appearing in the 'natural resources and conservation' or 'parks, recreation, leisure, and fitness studies' IPEDS major categories. From this (N=1,030), I sorted universities by major category (natural resources and park management), ownership (public vs. private) and IPEDS -defined size (small, medium or large; I collapsed very small and small together). This returned twelve lists of universities for each of the two major categories (Table 1). From this population (N), I drew a sample (n) valid at a 95 per cent confidence interval and a confidence level of 5. I then examined each university's list of majors. Despite IPEDS's coding of these universities as having a relevant programme, many in fact lacked these majors (Table 1) and were therefore discarded from the study.

To create a sample for Australia, New Zealand and Canada, I made a list of all universities in each country. I examined each university's website to determine if the university had majors that should be included in the study using the same criteria as in the USA. These majors were the population for my sample: Canada N=43, n=39; Australia N=71, n=60; New Zealand N=7, n=7.

Table 1. Sampling for USA universities

	Population of universities, from IPEDS (N)	Sample of universities (n)	Number of majors in study
Natural resources management, private universities			
Small	324	176	17
Medium	124	95	9
Large[1]	24	24	7
Subtotal	*472*	*295*	*33*
Natural resources management, public universities			
Small	35	35	16
Medium	94	76	35
Large	180	123	75
Subtotal	*309*	*234*	*126*
Park management, private universities			
Small	65	57	23
Medium	28	26	6
Large	4	4	2
Subtotal	*97*	*87*	*31*
Park management, public universities			
Small	11	11	5
Medium	42	38	24
Large	99	79	66
Subtotal	*152*	*128*	*95*

Partial reconstruction of the Indigenous labourers' village at Fort Vancouver National Historic Site. Until the arrival of (current) Superintendent Tracy Fortmann, the park primarily interpreted white settler heritage, despite the fort's reliance on an overwhelmingly Indigenous labour force. © Chance Finegan

After reviewing the most current course catalogue/ calendar for each university and degree programme, I read each degree's requirements. From the lists and descriptions of required and elective courses for each degree programme, the explicit mention of Indigenous peoples, settler-colonialism or imperialism was identified. I used a variety of terms when looking for mentions of Indigenous peoples (e.g. First Nation(s), Métis, Cree, Inuit, etc.). I coded courses meeting the search criteria to indicate if the classes are in-major requirements, in-major electives, or out-of-major electives. For American universities, I split GE courses into a separate code. For elective classes, I counted classes with no more than two pre-requisites. I believe a course with more than two pre-requisites is unlikely to be taken as an elective. I also excluded vocational classes, such as those in social work, education and nursing. For example, the University of Alberta's course 'Second Language Acquisition: Teaching Indigenous Languages in an Immersion Context' requires only one pre-requisite and has Indigenous content, but it is very unlikely that an aspiring park manager would enrol in this course as an elective. I recognise the arbitrary nature of such choices, but my goal was to balance the theoretically possible against the likely. Finally, settler-colonialism is distinct from other forms of colonialism (Veracini, 2010, 2015). Thus, I specifically excluded courses that appeared to cover colonialism rather than settler-colonialism.

My approach has its limitations. It does not, for example, rely on practitioners' nor communities' lived experiences to identify current shortcomings, if any, in university curricula. Additionally, course descriptions do not necessarily identify all topics covered in a class. However, course descriptions are valid indicators of the key themes a course broadly teaches. My methods mirror those used by Flores et al. (2000). Boyd et al. (2008, p. 44) argues that "ethics in geography should be embedded in every part of the curriculum". Spink and Cool (1999) and Wells et al. (2003) used a single question – "do you offer" as the primary way to measure if the content is taught in surveyed programmes. This is not dissimilar to my method of using course descriptions to uncover key areas in course content. If something is "embedded in every part…" of a degree programme, it should, I argue, be visible in at least some of the course descriptions for that programme.

RESULTS

Overall USA results

Overall, this research reveals a lack of courses about Indigenous peoples. None of the American majors in the park management category require a course that meets the search criteria for Indigenous content. Natural resource management programmes fare better, with 5.7 per cent of programmes requiring an Indigenous-focused class. Park management and natural resources management major programmes in the USA differ also by the number of programmes offering Indigenous-focused, in-major elective classes, at 9 per cent (park management) and 18 per cent (natural resources). This difference is likely linked to the major category (x^2=5.3).

USA park management results

Zero American park management programmes in the study require Indigenous-focused classes. Of the majors (31) at private universities, only one (a small university) offers in-major elective courses (2 courses). At public institutions, 10.5 per cent of universities offer elective courses: one small university ($\sum$=1) and nine large universities (mean = 5 classes). Regarding GE offerings in park management, 29 per cent of private universities offer GE courses (mean = 3.7 classes) while 82.1 per cent of the public universities do so (mean = 7.2 GE courses). Ownership (public vs. private) likely explains the different means (x^2=30.8). Although more universities offer GE classes than not, the number of GE courses at universities in the park management category, across all size and ownership combinations, is clustered at five or fewer (≤5 GE classes = 92 universities; x≥6=34).

USA natural resources management results

Overall, 5.7 per cent of American natural resources management programmes require Indigenous-focused coursework and 18.2 per cent offer elective coursework. GE courses meeting the search criteria are available at 71.1 per cent of universities in this category. Public universities offer more GE courses than private universities (79.4 per cent vs. 39.4 per cent) and this

divergence is likely linked to the different ownership (x^2=20.3).

Of the 33 natural resource management majors at private universities, only one requires an Indigenous-focused class. Six offer electives (mean = 1.2 electives). Of the private universities with relevant majors, 39.3 per cent offer GE classes.

Majors at public universities include more Indigenous-focused classes in their curricula than the private universities. Yet, the number of public majors requiring such instruction is low. Only 6.4 per cent require classes meeting the search criteria (mean = 1.9 courses). In-major elective classes are available at 18.3 per cent of public universities (mean =2.6 classes).

Public universities' GE offerings (mean = 10.4 courses) are relatively more numerous than the required or elective classes. Of public universities in the natural resources management group, 79.4 per cent offer GE classes meeting the search criteria. Variation in the number of public universities' GE offerings may be linked to changing the size of the university (x^2=8.3).
Australia results

Australia park management results

Of Australia majors (N=71; n=60), six are in park management. Indigenous-focused coursework is required in half of these. Similarly, three of the six offer Indigenous-focused elective coursework, but with a wide range of elective offerings (one, five and 24 classes among the three programmes).

Australia natural resources management results

In Australia (all majors N=71, n=60), the sample includes 54 natural resources management programmes. Of these, 42.6 per cent require Indigenous -focused courses. The results are tightly clustered (only one university requires more than three classes; 58 per cent of those with required courses offer only one). Of the majors in the natural resources category, 77.8 per cent offer elective courses. The number of elective classes is widely-distributed (Figure 1).

New Zealand results

New Zealand has eight universities. I identified seven programmes for inclusion in the study, after carefully reviewing the curricula of all New Zealand degree programmes. Of the seven majors, six are in the natural resources management category and one is park management. Half of the natural resources programmes require Indigenous-focused courses; each of these programmes requires two courses. Elective coursework is available in 77.8 per cent of the natural resources majors; the number of electives varies from five up to 42 (Figure 2). The one park management programme neither requires nor offers any classes as an elective.

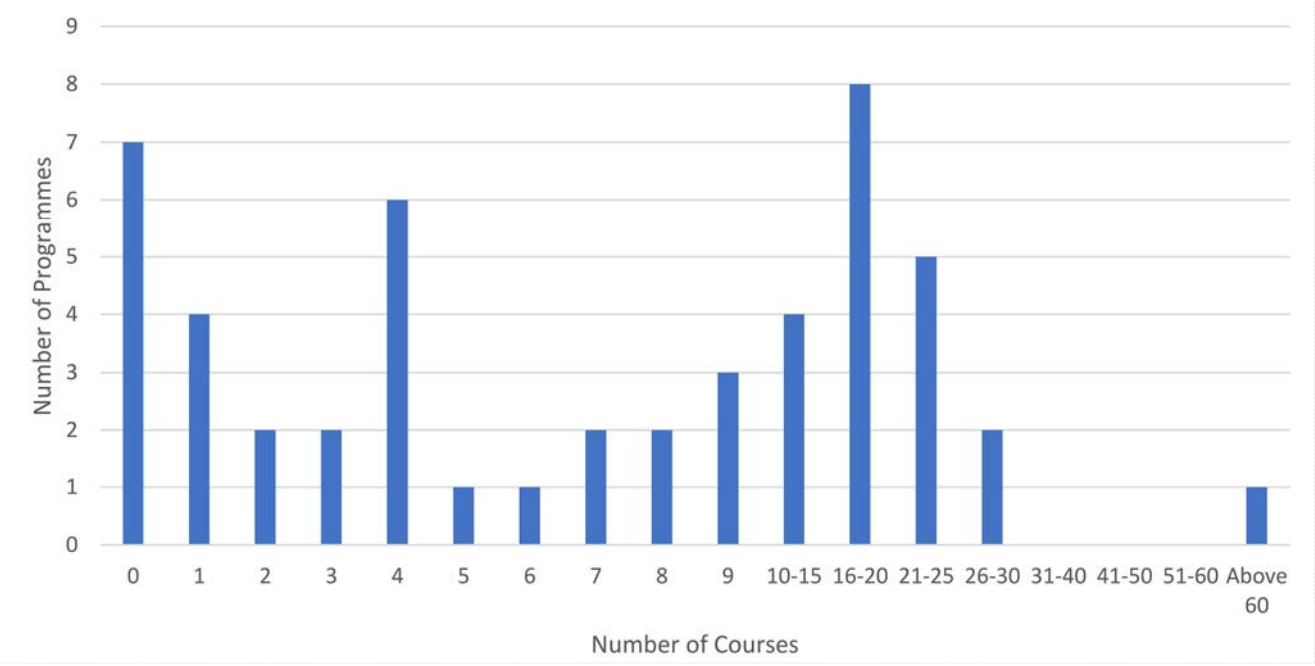


Figure 1. Distribution of elective courses with Indigenous content in Australian natural resources management programmes

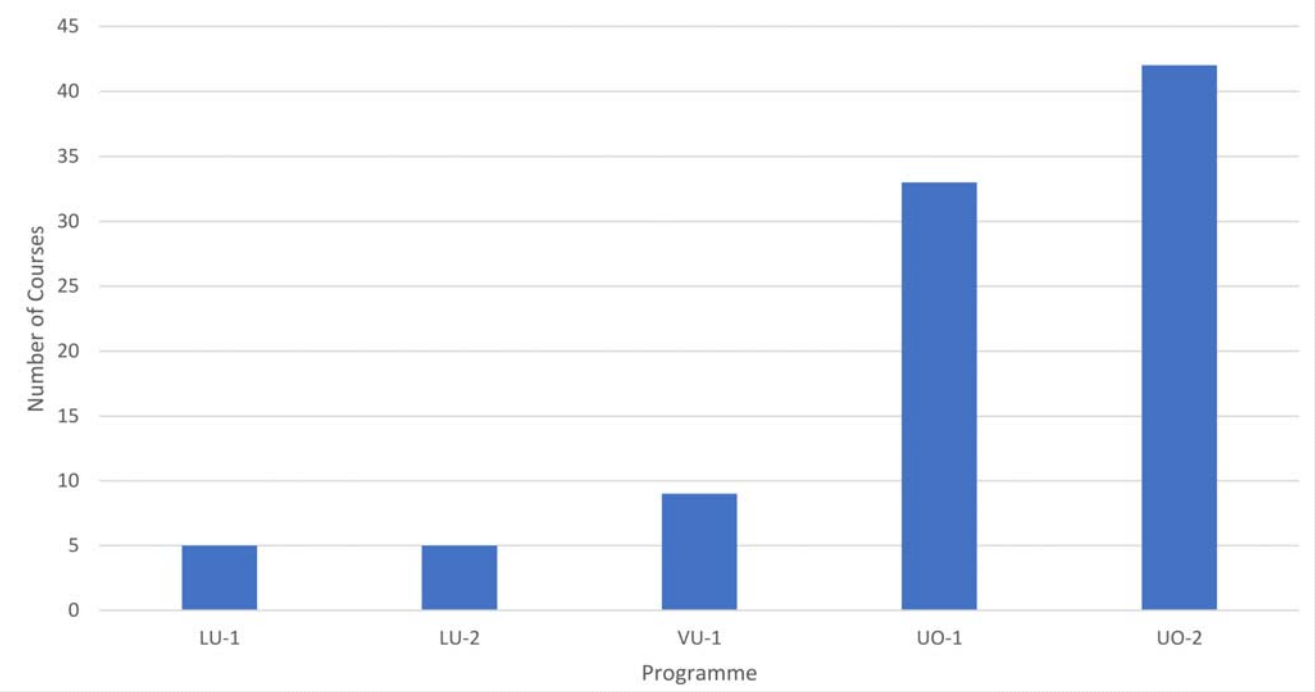


Figure 2. Distribution of elective courses with Indigenous content in New Zealand natural resource management programmes with at least one such course (LU=Lincoln University, VU=Victoria University of Wellington, UO= University of Otago)

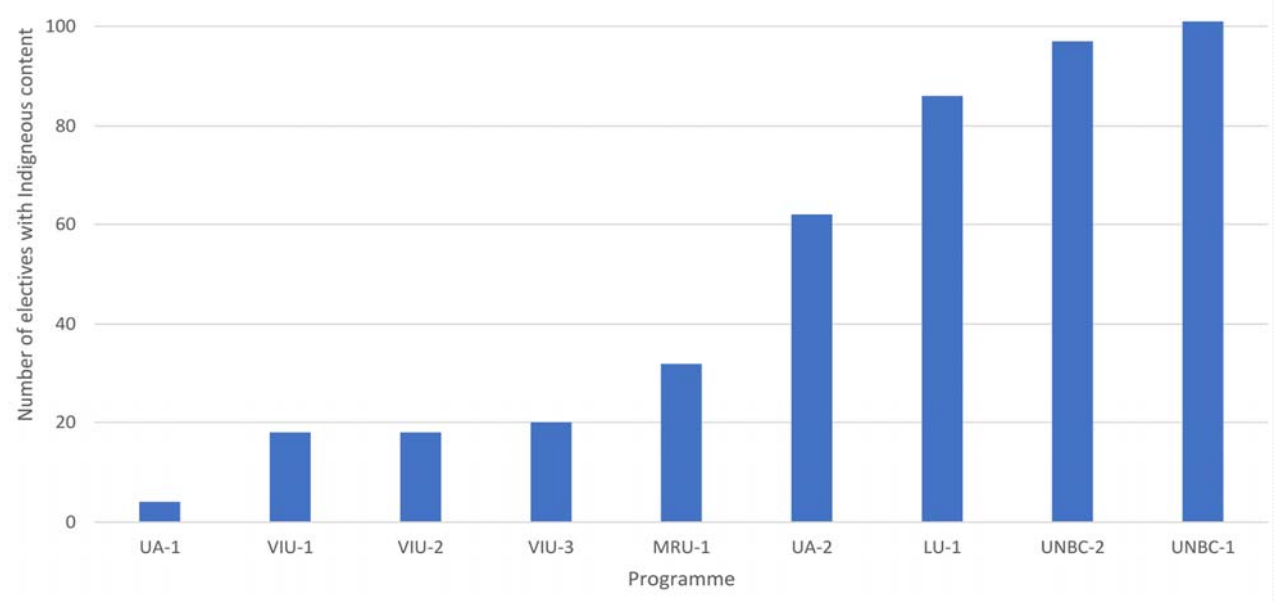


Figure 3. Number of Indigenous-focused electives in Canadian park management majors with at least one such course (UA=University of Alberta, VIU Vancouver Island University, MRU- Mount Royal University, LU= Lakehead University, UNBC= University of Northern British Columbia)

Canada results

Canada natural resources management results

In Canadian natural resources management programmes (all Canadian programmes N=43; n=39; of which 29 are natural resources), there is a noticeable inverse relationship between the size of the university and whether a major requires Indigenous-focused classes (small = 70 per cent require, medium = 42.3 per cent, large = 8.3 per cent). This variation is likely linked to the size of the university (x^2=8.9). Of the programmes that require courses, 72.8 per cent require one or two classes. Of Canadian programmes in the natural resources management category, 93.1 per cent offer Indigenous-focused elective classes (overall mean =44).

The number of electives in Canadian programmes is widely-distributed.

Canada park management results

Of the 10 park management majors in the study, six require courses. The number of required courses is at most three. Canadian elective numbers (Figure 3) are high because one's choice of electives is generally unrestricted (i.e. a student can enrol in any course across the university as an elective).

DISCUSSION

Across the CANZUS states, undergraduate park management degree programmes do not typically require students to take classes focusing on Indigenous peoples. While the numbers for the natural resources management category are better (relative to the park management category), they remain particularly poor in the USA, where only 5.7 per cent of programmes require all students to take Indigenous-focused classes. About 45 per cent of natural resources programmes in the three Commonwealth countries require such coursework. American universities are neither requiring such classes nor offering electives specific to majors at a high rate. While it is true that 70.2 per cent of the American universities in this study offer Indigenous-focused GE classes, such courses are taken at the students' discretion.

Broadly, this research demonstrates that across the CANZUS nations, students generally are left to choose if they wish to learn about Indigenous peoples. While knowledge of Indigenous history and rights is generally regarded as a necessity for park employees in the CANZUS countries, universities appear to treat preparing students to engage in this challenging, critical work as a personal choice of the student rather than as the responsibility of the institution.

As Lowman and Barker (2015, p. 34) argue, ignoring Indigenous peoples feeds "the narratives through which violent colonialism is transformed into heroic struggle and inevitable establishment of an exceptionally just, successful society". Settler-colonialism is not an abstract structure that people are no longer participating in, it is 'pervasive' and 'resilient' (Veracini, 2015, p. 1). Settler-colonialism is a set of choices and until CANZUS residents cogitate on their own, individual connections to settler-colonialism and how they benefit from and perpetuate it, it will likely not be resolved (Lowman & Barker, 2015). Therefore, undergraduate education regarding Indigeneity cannot

Cathlapotle, a contemporary plankhouse built through a Chinook Indian Nation and U.S. Fish and Wildlife Service partnership. How can the academy prepare students to leverage protected areas to support contemporary Indigenous cultural practices? © Chance Finegan

simply be a niche subject for Indigenous students. If Indigenous peoples are the only ones talking about settler-colonialism, this may "further entrench the us-and-them divide – rather than achieve advances in reconciliation and inclusion…" write Clark et al. (2017, p. 394). Failing to require students to understand how their specific major and profession will interact with Indigenous peoples, as many of the universities in this study do, is an example of such entrenchment. Not requiring this content betrays the academy's goal of inculcating 'social responsibility' through liberal education. This study reveals how, by making Indigenous-focused courses primarily optional rather than mandatory, universities advance settler-colonialism.

CONCLUSION AND FUTURE RESEARCH

This exploratory study provides a broad overview of the extent to which undergraduates seeking careers in protected areas are likely to learn about Indigenous peoples in four Anglo settler states. It reveals that learning about Indigenous peoples is optional, rather than required, for undergraduates in natural resources management and park management majors in the CANZUS countries, but most egregiously in the USA. This research highlights the lack of Indigenous content in park management majors especially.

Shortcomings of this work include that it relies on course descriptions rather than syllabi. In some categories, such as Canadian park management, there were only a handful of programmes in the study. There is no recognised measure for how much Indigenous-focused content should be in majors like these. While having a sense of the current landscape – which this study attempts to provide – is useful, without a benchmark of what is needed, these results may be less than fully useful.

Future research could use syllabi to better measure Indigenous content or focus on the quality of teaching about Indigenous issues. To address the benchmark issue, researchers should be speaking directly with Indigenous peoples and practitioners to identify what they believe aspiring park managers should learn about working with Indigenous communities. Then, one could build a good sense of the relative success of a programme in preparing students.

In the meantime, course instructors could review conference programmes (e.g. those of the Canadian Parks Conference) and IUCN World Conservation Congress resolutions to learn what topics practitioners are grappling with and then use this to build new course material. Finally, official inquiries such as Canada's Truth and Reconciliation Commission may provide insight into how universities should be teaching students about Indigenous peoples more generally.

The relationship between protected area agencies and Indigenous peoples is a key facet of contemporary park management. This exploratory research suggests a wide gap in undergraduate education regarding this topic in the CANZUS nations, where learning about Indigenous issues tends to be left to student choice, rather than be required. Yet, this is not an unsurmountable challenge – it is very much within the power of universities to broaden their curriculum to include such content.

ENDNOTES

[1] Puerto Rico's Universidad Metropolitana, which is in the IPEDS database as a 25th university, was excluded from the study.

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I live and work the traditional territory of many Indigenous nations, in what is now known as Toronto, Canada. The Anishinaabe, Haudenosaunee Confederacy, and Huron-Wendat have cared for southern Ontario for centuries. Today, Toronto is home to Indigenous peoples from across Turtle Island.

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RESUMEN

Los derechos de los pueblos indígenas exigen una atención cada vez más urgente de parte de los agentes gubernamentales, incluidos los administradores de áreas protegidas en los estados CANZUS (Canadá, Australia, Nueva Zelanda y los EE. UU.). Las relaciones entre los parques y los pueblos indígenas son parte fundamental de las competencias de los empleados de parques de los estados CANZUS. Esta investigación exploratoria se basa en 391 programas universitarios para cuantificar el grado en que los programas universitarios de los estados CANZUS en gestión de recursos naturales, gestión de parques y campos afines podrían preparar a los aspirantes a empleados de parques de los estados CANZUS para trabajar con los pueblos indígenas; concluyo que los programas generalmente no lo hacen. De acuerdo con el estudio, las especializaciones relacionadas con la gestión de parques estadounidenses requieren cursos centrados en los indígenas. En los países de la Mancomunidad, el 52% de los programas sobre gestión de parques lo hacen; solo el 6% de las especializaciones en gestión de recursos naturales en los Estados Unidos incluyen este tipo de cursos, frente al 45% en los países de la Mancomunidad. Esto llama la atención sobre la necesidad urgente de mejorar la comprensión de los aspirantes a empleados de parques con respecto a cómo se interrelaciona su trabajo con los pueblos indígenas y el colonialismo de asentamiento.

RÉSUMÉ

Les droits des peuples autochtones exigent une attention de plus en plus urgente de la part des organismes gouvernementaux, y compris des gestionnaires des aires protégées dans les pays de la région CANZUS (Canada, Australie, Nouvelle-Zélande et États-Unis). Les bonnes relations entre les parcs et les autochtones constituent une compétence professionnelle fondamentale pour les employés des parcs du CANZUS. Cette recherche exploratoire s'appuie sur 391 programmes universitaires afin d'examiner dans quelle mesure les programmes en gestion des ressources naturelles, des parcs et des domaines connexes dans les états de la région CANZUS préparent leurs futurs employés des parcs à travailler en collaboration avec les peuples autochtones. Je conclus que ces programmes faillissent à ce besoin. Aucun programme universitaire américain en gestion de parcs étudié ne requiert des cours axés sur les autochtones. Dans les pays du Commonwealth, ce chiffre est de 52 pour cent. En ce qui concerne la gestion des ressources naturelles, seulement 6 pour cent des programmes universitaires américains requièrent des modules sur ce sujet, contre 45 pour cent dans les pays du Commonwealth. Cela attire l'attention sur la nécessité urgente d'améliorer la compréhension des futurs employés des parcs sur la façon dont leur travail recoupe les peuples autochtones et le colonialisme du peuplement.

GEODIVERSITY OF KARST LANDFORMS WITH HIGH PRIORITY CONSERVATION AREAS FOR SOOTY FALCON (*FALCO CONCOLOR*) IN THE WHITE DESERT NATIONAL PARK, WESTERN DESERT, EGYPT

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ABSTRACT

This paper examines the relationship between karst landforms and biological diversity. We investigated the distribution of a migratory threatened species, the Sooty Falcon (*Falco concolor*), within different karst landform zones identified in the White Desert National Park in the Farafra Oasis, Western Desert, Egypt. Field surveys of the distribution and breeding of Sooty Falcons were conducted within different karst landforms in the White Desert National Park during September to November from 2009 to 2013. Numbers of Sooty Falcon pairs recorded in the park have ranged from 33 to 101 per annum and the species has been recorded in all years from 2009 to 2013. The number of single adults and juveniles ranges from 11 to 71, while the nestlings recorded range between 29 and 88 through the study period. Our results confirm that the distribution pattern, density and breeding success of the falcons are strongly related to solution cavities formed within tower karsts which are the home base for the species. The increased numbers in the last two years are likely related to lesser impacts of human disturbance as a result of a decrease in tourist activity in the study area due to security concerns.

Key words: White Desert, karst landforms, solution cavities, tower karst, Sooty Falcon, *Falco concolor*

INTRODUCTION

Ecosystems depend on their non-living parts such as bedrock, landforms, soils and related processes. In the early nineties, the term 'geodiversity' was first introduced by geologists as an analogue to biodiversity (Sharples, 1993; Wiedenbein, 1994). Geodiversity is known as the variety of rocks, fossils, minerals, natural processes, landforms and soils that underlie and determine the character of our landscape and environment (Dudley, 2008; Gray, 2013; Crofts & Gordon, 2014). The term biodiversity (biological diversity) means the variety of all life on Earth. It includes all living things: plants, animals, fungi, algae and bacteria. Often geodiversity provides fundamental elements for biodiversity in forming major ecosystem attributes. The variation in Earth's abiotic processes has strong effects on biodiversity patterns (Zarnetske et al., 2018). The interesting pioneer study by Anderson and Ferree (2010) drew attention to the importance of areas that represent a diversity of current abiotic conditions and that will likely provide the diversity of environments needed to support future biodiversity, even if the climatic conditions and species in those areas change.

Although the Middle East supports a high level of avian biodiversity, few detailed studies have been conducted on the ecology of species that use the region. Despite its restricted breeding distribution in the Middle East, and apparent unfavourable conservation status, little is known about the population ecology of the Sooty Falcon (*Falco concolor*) (McGrady et al., 2015).

The Sooty Falcon is a small to medium sized migratory species, which breeds in mountainous desert areas with canyons and cliffs, across eastern North Africa, from eastern Libya through Egypt and Jordan, to the coasts of the Red Sea and Arabian Gulf, through the Middle East to southwest Pakistan in summer (Walter, 1979a, b; Cramp & Simmons, 1980; Del Hoyo et al., 1994; Gaucher et al., 1995; Jennings, 1995; Semere et al., 2008; McGrady et al., 2019). Recently they have been recorded nesting in Iran (Fahimi & Jowkar, 2010; Kashfi et al., 2019). In the non-breeding season (winter),

they are predominantly found in Madagascar (Javed et al., 2011). No surveys have been conducted to establish their distribution in the Western Desert before. The objective of this study was to assess whether the geodiversity in White Desert National Park influenced Sooty Falcon distribution patterns.

Sooty Falcon (*Falco concolor*) in flight ©Mohamed Gebrel

STUDY AREA

The White Desert National Park occupies the northern part of the El Farafra Depression, Western Desert, New Valley Governorate, Egypt. It covers an area of about 3,010 km2 (Figure 1) and was declared to protect the desert ecosystems, karst landforms and spectacular scenery and erosional features in the chalky limestones. It is listed as IUCN category II - National Park based on the management objectives.

The exposed rocks in the Bahariya-Farafra territories are sedimentary in nature and can be classified into two types, karst and non-karst rocks (El Aref et al., 2017a). The first type includes the carbonate rocks of the El

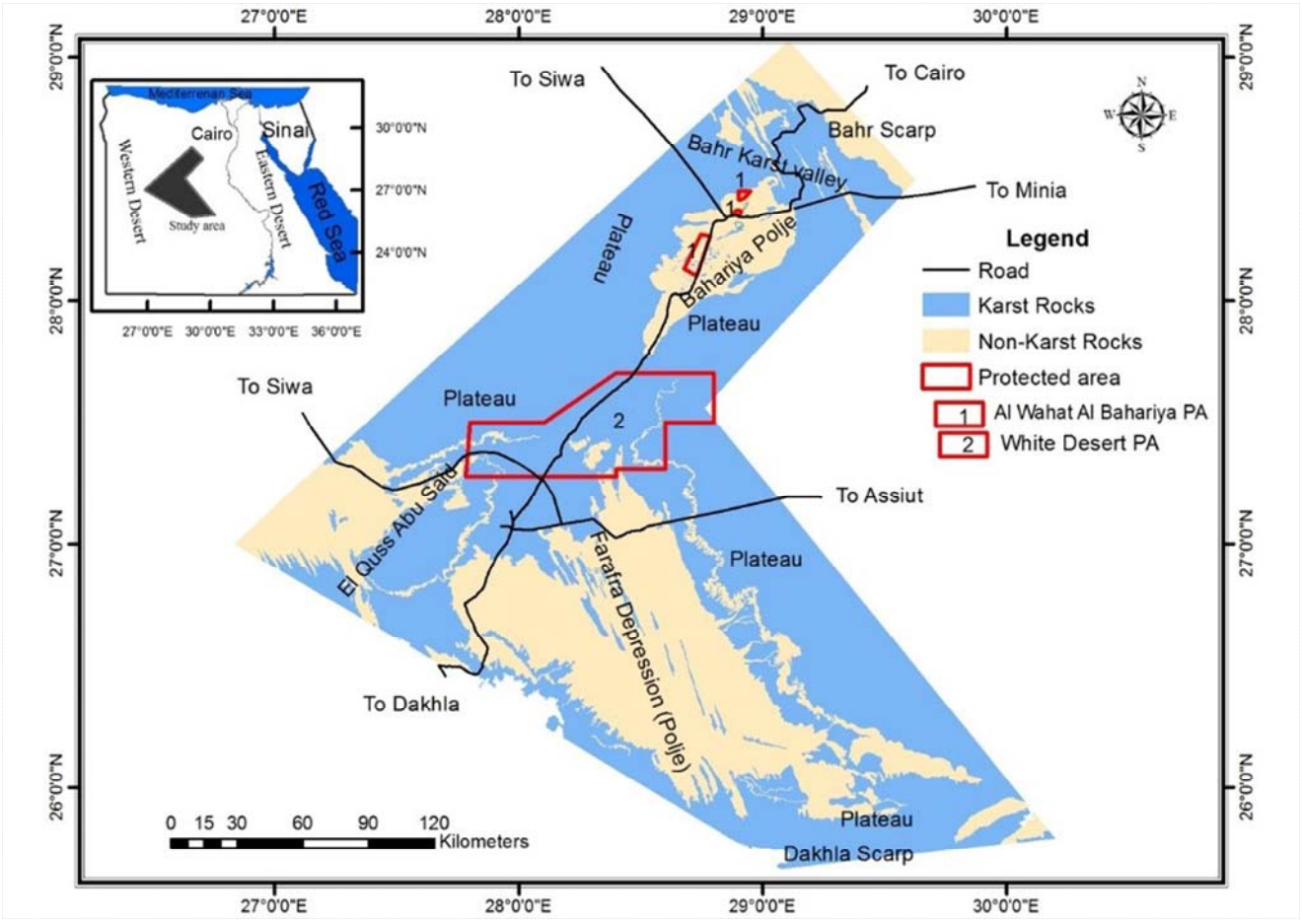


Figure 1. Map of the study area including protected areas Note the distribution of karst and non-karst rocks (after El Aref et al., 2017a)

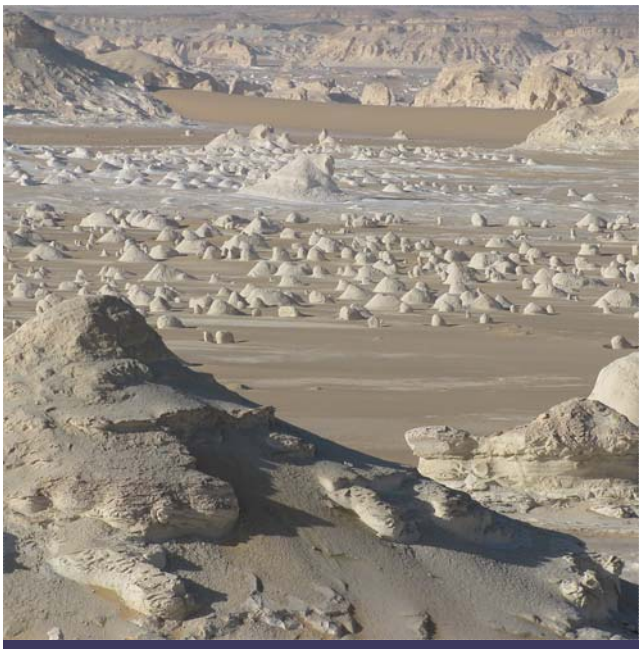
Hefhuf, Khoman Chalk, Tarawan and Naqb formations of the Campanian, Cretaceous, Palaeocene and Eocene ages respectively. Non-carbonate rocks include the Bahariya, Wadi Hennis, Dakhla and Esna formations of the Cenomanian, Cretaceous and Palaeocene ages in addition to sand dunes of the Quaternary period covering a huge area.

METHODS

The annual survey began in 2009 as part of an inventory of the geological heritage in a unique area of the White Desert National Park to record geosites (El Aref et al., 2017b). The survey was conducted annually from September to November from 2009 to 2013. During these surveys, direct observations of the Sooty Falcon identified pairs of birds, individuals and nesting location with GPS locations noted. We systematically followed the same GPS routes used in the first year to monitor the whole national park in the following years.

RESULTS

The results of the mapping identified twelve karst zones (Figure 2).



Protection of karst landforms, White Desert National Park, Egypt ©Ahmed Salama

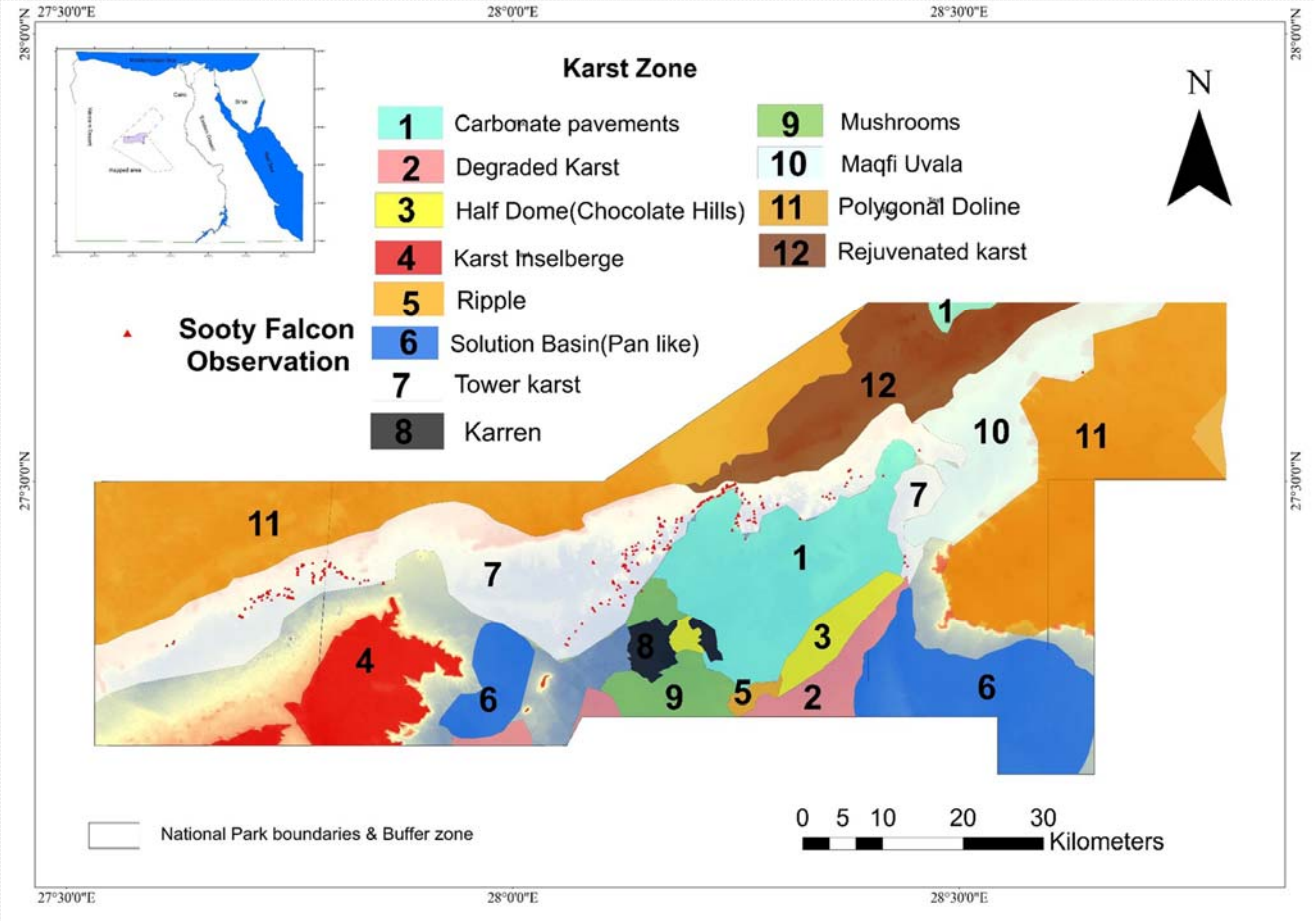


Figure 2. Zonation map of karst landforms in the White Desert National Park (modified after El Aref et al., 2017a)

Carbonate pavements zone

This field covers an area of about 402 km2 in the northern part of El Farafra Depression (Figure 2). Small -scale structurally controlled grikes of rectangular shape develop along crosscutting fractures and faults (Figure 3a).

Degraded karst zone

Typical degraded karst chalk and limestone scenery of the White Desert, showing eroded remains of all shapes and sizes, creating a spectacular and amazing landscape of outstanding natural beauty (stone art), which has made the region a globally renowned tourist site (Figure 3b). This 1,129 km2 field represents the main destination for visitors to the national park

Polygonal half-dome zone

This field (about 76 km²) encompasses a compound of symmetrical half-dome hills (up to 5 m in diameter and 5 m high) like chocolate balls (Figure 3c), formed of Cretaceous chalks in the lower levels and white silty chalky Quaternary playa sediments in the upper levels.

Karst isolated inselbergs

Many carbonate inselbergs are distributed over the floors of El Farafra Depression (such as El Quss Abu Said Plateau and Gebal Gunna) (Figure 3d), both inselbergs are located in the buffer zone of White Desert National Park.

Polygonal ripple or cuesta-like zone

This zone (about 15 km2) consists of asymmetrical small ridges forming a ripple or cuesta-like range between 0.5 and 2 m in length, 1 to 3 m width and 1 to 3 m in height, with a steep slope on one side and a gentle slope on the other (Figure 3e).

Polygonal solution basins (pan-like) zone

This zone is located at the pediments of the eastern and western Farafra scarps. It is formed of small-scale and closely spaced chalky rounded hills topped by a hard dolomitic cap of pan-like shape having well developed outlets running downwards through solution channels disappearing into solution sinks commonly distributed in the surrounding lowlands (Figure 3f).

Polygonal tower karst zone

This zone covers an area of about 884 km2 delineating the northern scarp of El Farafra Depression (Figure 2). The Cretaceous chalks form spectacular steep sided and high-standing tower forms together with variable varieties of smaller-sized pedestal rocks, and smooth cylindrical pinnacles. The walls of karst towers are characterised by the association of trittkarren (armchair -like or heelprint shape) and small-scale solution cavities. This zone represents one of the most attractive habitats for Sooty Falcons (Figure 4a).

Karren zone

These zones demarcate nearly flat areas, some of which are characterised by a wide distribution of round and dish-shaped hollows (kamenitza), developed on gently sloping sides or along fractures (Figure 4b).

Mushroom zone

This zone covers an area of about 244 km2 in El Farafra Depression, dominated by irregularly distributed short mushroom-like solution columns having a stem or neck and cap. The cap is larger than the stem that supports it. They stand in isolation above the depression floor (Figure 4c). This zone is easily accessed by visitors by an asphalt road.

Polygonal solution dolines

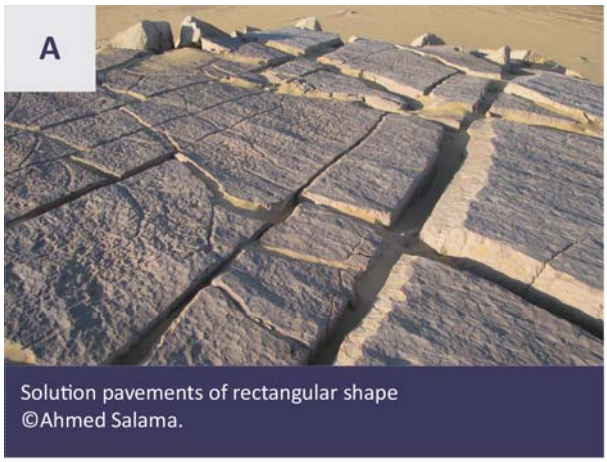
The Early Eocene carbonate of the eastern and western plateau of El Farafra Depression are commonly pitted by dense populations of solution dolines of variable diameters, rimmed by thin walls dissected by solution channels (runnels, grooves). The dolines are surrounded by connected or disconnected ridges (Figure 4d) and commonly incised by dry blind valleys.

Maqfi uvala zone

This lies in the north-eastern part of El Farafra Depression and was excavated within the Tarawan, Esna and Farafra formations of the Palaeocene – Early Eocene period. The floor of the uvala is covered by very hard recrystallised marmorised limestones (Figure 4e).

Rejuvenated karst

This zone is located on the plateau between Bahariya and Farafra Depression, covering an area of about 401 km2 known as Qaret El Sheikh Abdallah and the associated 'Crystal Depressions'. It exhibits an amazing complex of karst landforms generated during periods of uplifting and karstification. The rejuvenated karst features include widened joints, sinkholes, collapse breccias, subsurface channels and caves (Figure 4f). These solution features are partially or completely filled by a variety of autochthonous and allochthonous palaeo-cave sediments.



Solution pavements of rectangular shape ©Ahmed Salama.

Karst isolated inselbergs - Panoramic view of Gebal Gunna north ©Ahmed Salama.

Rabbit-like shape in chalk limestone ©Ahmed Salama.

Cuesta-like ripple ©Ahmed Salama.

Half-dome symmetrical forms (like chocolate balls) ©Ahmed Salama.

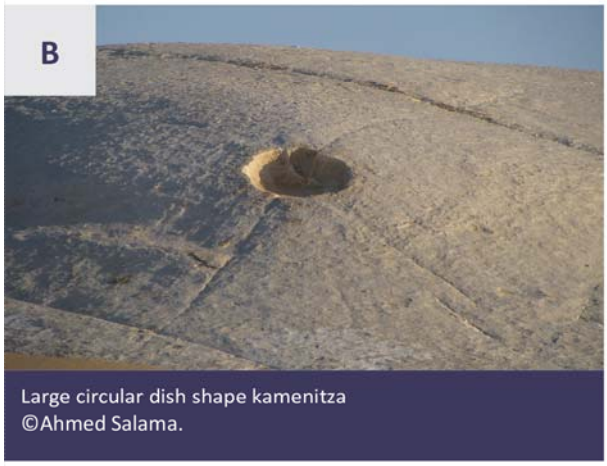
Solution basin with pan-like shape ©Ahmed Salama.

Figure 3a. to 3f. Karst zones mapped in White Desert National Park.

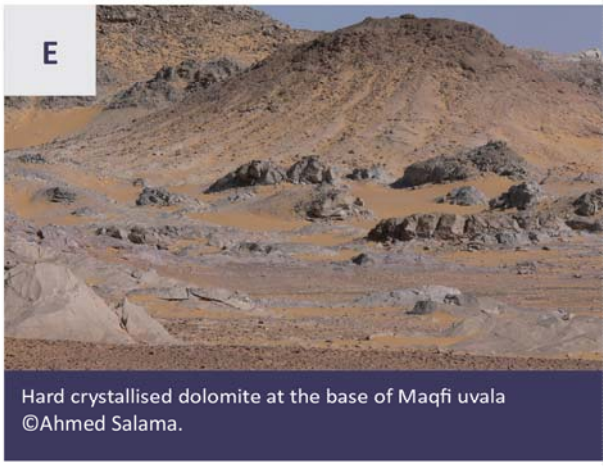
3a. Carbonate pavements zone; 3b. Degraded Karst zone; 3c. Polygonal half-dome zone; 3d. Karst isolated inselbergs; 3e. Polygonal ripple or cuesta-like zone; 3f.Polygonal solution basins (pan-like) zone

A pair of juvenile Sooty Falcons in a cavity in a carbonate tower karst ©Mohamed Gebrel.

Google Earth photo showing solution dolines



Large circular dish shape kamenitza ©Ahmed Salama.



Hard crystallised dolomite at the base of Maqfi uvala ©Ahmed Salama.

Mushroom shape ©Ahmed Salama.

Grain-supported in-situ breccia invaded by red soils ©Ahmed Salama.

Figure 4a. to 4f. Karst zones mapped in White Desert National Park.

4a. Polygonal tower karst zone; 4b. Karren zone; 4c. Mushroom zone; 4d. Polygonal solution dolines; 4e. PMaqfi uvala zone; 4f.Rejuvenated karst

Juvenile Sooty Falcon roosting in solution cavities in the tower karst zone ©Ahmed Salama

Sooty Falcon observations in the karst zones

The number of Sooty Falcon pairs recorded in the White Desert National Park ranges from 33 to 101 per annum (Table 1) over the years from 2009 to 2013. The number of single birds (adults and juveniles) ranges from 11 to 71, while occupied nests range from 29 to 88 per annum. The trend has been one of gradual increase in the number of breeding pairs in the park over the period of the survey (Table 1).

The increased numbers in the last two years may be related to low levels of human disturbance as a result of a fall in tourist activities in the study area due to security concerns. The majority of Sooty Falcons were observed in the tower karst zone, except for a few that were seen in the carbonate pavements zone.

Our field survey shows that Sooty Falcon communities live and build their nests in solution cavities of very high

Table 1. Direct observations of Sooty Falcons (pairs, singles and nestlings) in the karst zone

				Karst Landform assemblages											
Year	Pairs	Single	Nestling	CP	DK	HD	KI	R	SB	TK	K	M	MQU	PD	RE
2009	34	20	30	✓	x	x	x	x	x	✓	x	x	x	x	x
2010	33	11	29	x	x	x	x	x	x	✓	x	x	x	x	x
2011	81	36	58	x	x	x	x	x	x	✓	x	x	x	x	x
2012	101	71	88	x	x	x	x	x	x	✓	x	x	x	x	x
2013	101	71	88	x	x	x	x	x	x	✓	x	x	x	x	x
Mean	70	41.8	58.6	X = not recorded						✓ = recorded					

CP=Carbonate Pavements, DK=Degraded, HD=Half Dome, KI=Karst Inselbergs, R=Ripple, SB=Solution Basin, TK=Tower Karst, M=Mushrooms, MQU= Maqfi Uvala, PD=Polygonal Doline, RE=Rejuvenated

steep tower karsts up to 55 m in height on the northern scarp of El Farafra Depression. These solution cavities are the main nesting habitat for Sooty Falcons in the White Desert National Park.

CONCLUSIONS AND RECOMMENDATIONS

In spite of the White Desert National Park not being rich in elements of biological diversity due to the hyper aridity of the area, the diversity of karst landforms provides the basis for a diversity of species. A similar observation was reported by Anderson and Ferree (2010) who concluded that unique cave and karst features that are formed in limestone regions are host to a unique set of species found only on these landforms. The classification of karst landforms provides markedly different environments for the development of specific habitat types from limestone pavements to tower karst. One significant species to make use of karst landforms is the Sooty Falcon, a migratory, near-threatened species. We suggest that Sooty Falcons favour the tower karst zone for different reasons: firstly, the high topographic features of this zone may be the most important factor influencing the distribution of Sooty Falcons in the area by providing elevated nesting areas. Secondly, cavities and caves protect their nests from predation. Thirdly, the tower karst zone is located in areas that are not accessible to visitors due to security concerns. The other eleven types of karst zone may not be suitable because of lower elevation and the absence of protected cavities or caves. In addition, these lower elevation areas are very easily accessible, therefore disturbance by visitation would be higher. Similar trends have also been noted in the study of McGrady et al., (2019) on the Daymaniyat Islands of Oman which concluded that the number of Sooty Falcon breeding pairs on islands accessible to humans are less than half those on inaccessible islands. We recommend restricting tourist visits during the breeding season of Sooty Falcon in important zones for this species. It is essential to consider the protection of the karst landform zones when updating the management plan for White Desert National Park.

ABOUT THE AUTHORS

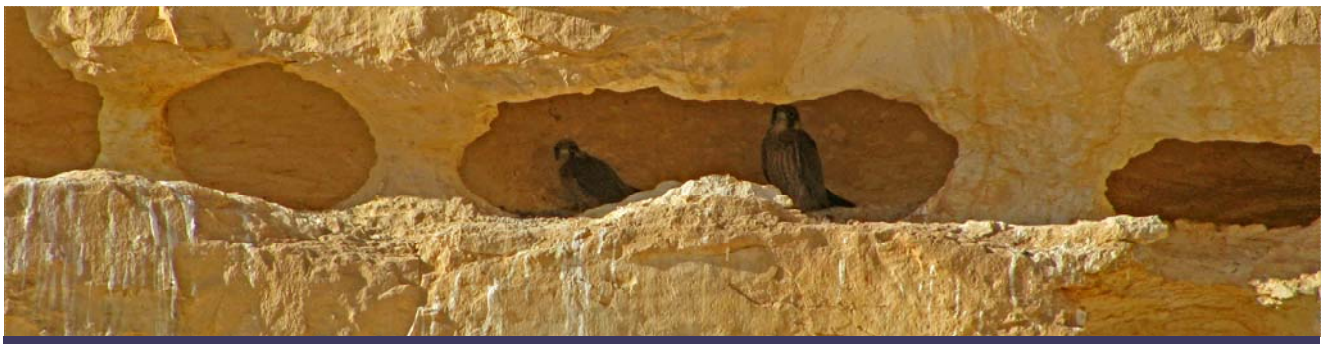
Ahmed Salama graduated from Cairo University with a BSc, MSc and PhD in geology. He has worked for 26 years in the management and planning of protected areas in Egypt. He is former Head of the Nature Conservation Sector and General Manager of Western Desert Protected Area in the Egyptian Environmental Affairs Agency, Ministry of Environment. He was responsible for the management of 30 protected areas and biodiversity. Ahmed is now working as adviser to the Chief Executive Officer of the Egyptian Environmental Affairs Agency for Nature Conservation.

Mortada M. El Aref is a Professor of ore geology in the Geology Department, Faculty of Science, Egypt. Dr El Aref sits on and chairs several councils and committees belonging to the Higher Ministry of Education, the Ministry of Petroleum and Mineral Resources and the Ministry of State of the Environment. He is a pioneer of karstology and karst landscape, processes and related deposits in Egypt.

Mohamed Saleh is associate professor of structural geology in the Geology Department of Cairo University. He has over 26 years' experience in the field of structural geology, field mapping and GIS and remote sensing applications.

Wael Thabet has an MSc in Geology from Menoufia University and he worked as environmental researcher at the White Desert National Park from 2008 to 2016. Now Wael is the Director of El Wahat El Bahariya Protected Area.

Mohamed Gebrel completed a PhD degree at the Faculty of Agriculture, Minia University, and he now works as an environmental researcher in White Desert National Park since 2008 and is responsible for monitoring the fauna in the park.



Connected solution cavities of different shapes host pairs of Sooty Falcons ©Wael Thabet

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RESUMEN

Este artículo examina la relación entre los accidentes geográficos kársticos y la diversidad biológica. Investigamos la distribución de una especie migratoria amenazada, el halcón pizarroso, *Falco concolor*, dentro de diferentes zonas de relieve kárstico identificadas en el Parque Nacional del Desierto Blanco en el Oasis de Farafra, Desierto Occidental, Egipto. Los estudios de campo de la distribución y cría del halcón pizarroso se llevaron a cabo dentro de diferentes formas de relieve kárstico en el Parque Nacional del Desierto Blanco durante septiembre a noviembre de 2009 a 2013. El número de parejas de halcones pizarrosos registrados en el parque ha oscilado entre 33 y 101 por año y la especie ha sido registrada en todos los años desde 2009 a 2013. El número de adultos solteros y juveniles varía de 11 a 71, mientras que los pichones registrados varían entre 29 y 88 durante el período de referencia. Nuestros resultados confirman que el patrón de distribución, la densidad y el éxito reproductivo de los halcones están estrechamente relacionados con las cavidades de disolución formadas dentro de las torres kársticas, que constituyen el emplazamiento de la especie. El incremento del número en los últimos dos años probablemente esté relacionado con un menor grado de perturbación humana como resultado de la disminución de la actividad turística en el área de estudio debido a consideraciones de seguridad.

RÉSUMÉ

Cet article examine la relation entre les reliefs karstiques et la diversité biologique. Nous avons étudié la distribution d'une espèce migratoire menacée, le faucon fuligineux, Falco concolor, dans différentes zones de relief karstique identifiées dans le parc national du désert blanc dans l'oasis de Farafra, désert occidental, en Égypte. Des relevés sur le terrain de la distribution et de la reproduction des faucons fuligineux ont été menés dans différents reliefs karstiques dans le parc national du désert blanc de septembre à novembre de 2009 à 2013. Le nombre de couples de faucons fuligineux enregistrés dans le parc a fluctué entre 33 et 101 par an et les enregistrements ont été effectués chaque année de 2009 à 2013. Au cours de la période d'étude, le nombre d'adultes et de jeunes isolés varie de 11 à 71, tandis que les oisillons enregistrés varient entre 29 et 88. Nos résultats confirment que le modèle de distribution, la densité et le succès de reproduction des faucons sont fortement liés aux cavités de solution formées dans les karsts à tour qui sont l'habitat d'origine de l'espèce. L'augmentation du nombre de faucons au cours des deux dernières années est vraisemblablement imputable à l'impact réduit des perturbations humaines dans la zone d'étude suite à une diminution d'activité touristique en raison de préoccupations d'ordre sécuritaires.

ENVIRONMENTAL FUNDS TO SUPPORT PROTECTED AREAS: LESSONS FROM BRAZILIAN EXPERIENCES

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ABSTRACT

Despite the recent initiatives to create private environmental funds to support finance for the Brazilian Protected Areas System, this subject is still poorly studied. This article aims to systematically analyse key aspects of the establishment and operation of nine private funds for protected areas in Brazil: their financing priorities; legal, financial and governance structures; and accountability procedures. The analysis was based on data collected from academic articles, documents, annual reports and structured email questionnaires with representatives of protected area funds. In addition, we assess the level of compliance with environmental funds practice standards regarding asset management, governance structure and accountability procedures. Altogether, the funds mobilised R$583 million (Brazilian currency) or US$138.8 million in the 2003–2015 period to support 197 PAs in the Amazon and the Atlantic Forest, over an area of 807,000 km². There is a diversity of institutional structures and innovative arrangements to raise funds from the national business sector, international donors, and to increase public investments in protected areas. The governance structure and accountability processes were found to be major deficiencies in the environmental funds' operations. From the systematic analysis of Brazilian protected area funds, the article presents some refinement of environmental funds' best practice guidelines.

Key words: protected areas, financing mechanisms, private environmental funds, Brazil

INTRODUCTION

Although the establishment of protected areas (PAs) is considered the main strategy adopted by countries to conserve natural ecosystems, the resources available for PA establishment and adequate management fall short of their needs (Emerton et al., 2006; Bovarnick et al., 2010). In Brazil, the reality is no different. The significant efforts to expand the Protected Areas National System (SNUC) (Jenkins & Joppa, 2009) were not accompanied by a sufficient increase in the budget allocated to these areas (WWF-Brazil, 2018; Machado et al., 2019), and a significant funding gap persists (MMA, 2009; Bovarnick et al., 2010).

This underfunding compromises the allocation of human resources, infrastructure and equipment, and the realisation of basic activities for effective biodiversity protection, since the provision of sufficient, stable, long-term funding is essential for PAs to function effectively and to achieve conservation outcomes (Bonham et al., 2014; WWF-Brazil & Funbio, 2017).

Given Brazil's large area and rich biodiversity, achieving the conservation goals established in global agreements such as the Convention on Biological Diversity and the Sustainable Development Goals requires a significant amount of resources. Since the main funding sources for PAs in Brazil (public budgets and international cooperation) have decreased over the years (Young & Bakker, 2016; WWF-Brazil, 2018; Machado et al., 2019), it is necessary to explore new sources and financing mechanisms, especially through strategic public–private partnerships (World Bank, 2013).

Environmental funds are considered an important financing mechanism to be part of the sustainability plan of PA national systems and to provide long-term financing (Emerton et al., 2006; Spergel & Taieb, 2008; Bonham et al., 2014; CFA, 2014). Private PA funds or Park funds often finance part of the operational and/or establishment costs of a PA individually or a country PA (sub)system, as well as sustainable development and conservation programmes in PA buffer zone communities (Spergel & Taieb, 2008; Spergel & Mikitin,

2013; CFA, 2014). In many countries, PA funds, besides raising and generating considerable long-term resources, have demonstrated the capacity to increase government investments in PAs (Oleas & Barragán, 2003; CFA, 2014).

In the past two decades, some Brazilian nongovernmental organisations (NGOs) have established, in partnership with public environmental agencies, private funds to finance PAs in the long term (Funbio, 2014; Conservation International-Brazil, 2015; FAS, 2016; SOSMA Foundation, 2017). Although this strategy is in evidence, the literature about Brazilian private PA fund experiences is scarce. With the exception of the Brazilian Biodiversity Fund (Funbio), no Brazilian PA fund has participated in international assessments (GEF, 1998; Spergel & Taieb, 2008; Mathias & Victurine, 2018).

The objective of this article is to systematically analyse key aspects of the institutional arrangements and operation of Brazilian private PA funds and discuss if they are in line with environmental fund best practice principles as recommended in the literature (GEF, 1998; Spergel & Mikitin, 2013). In addition, we assess the PA funds' level of compliance with Conservation Finance Alliance (CFA) guidelines and provide recommendations to improve their management.

METHODS

In order to understand the concept of environmental funds we reviewed the literature on their key institutional and operational elements. Based on the methodology used by Barcellos (2015) to analyse environmental funds for indigenous lands in Brazil, we examined nine private PA funds considering the following key aspects: financing priorities; legal structure; financial structure; governance structure; and accountability procedures.

The PA funds analysed were: 1) Transition Fund of the Amazon Region Protected Areas Program (ARPA TF), 2) Amazonas Sustainable Foundation (FAS), 3) Rio de Janeiro Atlantic Forest Fund (FMA/RJ), 4) Atol das Rocas Fund, 5) Guanabara Fund, 6) Costa do Corais Environmental Protection Area Fund, 7) Cagarras Islands Fund, 8) Juatinga-Cairuçu Fund and 9) Amapá Fund, located in three of the five geographical regions of Brazil.

We collected data from scientific articles, documents and fund reports, especially those available on the internet. Representatives of the PA funds provided additional information through a structured email questionnaire.

To assess the level of compliance of the PA funds with CFA guidelines (Spergel & Mikitin, 2013), we used a three-level scoring scale (strong, moderate and weak), proposed by Thuault et al. (2011) to evaluate the governance of forest funds in the Brazilian Amazon. A 'strong' score refers to full compliance with the guidelines. A 'moderate' score signifies partial compliance. A 'weak' score refers to insufficient compliance or non-compliance with the guidelines. We assessed seven guidelines related to asset management, governance structure and accountability processes.

KEY ELEMENTS OF ENVIRONMENTAL FUNDS

The first environmental funds emerged in the early 1990s and since then many new funds have been created in over 50 developing countries (GEF, 1998; 2019; Spergel & Taieb, 2008). According to the literature, there is no typical environmental fund. However, all of them have one thing in common: acting as intermediaries to finance medium and long-term public interest agendas (GEF, 1998; Spergel & Taieb, 2008).

Barcellos (2015, p. 55) conceptualises socio-environmental funds as "organizations created to act as intermediaries between donor and grantees, promoting the contribution of public or private resources to

Waterfall at Tijuca National Park © Patricia Ferreti

implement collective initiatives (projects and programmes), that take into account environmental, social and economic aspects".

Protected areas are among the various recipients that environmental funds can finance. Environmental funds created with the purpose of financing a particular PA or a PA (sub)system are defined as a Protected Area Fund or Park Fund. Besides operating financing mechanisms for conservation, private environmental funds have played a key role in defining national conservation strategies, and promoting public–private partnerships to develop efficient and innovative management strategies for conservation. The key attributes that distinguish one fund from another are related to legal, financial and governance features (GEF, 1998; Bayon et al., 1999; Oleas & Barragan, 2003; Spergel & Taieb, 2008), which are discussed below.

Financing priorities

The financing priorities delimit the object(s) of the financing, the target area for which the financing is available, and lines of action of each environmental fund. This is a very important element to plan funds' resource mobilisation, management and delivery (Barcellos, 2015). PA funds typically finance a portion of long-term management costs and/or the establishment costs of specific PAs, or of a country's entire PA system. Sometimes, PA management costs can also include financing for alternative livelihoods or sustainable development activities in PA buffer zone communities. In principle, salaries of PA staff should be a government responsibility, but in practice, some governments may lack sufficient resources to pay salaries, and PA funds may have to fill this gap (Spergel & Taieb, 2008).

Most PA funds are not sufficiently large to support all PAs in their country's PA system. Therefore, PA funds or the PA management agencies must prioritise which PAs should be supported. However, there can be a bias toward donors' priorities. In Brazil, for example, most external funding is directed to the Amazon region, whereas significantly fewer resources are dedicated to other threatened biomes, such as the Cerrado and Caatinga, with a much lower international appeal (Young & Castro, 2017).

Legal and financial structure

The definition of an environmental fund's legal status depends on the legal system of the country where it was created. In Common Law system countries, private environmental funds have been set up as trust funds. A trust is a legal arrangement in which assets (grants or other donor funds) are managed by another individual or legal entity, called a trustee, for the benefit of the donor or third party beneficiaries. In Civil Law countries, including Brazil, where there is no legal basis for the establishment of trust funds, environmental funds are established as non-profit civil organisations, usually as foundations (GEF, 1998; Spergel & Taieb, 2008).

In addition, in Civil Law countries, there are cases where environmental funds do not have a separate legal status, being subject to an incubation process. In this process, the environmental funds functions as a sector or department of a formally established civil organisation, which provides support to enable its operation. The support offered includes the provision of physical and administrative infrastructure, operational and financial management, and compliance with standards and contracts. Sometimes, this process aims to support the organisational arrangement for a period, with the hope that the environmental funds operates independently later on. Incubation processes are formalised through a contract between the incubator organisation and the different actors involved in this process, which include the fund's donors and beneficiaries (Barcellos, 2015). Moreover, environmental funds can be established by national/subnational law or decree (Norris, 2000).

The financial structure of environmental funds encompasses issues related to funding sources, financial operations and the asset management policies adopted by them. The sources of funding directly influence the operational prospects of environmental funds, reflecting on their governance aspects, management structure, operational costs, financial management strategies and on their possibilities of transferring funds to grantees (Geluda, 2010; Serrão, 2014).

Each funding source has characteristics and specificities that should be considered on a case-by-case basis. Therefore, it is recommended that environmental funds diversify their funding sources and prepare themselves institutionally to carry out the responsible management of the funds raised (Serrão, 2014). Regarding financial strategy, the literature usually identifies three typologies of funds (GEF, 1998; Serrão, 2014):
(a) Cash/sinking fund – the capital and the investment income are disbursed each year over a defined period until they sink to zero;
(b) Endowment fund – preserves the capital and only the investment income is used to finance grants and activities;
(c) Revolving fund – is replenished on a regular basis (usually through fees and taxes) to be used for specified purposes. A proportion of the revenues can be set aside to create an endowment.

Costa dos Corais Environmental Protection Area © Patricia Ferreti

Any environmental fund can combine these different strategies within its overall financial structure (Norris, 2000; Mathias & Victurine, 2018).

The asset management of an environmental fund is an important aspect to ensure its success in achieving its objectives and its long-term sustainability (Norris, 2000). For this reason, environmental funds often adopt asset management policies considering their investment objectives, donor requirements and the local economic context. The CFA recommends that a financial agency or an external and specialised investment adviser perform the asset management supervised by a governing board or a financial committee (Spergel & Mikitin, 2013).

Governance structure

The governance structure of an environmental fund comprises "the governing bodies set up for decision-making and implementation of actions to mobilize, manage and use resources to meet its objectives and implement its funding agenda (priorities)" (Barcellos, 2015, p. 65). There is no predetermined governing bodies' arrangement for environmental funds; each one must define the governance structures that best suit its objectives and the local context. However, based on environmental funds' experiences, the literature presents recommendations.

It is important that the governance structure of an environmental fund always be supported by a legal apparatus that includes the constituent documents (decree, social contract, bylaws), and an internal rules and operations manual (RedLAC, 2013). It is also recommended that the environmental fund's board have balanced governmental and private sector (companies and/or NGO) representation (Norris, 2000; Spergel & Mikitin, 2013), which would avoid the domination of a certain interest group in the board's decision-making process (RedLAC, 2013). In general, it is considered positive to have some governmental representation on the board because it helps to ensure sufficient coordination of the environmental fund's activities with government policies and institutions. In addition, it signals a political commitment to the conservation strategies implemented by the fund and can channel public resources such as taxes and fees to the environmental funds to manage them (RedLAC, 2013; Spergel & Mikitin, 2013).

Besides the governing board, some funds may also establish expert committees to support decision-making on specific topics such as finance and investment and technical and scientific issues. The establishment of committees is positive since they provide technical advice on topics of interest to the fund, improving its operation and results, and allows broader social participation in its management (RedLAC, 2013).

Accountability procedures

Since environmental funds manage third-party resources, they need to have credibility and ensure transparent operations. In addition, the public interest inherent to the financing agenda forces them to provide adequate means for society to monitor their activities. These obligations are called accountability procedures (Barcellos, 2015).

One of the actions considered fundamental to accountability is the publication of annual reports on their activities. The annual report acts as a tool that informs key partners (donor, government, public) about the fund's mission, its activities and results, as well as financial information such as amounts disbursed for projects/programmes and administrative costs. Furthermore, it can serve to attract new donors (Spergel & Mikitin, 2013). The public disclosure of funds' operational and governance documents such as governing board bylaws, meeting minutes and operational manuals is also considered part of the transparency and accountability procedures.

Based on the discussion of the key elements of environmental funds, the following information from Brazilian PA funds was collected:

(i) Financing agenda: target area (specific PA or a PA subsystem), biome where the supported PAs are located and area under protection;

(ii) Legal structure: legal status (whether the fund is incubated or not);

(iii) Financial structure: origin and volume of funds for initial capitalisation, type of financial operations adopted (sinking, endowment, revolving funds) and asset management (if done by own organisation or external consulting);

(iv) Governance structure: identification of the organisations that are part of the institutional arrangement (initiative leader, operational and financial manager), the existence and composition of the governing board and/or thematic committees;

(v) Accountability procedures: public disclosure of annual reports, public disclosure of the fund's operation and governance documents.

BRAZILIAN ENVIRONMENTAL FUNDS FOR PROTECTED AREAS

A brief overview of Brazilian initiatives

In Brazil, the first environmental funds, created in the late 1980s, were public. Private funds, such as an intermediary grant-making agent, emerged in the 1990s (Serrão, 2014).

In the last two decades, some NGOs adopted the creation of private funds as a long-term financing strategy to support PAs. Funbio is a pioneer in operating PA funds. The first one was the Fund for Protected Areas (FAP), established in 2003 as an endowment mechanism under the Amazon Region Protected Areas (ARPA) Program (Geluda, 2010). However, in 2012, the ARPA Program reviewed the financing strategy and created the Transition Fund (TF) with the FAP capital (the FAP was closed and the funds transferred to TF) and additional international and national donations. The TF is a sinking fund to finance the consolidation of the ARPA Program beneficiary PAs until 2039 when federal and Amazonian state PA agencies should fully assume the recurrent costs of PAs (ARPA Program, 2015). In this new model, a greater public effort is encouraged to leverage budgetary and non-budgetary sources to finance its PA systems.

As one strategy of its Atlantic Coast Program, the SOS Mata Atlântica Foundation (SOSMA) created endowment and sinking funds to support marine PAs. The first PA fund, created in 2006, was the Atol das Rocas Fund. An additional four funds were subsequently established: Guanabara Fund (2008); Costa dos Corais Environmental Protection Area Fund (2011); Cagarras Islands Fund (2012); and Juatinga-Cairuçu Fund (2013) (Martinez et al., 2015). Based on these experiences, SOSMA has been working with the Chico Mendes Institute for Biodiversity Conservation (ICMBio), the federal government PA agency, to establish new funds to support other Atlantic Forest PAs (SOSMA Foundation, 2017).

In 2007, within the scope of the Climate Change State Policy, the Amazonas Government determined that the management of resources to pay for environmental services in 16 state PAs – the Bolsa Verde Program, would be under the responsibility of a private non-profit organisation, which led to the creation of the Amazonas Sustainable Foundation (FAS). Initially, FAS operated an endowment mechanism made up of donations from State Government and Bradesco Bank of R$ 20 million (US$ 4.7 million[1]) each. In 2015, FAS changed the financial strategy to a sinking fund and currently raises funds through sponsorships, donations and projects supported by the Amazon Fund (Amazonas State Government, 2007; FAS, 2016).

In 2009, the Rio de Janeiro State Environment Secretariat (SEA), in partnership with Funbio, created the Rio de Janeiro Atlantic Forest Fund (FMA/RJ), a financial and operational mechanism to manage, among other funding sources, the environmental compensation

resources from enterprises (such as from the construction of a road, factory, etc.) licensed by the State Environmental Institute (INEA) (Ilha & Albuquerque, 2012; Petroni et al., 2015). Based on the FMA/RJ experience, Funbio has collaborated with five other states to replicate this model (Serrão, 2014).

Conservation International Brazil (CI-Brazil) also adopted a strategy of establishing endowment funds to provide financial sustainability for PAs and regional conservation strategies, called 'Funds for Life' (CI-Brazil, 2015). In July 2015, CI-Brazil announced the creation of the Amapá Fund, in partnership with the Amapá State Government and Funbio, with an initial Global Conservation Fund donation of R$5 million (US$ 1.19 million[1]), to support the conservation and sustainable use of natural resources, including management, technical training and establishment of local productive arrangements (CI-Brazil, 2016). CI-Brazil announced the launching of another fund to support PAs in South Bahia State and Abrolhos Archipelago (Fonseca, 2015).

Financing priorities

Although all funds analysed are park funds, their financing priorities are diverse. Four funds support PA subsystems: ARPA Program TF supports PAs in the Amazon Forest; FAS, FMA/RJ and the Amapá Fund support PAs inside the territory of Amazonas, Rio de Janeiro and the Amapá State, respectively. The other five funds, established by SOSMA, support specific PAs in the Atlantic Forest Coast. In addition, the FAS operates grant funds, since it supports sustainable development projects of local communities living inside and around the beneficiary PAs (FAS, 2016).

Most of the funds operate in partnership with the PA government agency at the federal level, ICMBio: the five funds operated by SOSMA, and the ARPA Program TF. The latter also formed a partnership with seven Amazonian States PA agencies. FAS operates exclusively in partnership with the state PA agency. The Amapá Fund and FMA/RJ support PAs managed by federal, state and local (municipal) governments (Table 1).

Table 1 Financing priorities of Brazilian PA funds

Fund	Year of creation	Object	PA beneficiaries (administrative level)	Biome	Area under protection (km^2)
Protected Area Fund/ Transition Fund of Amazon Region Protected Areas (ARPA) Program	2003/ 2012	PA subsystem	114 PA (69 federal and 45 state)	Amazon	593,195
Atol das Rocas Fund	2006	PA individually	Atol das Rocas Biological Reserve (federal)	Marine-Coastal	352
Amazon Sustainable Foundation	2007	PA subsystem	16 PA (state)	Amazon	109,750
Guanabara Fund	2008	PA individually	Guanabara Ecological Station and Guapimirim Environmental Protection Area (both federal)	Marine-Coastal	139
Rio de Janeiro Atlantic Forest Fund	2009	PA subsystem	48 PA (3 federal, 28 state and 17 local) - until December 2014	Atlantic Forest	4,702
Costa do Corais Environmental Protection Area Fund	2011	PA individually	Costa dos Corais Environmental Protection Area (federal)	Marine-Coastal	4,136
Cagarras Islands Fund	2012	PA individually	Cagarras Islands Natural Monument (federal)	Marine-Coastal	1
Juatinga-Cairuçu Fund	2013	PA individually	Juatinga Ecological Reserve (state) and Cairuçu Environmental Protection Area (federal)	Marine-Coastal	326
Amapá Fund	2015	PA subsystem	12 PA (7 federal, 5 state)	Amazon	94,340
Total			197 PA		806,941

Trail to Sono Beach at Juatinga Ecological Reserve © Patricia Ferreti

The PA funds' financing priorities are restricted to the Amazon and the Atlantic Forest with their associated marine and coastal ecosystems. This can be explained by the opportunities for national and international donations focused on tropical forests (Serrão & Geluda, 2015; Young & Castro, 2017) and to the mission of the operating organisations, such as the marine PA funds created by the SOSMA Foundation (Vialli, 2012).

In order to provide similar support to PAs in other biomes such as the Cerrado and Caatinga, PA government agencies need to establish a partnership mobilisation and fundraising strategy that highlights the importance of the PAs in these biomes.

The nine funds analysed here, together, support 197 PAs, totalling around 807,000 km². This represents nearly 10 per cent of Brazilian PAs and, more impressively, 9.4 per cent of the Brazilian territory.

Legal and financial structure

All of the PA funds analysed in this article are private and operate under a partnership between NGOs and government, supported by Law nº 13,019/2014, which establishes the legal regime of partnerships between the public administration and civil society organisations for the achievement of public interest objectives (Table 2).

In three cases, the operation of private PA funds is integrated with public policies and specific legislation supported their creation. FAS is integrated with the Amazonas State Climate Change Policy; FMA/RJ was created through the regulation of the SNUC and State Law; and the Transition Fund is the long-term financing mechanism of the ARPA Program, coordinated by the Ministry of the Environment (MMA).

Regarding their legal status, only FAS was formalised specifically to operate funds to promote forest conservation and sustainable use in PAs. The other PA funds were incorporated into already existing organisations. This is a situation that corresponds to the incubation process explained by Barcellos (2015), where the incubated fund has the advantage of using the expertise and infrastructure of the incubator organisation.

Funbio operates three funds (FMA/RJ, ARPA Program TF and the Amapá Fund) and the SOSMA Foundation operates five funds, acting as incubator organisations. Both are national NGOs with recognised experience in mobilising resources and managing conservation projects, which have the confidence of PA government agencies and donors.

Funbio, in particular, has expertise in designing and operating PA financial mechanisms, providing technical advice to PA government agencies and to other NGOs that want to develop long-term conservation financing mechanisms (Funbio, 2014).

Regarding funding sources, only FMA/RJ operates resources arising from a legal obligation, the environmental compensation established in the SNUC Law[2].

The other eight PA funds raise funds through voluntary donations from different sectors. Donors include international cooperation agencies, private companies,

national and international NGOs, banks, government and individuals (Table 2).

Besides donations, two funds created innovative fundraising arrangements. FAS raises funds from a percentage of the revenue from Bradesco Bank products, such as capitalisation bonds, pension plans and mutual funds (Geluda, 2010). The Juatinga-Cairuçu Fund obtains a percentage of sales of products of a cosmetics company (SOSMA Foundation, 2013).

Altogether, the nine PA funds mobilised at least R$ 583.2 million (US$ 138.8 million1) to finance PA creation and management, and sustainable development projects inside PAs and in their buffer zones. This amount is quite significant compared to other developing countries' experiences. The Mexican NPAF's endowment reached US$ 75 million and in Madagascar, the FAPBM's endowment reached US$ 50 million in a 10–15-year period (CFA, 2014).

The literature has many examples of funds with the potential to leverage government investments in PAs (Spergel & Taieb, 2008). In Brazil, the PA funds stimulated the commitment of the public budget to the PAs. FAS received a R$ 20 million (US$ 4.7 million1) transfer from the Amazonas State Government, and the Government of Amapá State committed to contributing R$ 1 million (US$ 0.3 million[1]) to the Amapá Fund (Amazonas State Government, 2007; CI-Brazil, 2016).

Table 2. The legal and financial structure of Brazilian PA funds

	Legal Structure		Financial Structure			
Fund	**Juridical personality**	**Legal base for creation**	**Resource mobilized***	**Origin of resources**	**Type of financial strategy**	**Asset management**
Protected Area Fund/ Transition Fund of Amazon Region Protected Areas (ARPA) Program	Incubated**	National Legislation (Decree nº 4,326/2012 and nº 8,505/2015) and Technical Cooperation Agreement	R$ 245 million (US$ 58.3)	FAP (World Bank/GE; KfW, WWF-Brazil and national companies' donations) FT (FAP capital + WWF and Anglo American company donations)	First endowment, changed to sinking	External consulting
Atol das Rocas Fund	Incubated**	Technical Cooperation Agreement	R$ 1.7 million (core capital) (US$ 404,761)	National individual donation	Endowment	Own organization
Amazon Sustainable Foundation	Non-profit civil organization	State Law nº 3,135/2007 and Social Statute	R$ 40 million (seed money) (US$ 9.5 million)	Amazon State Government and Bradesco Bank donations	First endowment, changed to sinking	External consulting
Guanabara Fund	Incubated**	Technical Cooperation Agreement	R$ 1.5 million (core capital) (US$ 357,142)	National individual donation	Endowment	Own organization
Rio de Janeiro Atlantic Forest Fund	Incubated**	State Law nº 6,572/2013 and Law nº 7,061/2015 and Agreement term (SEA/RJ 003/2009).	R$ 280 million (until December 2014) (US$ 66.66 million)	Environmental compensation (SNUC Law nº 9.985/2000, art. 36)	Endowment and sinking	External consulting
Costa do Corais Environmental Protection Area Fund	Incubated**	Technical Cooperation Agreement	R$ 10 million (US$ 2.3 million)	Toyota Foundation of Brazil donation	Endowment	Own organization
Cagarras Islands Fund	Incubated**	Technical Cooperation Agreement	No information	Bradesco Cards donation	Sinking	Own organization
Juatinga-Cairuçu Fund	Incubated**	Technical Cooperation Agreement	No information	Bradesco Cards donation and 20% of sales of Juatinga products from EST Cosmetics Company	Sinking	Own organization
Amapá Fund	Incubated**	Agreement Term	R$ 5 million (US$ 1.19 million)	Global Conservation Fund (GCF) donation	Endowment	External consulting
Total			R$ 563.2 million (US$ 138.8 million)			

* US dollar exchange rate on 24 Nov, 2019, US$ 1 = R$ 4.20
** A PA fund is incubated when it does not have its own legal and administrative structure, it is operationalised through an already existing organisation

Table 3. Evaluation Brazilian PAs funds level of compliance* with best practice guidelines for environmental funds

Fund	Level of compliance with environmental funds best practices						
	Financial Structure		Governance			Accountability procedures	
	Asset management by specialized agency	Asset management supervised by financial committee	Formalized board	Board has equal public-private composition	Formalized thematic committees	Consolidated annual report	Fund's documents available to public
Protected Area Fund/Transition Fund (ARPA)	3	3	3	2	3	2	3
Atol das Rocas Fund	1	3	2	1	1	1	1
Amazon Sustainable Foundation	3	3	3	3	3	3	3
Guanabara Fund	1	3	1	0	1	1	1
Rio de Janeiro Atlantic Forest Fund	3	3	3	2	1	1	3
Costa do Corais Environmental Protection Area Fund	1	3	2	1	1	1	1
Cagarras Islands Fund	1	3	1	0	1	1	1
Juatinga-Cairuçu Fund	1	3	1	0	1	1	1
Amapá Fund	3	3	3	3	1	1	1

* Level of compliance: 3 = Strong; 2 = Moderate, 1 = Weak, 0 = Not applicable.

In the ARPA Program TF case, governments must meet progressive co-financing targets to access the fund resources (ARPA Program, 2015).

Seven funds adopted the endowment strategy, where the main capital is preserved and only the proceeds are used to support PAs. This is considered an efficient strategy to support PAs as it promotes stable and long-term financing (CFA, 2014).

Since Brazil is not included in the priority list of developing countries to receive Overseas Development Aid, international donors are structuring exit strategies, involving the design of long-term financing mechanisms, which can explain the increasing number of PA endowment funds in the country. In addition, private foundations and international NGOs have made large donations for the operation, capacity building and creation of endowment funds, and the exchange rate favours the receipt of foreign currency funds (Serrão & Geluda, 2015).

The FMA/RJ adopts the revolving financial strategy. The environmental compensation component receives, on a regular basis, resources from projects licensed under the INEA, which are applied to PA projects approved by the Environmental Compensation Chamber. About R$ 20 million (US$ 4.7 million[1]) of these resources were channelled to an endowment fund, where the income investment covers the recurrent costs of Rio de Janeiro state strict protection PAs (Ilha & Albuquerque, 2012; Petroni et al., 2015).

In the ARPA TF and FAS cases, there was a realignment of the financial strategy from endowment to sinking. The predominant factor for this change was that the income from the investments of the fixed capital was insufficient to cover the PAs' financing demands (Funbio, 2014; Lima, 2015).

Serrão (2014) considers that the asset investment model adopted by environmental funds is conservative, which limits access to new sources of funds and their ability to meet environmental demands. The usual financial application strategies can generate incomes below the PAs' financial requirements (Mathias & Victurine, 2018). Thus, Brazilian PAs funds need to diversify their investment strategies and identify other funding sources for constant capitalisation, as well as coordinate efforts with other financing strategies, such as short-term projects (Spergel & Mikitin, 2013; CFA, 2014).

Regarding asset management, four funds hire external asset management agencies (ARPA Program TF, FAS, FMA/RJ and the Amapá Fund) that are supervised by the funds' governing bodies. The SOSMA Foundation carries out the asset management for its five funds, with the advice of a finance committee[3] (Table 3). Although

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CFA recommends that asset management should be carried out by an external agency, if the amount of resources is not significant, as in the case of the SOSMA Foundation, hiring a specialised agency may increase administrative costs and reduce the budget available to invest in the PAs. A reasonable allocation of the available budget between a fund's management expenses and PA projects is also important (CFA, 2014). According to Spergel and Taieb (2008), it is expected that the administrative costs of the environmental funds range from 10 to 20 per cent of the total annual budget. Some donors establish a 'cost ceiling', commonly 15 per cent of total expenses.

Thus, we suggest that this best practice guideline could be more flexible if the fund's operational manager carries out the asset management, ensuring compliance with accounting standards and under a financial committee's supervision, as in the case of the SOSMA Foundation's PA funds.

Governance structure

Only three organisations are responsible for the operation of the PA funds. The SOSMA Foundation operates five funds, all of them conceived and established by the institution. Funbio is the operational and financial manager of three funds, whose establishment involved public agencies (Ministry of the Environment, Rio de Janeiro State Environment Secretariat and the Amapá State Government), as well as NGOs. The FAS was created to operationalise the Amazonas State's Climate Change Policy, initially managing grant resources from the State Government and Bradesco Bank and then diversifying its funding sources.

The PA government agencies participate in the funds' governance and operation in different ways. The government can be the leading organisation in the creation of funds (FMA/RJ, ARPA TF and FAS) and/or co-financier (FAS and the Amapá Fund). It is important

Table 4. Governance structure of Brazilian PA funds

Fund	Governance Structure			
	Organization that led the fund's creation	Operational Manager	Finance Manager (asset management)	Governance bodies
Protected Area Fund/Transition Fund (ARPA)	Ministry of Environment	Brazilian Biodiversity Fund	Specialized external asset consulting	Management Committee
Atol das Rocas Fund	SOS Mata Atlântica Foundation	SOS Mata Atlântica Foundation	SOS Mata Atlântica Foundation	Donors Consulting Board, Finance Committee
Amazon Sustainable Foundation	Amazon State Government	Amazon Sustainable Foundation	Bradesco Asset Management (BRAM) and Bank of Brazil	Administrative Board, Fiscal Board, Consulting Board
Guanabara Fund	SOS Mata Atlântica Foundation	SOS Mata Atlântica Foundation	SOS Mata Atlântica Foundation	No specific board, Finance Committee
Rio de Janeiro Atlantic Forest Fund	Rio de Janeiro State Environmental Secretary	Brazilian Biodiversity Fund	Bradesco Bank	Environmental Compensation Chamber
Costa do Corais Environmental Protection Area Fund	SOS Mata Atlântica Foundation	SOS Mata Atlântica Foundation and Toyota Foundation of Brazil	SOS Mata Atlântica Foundation	No specific board, Finance Committee
Cagarras Islands Fund	SOS Mata Atlântica Foundation	SOS Mata Atlântica Foundation	SOS Mata Atlântica Foundation	No specific board, Finance Committee
Juatinga-Cairuçu Fund	SOS Mata Atlântica Foundation	SOS Mata Atlântica Foundation	SOS Mata Atlântica Foundation	No specific board, Finance Committee
Amapá Fund	Conservation International - Brazil	Brazilian Biodiversity Fund	Specialized external asset consulting	Deliberative governing council

to highlight that in all the funds analysed the public agencies have the autonomy to manage the PA as they are responsible for the elaboration and execution of PA work plans. Maintaining an autonomous operation but being linked to government is found to be a key factor in funds' success (Bladon et al., 2014).

Regarding governance structure, only four funds have formalised boards, and among them, two have parity between government and non-government representatives (Table 3 and Table 4). The ARPA Transition Fund has an eight-member Committee: six nominated by donors and two Brazilian Federal Government officials representing the MMA and the Ministry of Planning, Budget and Management. The TF Committee is part of the broader governance structure of the ARPA Program, which includes the Program Committee (deliberative board) and the Technical Forum and the Scientific Advisory (advisory bodies) (ARPA Program, 2015).

FAS has a Deliberative Administrative Council formed by three representatives from the government and three non-government representatives from civil society, business and academic sectors. There is also a Fiscal Council and an Advisory Council (FAS, 2016). Five civil society and five Amapá government representatives comprise the Deliberative Council of the Amapá Fund (CI-Brazil, 2016).

The FMA/RJ governing body is the Environmental Compensation Chamber, made up of six representatives from civil society, which include an NGO, academia, Trade Association, Industries Federation, Brazilian Hotel Industry Association, Brazilian Service for Micro and Small Enterprises Support, and eight government representatives (Rio de Janeiro State Secretary, 2016).

Three funds operated by the SOSMA Foundation do not have specific governing bodies (Cagarras Island, Guanabara and Juantinga-Cairuçu). The Atol das Rocas

Fund has a committee (Atol das Rocas Friends' Council) formed by the seven donors and one representative from ICMBio and SOSMA each (Martinez et al., 2015). The APA Costa dos Corais Fund is co-managed with the Toyota Foundation of Brazil, the donor[3].

Following a worldwide tendency, Brazilian PA government agencies have suffered severe cuts in their budgets, placing them in a position of dependence on private resources (Fortwangler, 2007). The absence of a formal governance structure with the participation of public authorities can compromise the PA agencies' ability to negotiate the resource use priorities with donors in accordance with protected area needs. Thus, we reinforce the importance of a governance structure where public and private actors can maintain a dialogue and work for the achievement of the protected areas' collective benefits.

Accountability procedures

Regarding accountability procedures, most of the funds analysed need to make improvements (Table 3 and Table 5). Only FAS publishes a consolidated annual report about their activities, financial balance and list of beneficiaries (FAS, 2015; 2016). Although the ARPA Program TF and FMA/RJ make documents available on their web pages such as project reports, asset reports, meeting minutes and operational manuals, they do not make available an annual consolidated report (ARPA Program, 2015; 2016; Farias et al., 2015). As Thuault et al. (2011) emphasise, transparency is not only about making information available but also about making it available in a layout and language accessible to the public.

Funbio (2019) publishes the Amapá Fund asset balance on its website, but other documents are not available. The SOSMA Foundation (2016) publishes its annual activities and balance reports. However, these reports do not provide information about PA funds individually; therefore, they do not permit more detailed monitoring of these financing mechanisms.

Analysing the PA funds' publicised documents, we found that the accountability procedures prioritise financial matters and that it is the funds' incubator organisations and government agencies that are accountable to the

Table 5. Accountability procedures of Brazilian PA funds

Fund	Accountability Procedures	
	Publication of annual reports	Publication of other documents and reports
Protected Area Fund/Transition Fund (ARPA)	Yes	Minutes of board meetings, agreement contracts, operational manuals and assets balance reports.
Atol das Rocas Fund	No, but it is presented to Donors Consulting Board	No
Amazon Sustainable Foundation	Yes	Assets balance and audit reports, social contract, balance of beneficiaries of Bolsa Floresta Program
Guanabara Fund	No, but it is presented to Donors Consulting Board	No
Rio de Janeiro Atlantic Forest Fund	Yes	Minutes of Environmental Compensation Chamber meetings, agreement contracts, operational manual and assets balance reports.
Costa do Corais Environmental Protection Area Fund	No	No
Cagarras Islands Fund	No	No
Juatinga-Cairuçu Fund	No	No
Amapá Fund	No. (By the time of this study, Amapá Fund was initiating its operation, so no report was published yet)	No. (By the time of this study, Amapá fund was reviewing the operational manual).

donors, often without disclosing all the information. However, we emphasise the importance of improving the 'public interest' and external accountability, which from the authors' point of view includes greater involvement of government agencies in PA funds' decision-making and operation processes, as well as reporting the outputs, such as improvements in PAs' management effectiveness, in language accessible to the general public.

CONCLUSIONS

This paper has shown that Brazilian private PA funds have different institutional arrangements. The funds contribute to protecting almost 10 per cent of Brazilian territory, which is impressive.

Based on the analysis, it is possible to affirm that the Brazilian NGOs operating PA funds have been able to take advantage of the favourable scenario for the creation of these financial mechanisms, mobilising donations from different national and international institutions. In addition, innovative arrangements have been put in place to raise funds, such as FAS and the Juatinga-Cairuçu Fund that have established a partnership with the business sector, and the Rio de Janeiro Atlantic Forest Fund with the use of environmental compensation resources, which are a legal obligation.

Nevertheless, there are still challenges to overcome, especially regarding governance and transparency. We identify some key steps to ensuring the success of environmental funds: formalising a balanced public–private governance structure and publishing consolidated annual reports in accessible language. In doing so, we believe that Brazilian PA funds, besides being reliable for donors, could also be accountable to society and help to ensure the achievement of protected areas' public interest objectives.

In addition, we suggest the following improvements to refine environmental funds best practice guidelines: (i) the prioritisation of which PAs should be supported by environmental funds must involve government PA agencies; (ii) when the fund's capital is small it may be acceptable for the incubator organisation to carry out the asset management ensuring compliance with accounting standards and under a financial committee's supervision in order to reduce operational costs; (iii) it is important to strengthen the public interest character of the funds with a governance structure that includes the relevant government agency and the publication of consolidated annual reports in language accessible to the general public.

ENDNOTES

[1] Dollar price on 24 November 2019 (US$ 1.00 = R$ 4.20).

[2] Article 36 of Federal Law nº 9,895/2000 establishes that in ventures with significant environmental impact, the investor is obliged to allocate up to 0.5 per cent of the value of the enterprise to support the implementation and management of strict protection PAs.

[3] Information provided by Márcia Hirota, SOS Mata Atlântica Foundation Executive Director, by email interview on 28 November 2016.

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RESUMEN

A pesar de las iniciativas recientes para crear fondos ambientales privados para apoyar el financiamiento del Sistema Brasileño de Áreas Protegidas, este sigue siendo un tema poco estudiado. El presente artículo tiene por objeto analizar sistemáticamente aspectos clave del establecimiento y operación de nueve fondos privados para áreas protegidas en Brasil: sus prioridades financieras; estructuras legales, financieras y de gobernanza; y procedimientos de rendición de cuentas. El análisis se basó en datos recopilados de artículos académicos, documentos, informes anuales y cuestionarios estructurados enviados por correo electrónico a los representantes de los fondos para áreas protegidas. Además, evaluamos el grado de cumplimiento de las normas con respecto a las prácticas relacionadas con los fondos ambientales en términos de la gestión de activos, la estructura de gobernanza y los procedimientos de rendición de cuentas. En total, los fondos movilizaron R$583 millones (moneda brasileña) o USD138,8 millones en el período 2003–2015 en apoyo de 197 áreas protegidas en el Amazonas y la Mata Atlántica, en un área de 807.000 km². Se cuenta con una diversidad de estructuras institucionales y modalidades innovadoras para recaudar fondos tanto del sector empresarial nacional como de donantes internacionales y aumentar las inversiones públicas en áreas protegidas. Se encontraron grandes deficiencias en la estructura de gobernanza y los procesos de rendición de cuentas en lo referente a las operaciones de los fondos ambientales. A partir del análisis sistemático de los fondos brasileños para áreas protegidas, el artículo presenta algunos ajustes en las directrices de buenas prácticas relacionadas con los fondos ambientales.

RÉSUMÉ

Malgré les récentes initiatives visant à créer des fonds environnementaux privés pour soutenir le financement du système brésilien des aires protégées, le sujet est encore insuffisamment étudié. Cet article vise à apporter une analyse systématique des aspects clés de la mise en place et du fonctionnement de neuf fonds privés pour les aires protégées au Brésil, leurs priorités de financement, structures juridiques, financières et de gouvernance, et les procédures de responsabilisation. L'analyse est basée sur des données collectées à partir d'articles universitaires, de documents, de rapports annuels et de questionnaires structurés par courrier électronique avec des représentants des fonds des aires protégées. De plus, nous avons évalué leur niveau de conformité par rapport aux normes de pratique appliquées par les fonds environnementaux en matière de gestion d'actifs, de structure de gouvernance et des procédures de responsabilisation. Au total, les fonds ont mobilisé 583 millions de réaux (la devise brésilienne) ou 138,8 millions de dollars US sur la période 2003-2015 pour soutenir 197 aires protégées en Amazonie et dans la forêt atlantique, sur une superficie de 807 000 km². Il existe de nombreuses structures institutionnelles et des arrangements innovants pour lever des fonds auprès du secteur commercial national et des donateurs internationaux, et pour accroître les investissements publics dans les aires protégées. La structure de gouvernance et les processus de responsabilisation des opérations des fonds environnementaux se sont révélés être des lacunes majeures. A partir de l'analyse systématique des fonds brésiliens pour les aires protégées, cet article présente certaines précisions quant aux directives des fonds environnementaux concernant les normes de pratique.

WHAT DO RANGERS FEEL? PERCEPTIONS FROM ASIA, AFRICA AND LATIN AMERICA

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ABSTRACT

Rangers play an important role in the management and protection of biodiversity upon which human well-being depends for ecosystem services. While performing their duties in harsh field conditions, often with insufficient and inadequate equipment, rangers in many countries are under constant threat from encounters with wildlife and poachers. To better understand the rangers' perceptions of their working conditions, 1,742 rangers from 293 conservation sites representing 40 countries across the regions of Asia, Africa and Latin America were surveyed. Although results differed between regions, overall results showed that four out of five rangers have faced a life-threatening situation, more than a quarter saw their family for less than 5 days in a month and a large proportion do not feel adequately equipped or trained to fulfil their job requirements. Being close to nature was indicated as the key motivation for rangers, while low and/or irregular salary and dangerous working conditions were identified as the worst aspects of being a ranger. This survey is the first large-scale snapshot of ranger perceptions and will be followed by further detailed surveys and analysis.

Key words: Rangers, working conditions, job motivation, wildlife conservation, job satisfaction, poaching

INTRODUCTION

The world is facing a biodiversity crisis. The actions of humans have resulted in an overall decline of 60 per cent in wildlife population sizes since the 1970s (WWF, 2018). Current rates of species extinction are now 100 times higher than the standard rate of extinction in Earth's history (Lamkin & Miller, 2016). Biodiversity loss does not just impact Earth's wild ecosystems, but directly impacts human well-being which is dependent on the environment for goods and services (Diaz et al., 2006; Hooper et al., 2012).

Rangers are on the frontline of people working to manage and protect the world's biodiversity. The International Ranger Federation (IRF) defines a ranger as a "person involved in the practical protection and preservation of all aspects of wild areas, historical and cultural sites" (IRF, 2019a). Protected areas are constantly under threat from unsustainable resource use and hunting, recreation disturbance and fires, among others (Schulze et al., 2017). In addition to being responsible for the law enforcement of the areas in which they work, modern rangers are involved in a myriad of tasks that include monitoring and surveying wildlife, managing interactions with local communities and visitors and fire suppression. Rangers therefore play an instrumental and indispensable role in conserving biodiversity.

Despite the critical role that rangers play, their importance has long been overlooked as they often operate in rural areas with limited contact with society (Digun-Aweto et al., 2019). As a result of the lack of recognition for their work, low prioritisation of the issue

of illegal wildlife trade and limited governmental budgets, the level of support provided to rangers from governments and non-governmental organisations has been low. In 2017, the US government alone spent $30 billion on drug control efforts, whereas to tackle the issue of illegal wildlife trade, only $260 million was spent in 67 African and Asian countries (World Bank, 2019).

In addition to the inherently stressful nature of policing work (Moreto et al., 2016), most rangers carry out their roles in harsh field conditions while being inadequately trained and equipped, poorly paid and, under threat from wildlife encounters, poachers and communities (Leaky & Morrell, 2001; Ogunjinmi et al., 2008; Eliason, 2011a; Warchol & Kapla, 2012). The poor and hazardous working conditions of rangers, while well known to anyone working in the field, have only recently been brought to public attention. This is in part due to growing awareness of the high fatality rates of this occupation as a result of the data and publicity provided by the International Ranger Federation. Between 2009 and 2019, 1,020 rangers have lost their lives in the line of duty and this figure is likely to be an underestimate (IRF, 2018; IRF, 2019b).

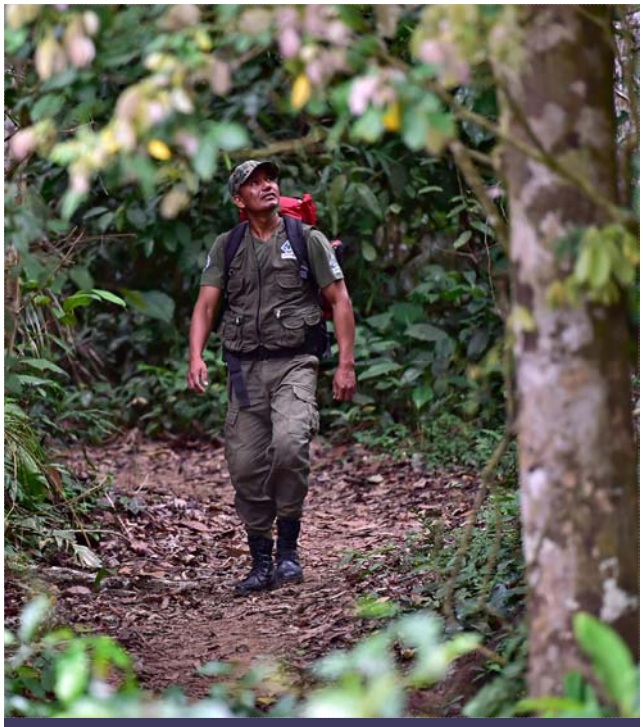
Several studies in Africa and the USA have found that dangerous and difficult working conditions affect rangers' motivation, morale and satisfaction with their job (Leaky & Morrell, 2001; Ogunjinmi et al., 2008; Meduna et al., 2009; Eliason, 2011b). For wildlife management to be effective, rangers have to perform well in their job (Jachmann, 2008). Seeing that job satisfaction and motivation have been found to be positively correlated with job performance (Judge et al., 2001), it is imperative that we better understand what motivates rangers to choose and remain in their occupation and what affects their job satisfaction to improve wildlife management.

While there has been a growing body of research on rangers in recent years, a disproportionate number of studies have been carried out on rangers from the USA and or Africa (Eliason, 2006, 2011a, 2011b, 2017; Ogunjinmi et al., 2008; Digun-Aweto et al., 2019; Spira et al., 2019). To the best of our knowledge, other than Moreto et al. (2017) which looked at a subset of the Asia dataset from this study, there has been no prior study of ranger perceptions in Asia and/or Latin America. Considering that the two regions contain over 7.5 million square kilometres of protected land area and 1.8 million square kilometres of protected marine area (UNEP-WCMC, 2020a; 2020b), we believe such a study is long overdue.

The intent of this paper is to provide a snapshot of rangers' personal views of their working conditions, and to gain a deeper insight into the factors that affect the motivation of rangers. As part of an initial pilot study of rangers, the data was previously published in a series of reports (WWF & RFA, 2016; WWF & TRAFFIC, 2016; WWF & GWC, 2019 – Supplementary Online Materials 1, 2 and 3) that were largely descriptive in nature with little discussion of results which this paper will delve into more deeply. It is hoped that this large data set, along with more detailed follow-up ranger surveys (Belecky et al., 2019), will serve to influence and improve government policy towards rangers, their working conditions and ultimately, wildlife law enforcement and protected area management.

METHODS

The sampling method consisted of a survey with close-ended questions (Supplementary Online Material 4) to gain insight into ranger working conditions and factors influencing ranger motivation. Questions were drafted by the World Wide Fund for Nature (WWF) in consultation with subject experts that included ranger associations, conservationists who work with rangers, and rangers themselves. The survey questions covered a range of topics related to working conditions, such as threats faced, how often respondents saw their family,



Ranger of Manuripi-Heath Amazonian Wildlife National Reserve, Bolivia © Adriano Gambarini / WWF Living Amazon Initiative

Figure 1 The countries where surveys were conducted with the number of sites and respondents for each country in parentheses, respectively[1]

and if they felt adequately trained and equipped for their job. To better understand ranger motivations, the survey also asked respondents to rank aspects they disliked about their job, what motivated them to stay on and, why they would or would not want their children to work in the same field.

Data were collected between 2015 and 2018 through surveys conducted in 293 conservation sites representing 40 countries across Asia, Africa and Latin America (Figure 1). In total, 1,742 ranger responses were received.

Site selection was based on accessibility and contacts in the field. For countries and sites where the WWF survey team did not have direct access to frontline staff, they partnered with other conservation organisations and ranger associations to increase the number and coverage of responses. This study did not include armed forces posted on deputation in national parks and wildlife sanctuaries and focused only on rangers hired either on permanent or short-term contracts by relevant forest and environment ministries. We therefore recognise that many other types of ranger are not represented in this study and recommend further studies focus on privately hired rangers, community game scouts, and indigenous rangers working in their ancestral domain.

The vast majority of surveys were conducted through personal interviews carried out by focal points in WWF offices, ranger association and other conservation organisations within each country in the local language. Each surveyor was briefed on the survey guidelines prior to conducting interviews to ensure that data were collected in a uniform and error-free manner. Instructions on how to complete and submit the survey were also included in the questionnaire. For countries in Asia, additional responses (about 10 per cent) were obtained from paper surveys submitted by mail and e-mail. Prior to completing the survey, all respondents were briefed on the survey's purpose, data use and confidentiality and their voluntary agreement to participate was obtained.

RESULTS AND DISCUSSION

A total of 1,742 rangers were surveyed from 39 sites in 11 countries in Asia (n=530), 65 sites in 12 countries in Africa (n=570) and 189 sites in 17 countries in Latin America (n=642). Characteristics of the respondents are given in Table 1.

The majority of respondents were male (88.4 per cent). The most common age bracket surveyed overall was 31-40 years of age (32.3 per cent). For Asian rangers surveyed, however, a large proportion were middle aged at 41-50 years old (31.6 per cent). Conversely, the largest category of the African rangers surveyed were younger at 21-30 years old (46 per cent). Overall, very few of the respondents had served more than 20 years (12.2 per cent), with almost one-third having just 2-5 years of ranger working experience (29.5 per cent). Almost one-third of African respondents, however, had served 6-10 years (29.1 per cent). Rangers employed on permanent contracts are salaried and are usually provided government benefits as compared to Rangers on short-term contracts rangers who may be paid hourly or daily and are not usually eligible for government benefits. Overall, almost three-quarters of respondents were hired on a permanent contract (74.7 per cent). This figure was much higher for respondents in Africa (93.6 per cent) and lower in Asia (63.6 per cent).

Threat

Have you faced a life-threatening situation?

When provided with four life-threatening scenarios, an overwhelming 79.9 per cent of respondents indicated they had faced at least one in the course of their work (Table 2). Of those who responded affirmatively, "dangerous encounter with wildlife" was the most common situation experienced (64 per cent), followed by "threatened by poachers" (56.1 per cent), "threatened by communities" (51.8 per cent) and lastly, "attacked by poachers" (40.3 per cent). This order of scenarios was the same for rangers surveyed in each of the three regions.

The job of a ranger, like all law enforcement jobs, is an inherently dangerous one. That almost 80 per cent of all rangers surveyed have faced at least one life-threatening situation is testament to that fact. Due to the nature of ranger work, it is inevitable that rangers might come across dangerous wildlife encounters. In 2019 alone, 23

Table 1. Characteristics of ranger respondents

Characteristics		Overall (%)	Asia (%)	Africa (%)	Latin America (%)
Gender	Male	88.4	97.4	81.2	87.0
	Female	11.1	2.6	18.8	13.0
Age	<20 years	0.2	0.2	0	0.5
	21-30 years	26.8	21.8	**36.0**	21.9
	31-40 years	**32.3**	27.7	33.8	**33.1**
	41-50 years	24.9	**31.6**	17.6	23.5
	51-60 years	13.9	11.6	10.9	17.7
	>61 years	1.8	0.2	1.7	3.3
Years served	0-1 years	12.2	14.2	10.7	11.9
	2-5 years	**29.5**	**37.9**	19.5	**31.0**
	6-10 years	22.0	13.4	**29.1**	23.2
	11-20 years	24.0	23.8	23.9	24.3
	21-30 years	9.9	9.1	13.8	7.2
	31-40 years	2.2	1.5	2.8	2.3
	>41 years	0.1	0.2	0.2	0
Employment type	Permanent	74.7	63.6	93.6	74.5
	Short-term	25.3	36.4	6.4	25.5

Table 2 Exposure to life-threatening situations
Note: Percentages do not sum to 100 per cent as choices are not mutually exclusive

Region	Faced at least one life threatening situation	Attacked by poachers	Threatened by poachers	Threatened by communities	Dangerous encounter with wildlife
Overall	79.9%	40.3%	56.1%	51.8%	64.0%
Asia	63.4%	26.8%	52.4%	38.4%	62.2%
Africa	88.6%	66.7%	72.6%	70.5%	82.7%
Latin America	86.3%	25.2%	43.8%	43.6%	48.4%

of the 149 reported rangers who died in the line of duty were killed by wildlife (IRF, 2019b).

According to Schulze et al. (2017), hunting and resource use was found to be the most common threat in protected areas in the "Afrotropical, Indo-Malaya, and Neotropical realms" which correspond to our Africa, Asia and Latin America regions. Many local communities that live in or around protected areas usually depend on resources within for their livelihood or subsistence. This and the growing demand for wildlife products for the illegal wildlife trade is likely why more than half of respondents have been threatened by communities and/or poachers.

African respondents had the highest proportion of rangers who have faced at least one life threatening situation (88.6 per cent) and Asian rangers the lowest (63.4 per cent). Poaching, largely driven by the multibillion-dollar transnational illegal business that is illegal wildlife trade, unsurprisingly results in rangers coming into contact with poachers in remote locations armed with guns, knives and other weapons. This is especially so in Africa where demand for elephant ivory and rhino horn has led to the involvement of organised crime syndicates and armed militia that use highly advanced technology and heavy firearms (Austin, 2019), resulting in the high proportion of African respondents who have been "attacked by poachers" (66.7 per cent). Comparatively in Asia, snaring is the main form of hunting (Gray et al., 2018). Poaching and illegal wildlife trade in Latin America, while growing in recent years, is largely opportunistic and unlike in Africa and Asia, disorganised (Reuter & O'Reagan, 2017). Additionally, other than jaguars, Latin America does not hold megafauna with any great global demand. These reasons, coupled with the fact that the scenarios provided referred to poachers specifically and not illegal loggers who are more active in Asia and Latin America, could explain the comparatively lower proportions of Asian and Latin American respondents who have been "attacked by poachers" (26.8 per cent and 25.2 per cent respectively). Further studies looking at the relationship between threat types, types of protected area and ranger perceptions are required to gain a deeper understanding of the situation in Asia and Latin America.

Family

How many days a month do you get to see your family?

Overall, more than a quarter of rangers surveyed saw their family for less than five days in a month (26.5 per cent) and only one-fifth saw their family for more than 15 days (20.6 per cent) (Table 3). The remoteness and isolation of the locations that rangers work in often means postings to stations far away where they are unable to return home daily. Too few rangers may also result in longer average postings that see them away from their family for extended periods of time. Facilities in and around protected areas might be inadequate, resulting in rangers choosing to have their families in towns away from protected areas to give their children a better education and standard of living.

In a study on ranger motivation and job satisfaction, Spira et al. (2019) found that being able to live with their family was an aspect of the job that rangers liked and a positive factor in the rangers' level of satisfaction. In fact, many rangers considered it punishment when they were transferred to stations far from their home as it meant they would be away from their families for a prolonged period of time (Spira et al., 2019). Considering the fact that more than three-quarters of Asian and African rangers surveyed saw their families

Table 3 Amount of time rangers are able to spend with their families

Region	<5 days	5-10 days	10-15 days	15-20 days
Overall	26.5 %	37.5%	15.3%	20.6%
Asia	45.3 %	30.8%	10.6%	13.4%
Africa	30.2 %	46.9%	15.5%	7.5%
Latin America	7.7%	35.0%	19.2%	38.0%

for less than 10 days in a month (76.1 per cent and 77.1 per cent respectively), this could be having a significant impact on the morale and motivation of these rangers.

In contrast, in Latin America, more than a third of rangers surveyed saw their family at least 15 days in a month (38 per cent) and only a small minority of 7.7 per cent saw their family for five days and less. In general, many rangers in Latin American countries have easier access to their homes as their families either live close to or within protected areas as they are from communities around the area (Elbers, 2011; Jiménez, 2018). The contracts of most rangers in Latin American countries also include a rotating work shifts that results in shorter postings, allowing them to spend more time with their families (F. Avino, personal communication, 9 March 2020).

Enabling conditions

Do you feel you are provided with proper equipment and amenities to ensure safety?

Rangers were asked if they felt they were provided with sufficient basic equipment that includes boots, tents, a compass, GPS and other field gear as well as access to basic amenities such as clean drinking water, toilets, and bedding facilities. A majority (68.1 per cent) of respondents did not feel they were provided with proper equipment and amenities to ensure safety and fulfil their job requirements. The fact that a large proportion of rangers did not feel adequately equipped and provided with basic amenities while out in the field is not a new finding. Many past studies have found similar results (Gibson, 1999; Leaky & Morrell, 2001; Digun-Aweto et al., 2019). Given the importance of the work that rangers do and the severity of threats faced as a result of that work, rangers should at the very least be provided with basic equipment and amenities required in the field like clean water and mosquito repellent. This would help prevent unnecessary deaths caused not only from injuries, but also diseases such as malaria and other illnesses. In 2019, 27 rangers were reported to have succumbed to diseases encountered at work (IRF, 2019b).

Do you feel you are adequately trained to do your job?

When asked about training, 65.3 per cent of respondents felt that they were adequately trained to do their job to address the threats to biodiversity at their

Ranger with his family in Eastern Cambodia © Ranjan Ramchandani / WWF

Conservancy rangers at the Ololaimutia Ranger post at the border of Mara Siana conservancy, Kenya © Ami Vitale / WWF-UK

site (Table 4). Rangers in general undergo basic job training on how to carry out their daily tasks such as patrolling. However, the responsibilities of modern rangers have expanded beyond basic park management and protection to include tasks like intelligence gathering and community engagement and relations. These tasks require specialised training that many rangers do not receive. In a survey of management in protected areas in tiger range countries, one of the weakest elements observed that many rangers felt insufficiently trained in, were social aspects such as dealing with human-wildlife conflict and community issues (Conservation Assured, 2018).

Out of the three regions, Asian rangers surveyed had the lowest percentage of rangers who felt adequately equipped and trained (25.6 per cent and 52.3 per cent respectively). This could possibly be due to the fact that Asian rangers also had the lowest percentage of rangers on permanent contracts (63.6 per cent). Permanent rangers may be given higher priority for new equipment and training programmes over those on short-term contracts. An overwhelming 83.5 per cent of Latin American rangers surveyed however felt adequately trained. This high percentage might be the result of the strong and robust training provided to Latin American rangers by local governments and often through partnerships with non-governmental organisations (Paz -Barreto, 2010a). In addition to regional trainings for Latin American rangers, many individual countries have established training schools that offer academic ranger professionalisation courses (Carabias & Cadena, 2003; Paz-Barreto, 2010a, 2010b; Solveria, 2012; Columba, 2013). Interestingly though, in a paper by Coad et al. (2019) that looked at protected areas and their staff and budget adequacy, the region of IndoMalay actually had the highest proportion of protected areas with both

Table 4 Adequacy of equipment and training

	Proper equipment and amenities?		Adequately trained?	
Region	Yes	No	Yes	No
Overall	31.9%	68.1%	65.3%	34.7%
Asia	25.6%	74.4%	52.3%	47.7%
Africa	40.2%	59.8%	57.1%	42.9%
Latin America	29.7%	70.3%	83.5%	16.5%

adequate staff and budgets while the Neotropics had the lowest. These results are surprising as one would assume that sites with more funds would be able to better equip and train their staff and vice versa. While this could be due to differing sites and countries selected in both studies, it is clear more research is needed into the type, depth and frequency of trainings rangers receive in the different regions to better understand the situation and what capacity building improvements are needed.

Motivation

The survey also included three questions designed to better understand ranger motivations.

What is your motivation for continuing as a ranger?

The key reason selected by rangers surveyed from all three regions as the motivation for continuing as a ranger was "I enjoy being close to nature". The other two highest ranked reasons from Asian respondents were "I enjoy being a ranger" and "I have no other job options". For Africa, "I am a respected member of the community because of this work" and "I like to implement the law" were the two most highly ranked reasons after enjoyment of nature. Respondents from Latin America ranked "I enjoy being a ranger" and "I believe it is an exciting job" as the reasons for wanting to stay a ranger.

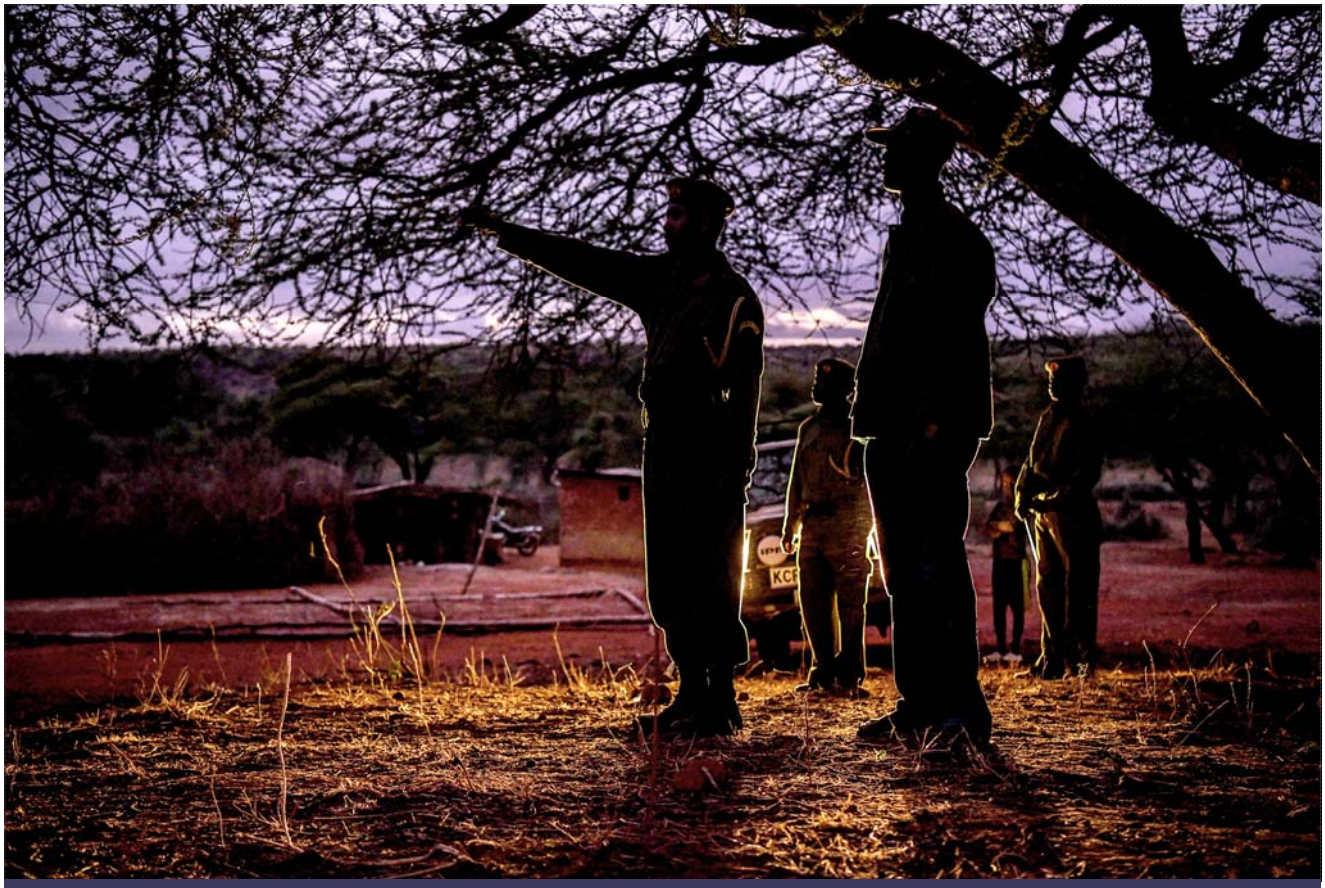
The results indicate that rangers from all three regions surveyed display a key motivation for pursuing and continuing a career in wildlife law enforcement. Namely, they enjoyed working and being in nature. Similar findings have been found in the US and Uganda (Moreto, 2016; Eliason, 2017). Two of the highest ranked motivations for African respondents had to do with respect and responsibility. In a study on ranger job satisfaction in Uganda, Moreto (2016) found that the responsibility that came from taking ownership of the Park, its wildlife and being provided a distinct role in Uganda's Wildlife Authority through conducting frontline work (like identifying illegal activities and apprehending suspects) contributed positively to the job satisfaction of rangers. This was a site-specific study though and may not be applicable to the entire African region. Clearly, there are many factors influencing the motivations of rangers that will require further in-depth study.

What is the worst aspect of being a ranger?

Conversely, when respondents were asked to rank the worst aspects of being a ranger, "Low and/or irregular pay" and "Dangerous working conditions" were overwhelmingly two of the top choices for all three regions. The third other most frequent response in Asia was "frequent transfer", whereas in Africa, other demotivating factors included "rarely see my family"

Table 5 Reasons why rangers would or would not like their children to follow the same career
Note: Percentages do not sum to 100 per cent as choices are not mutually exclusive

Reasons	Overall (%)	Asia (%)	Africa (%)	Latin America (%)
I would like my children to be rangers	56.7	52.1	42.2	70.9
To protect wildlife and biodiversity	**76.1**	**59.9**	**79.6**	**84.2**
I want my children to serve nature	**75.2**	**62**	**90.2**	**75.7**
I am proud to be a ranger	**65.7**	54.4	**66.7**	**71.9**
I want my children to serve their country	54.6	**57.7**	62.7	48.7
There is good job security	28.9	31.8	37.8	22.8
To have power and authority	22.1	21.5	32.4	17.3
It is easy to get a ranger job	11.5	8.4	20.4	9.0
I would not like my children to become rangers	43.3	47.9	57.8	26.1
It has a low salary	**69.4**	**68.3**	**69.2**	**71.4**
It is a dangerous job	**55.6**	**52.0**	**64.6**	**44.6**
There is no reward for hard work	**50.0**	40.9	57.8	**49.4**
They would have to stay apart from their family	49.0	**44.8**	**58.4**	38.1
There is no potential for promotion	40.9	43.7	39.9	38.7
There is no job security	33.7	32.9	37.7	27.4
The pay is irregular	27.2	25.8	34.1	16.7



Conservancy rangers on early morning patrol at Elangata Enderit village in lower Loita, Kenya © Ami Vitale / WWF-UK

and in Latin America, "little or no reward for hard work".

Low and/or irregular pay is a common issue identified in multiple studies on rangers (Leaky & Morrell, 2001; Ogunjinmi et al., 2008; Digun-Aweto et al., 2019). Many other studies on law enforcement jobs have found similar associations between low pay and poor job motivation and satisfaction, especially when taking into account the dangerous working conditions (Toch, 2002; Claridge et al., 2005; Kakira, 2010). "Dangerous working conditions" was also ranked by respondents from all three regions as one of the worst aspects of being a ranger. This is not surprising given that close to 80 per cent of all rangers surveyed have experienced at least one life-threatening situation.

Asian and African respondents also highlighted the options "Frequent transfer" and "Rarely see my family". This is not unexpected as a large proportion were found to only be able to see their families for less than five days in a month. Rangers surveyed in Latin America also disliked that there was "Little or no reward for hard work". In addition to monetary rewards, successful convictions also impact the morale of rangers. Time and effort spent catching poachers only to fail at the prosecutor level or lack of judicial support has been found to affect the job satisfaction of rangers (Spira et al., 2019) and is a key issue faced by many in wildlife law enforcement (Eliason, 2011b; Moreto, 2016). The overall effect of this, coupled with "low and/or irregular pay", results in not just reduced job satisfaction and ineffective output but may present a corrupting element and risk in terms of complicity with poachers in situations where there is little to no motivation to make arrests.

Do you want your children to become rangers?

Overall, 56.7 per cent of respondents wanted their children to become rangers (Table 5). When asked why they wanted their children to become rangers, the top three overall reasons selected were "I want my children to serve nature", "To protect wildlife and biodiversity" and, "I am proud to be a ranger". As previously found, a key motivation of respondents for continuing on as a ranger was enjoyment of being close to nature. As the majority of respondents themselves have a love of nature and an intrinsic desire to protect and conserve

natural habitats, it is unsurprising that they would want their children to have similar attitudes and values.

When respondents were asked why they did not want their children to become rangers, the top three overall selected reasons were "It has a low salary", "It is a dangerous job" and, "There is no reward for hard work". The reasons respondents gave for why they did not want their children to become rangers echo the worst aspects they ranked about being a ranger ("Low and/or irregular salary", "Dangerous working conditions", "Frequent transfer", "Rarely see my family", "Little or no reward for hard work"). Therefore, despite most respondents enjoying and having a love of nature, many did not wish for their children to be in the same line of work for practical reasons involving working conditions and benefits. Indeed, the study by Moreto et al. (2017) looking at intergenerational linkages within the ranger profession and using a subset of the same Asia dataset as this paper, found it cannot be assumed that frontline staff will be "intrinsically driven or that such motivation will be unaffected by the challenges and realities of the occupation". Instead, it is imperative that like any other profession, rangers are provided with adequate pay, equipment and promotional opportunities.

CONCLUDING REMARKS

This study is the first large-scale ranger perception study conducted in Africa, Asia and Latin America and contributes to the long needed growing discussion and literature on rangers on the frontline. However, it is not without its limitations. The uneven distribution of data collected from each country and site may have resulted in the overrepresentation of certain countries and sites. Therefore, the sample size should not be viewed as representative for any individual country, nor should they be extrapolated to all three regions as a whole. In addition, as a rapid assessment, the survey was relatively short and could not go more in-depth into the factors influencing rangers' perceptions of certain topics. Additional surveys that go into greater detail have the potential to provide a more complete picture of the challenges and conditions that impact rangers and their effectiveness. Future studies should also take note of the choice of wording of questions as it may influence results much like our usage of the word "poachers".

Despite the limitations, this study does present a snapshot of combined ranger perceptions of their working conditions and motivations for the three regions at the time of survey. The results of which clearly show that in general, rangers are motivated professionals with a true commitment to work and protect nature despite the harsh working conditions and lack of public recognition. In order to fully support all the work they do, we suggest the following recommendations which are in line with the 2019 Chitwan Declaration (IRF, 2019c; Supplementary Online Material 5) that came out of the 9th World Ranger Congress:

1. With dangerous working conditions, low salary, and poor work-life balance frequently topping the list of the worst aspects of ranger work, one of the greatest challenges is to improve basic working conditions throughout this sector. There is a huge shortfall in the provision of the health supplies, vehicles, weapons, field equipment, shelter, fresh food, and potable water required to keep rangers safe and ensure their effectiveness. Countries must allocate greater budgets for such items in the vast majority of locations where rangers work. Additionally, there is always a need to increase ranger numbers. The effectiveness of a protected area has been found to correlate strongly with the density of rangers (Bruner et al., 2001), and having a low density of rangers can even affect the motivation of rangers working in a protected area (Spira et al., 2019).

2. There is not enough recognition by governments and the public of either the importance or the daily difficulties of ranger work. Considering this, rangers should be treated similarly to other valued public employees who risk their physical well-being to protect the interests of the state – such as police, border officials, firefighters, military, and emergency response specialists. Rangers should be professionalised to the same extent as others performing comparable functions and be paid commensurate salaries and paid on time.

3. Although many NGOs have been trying to fill the capacity gap, there still remains a shortfall of adequate training. The long-term sustainable way to achieve this is through the establishment of specialised colleges and institutions and strengthening of existing institutions, which can develop and deliver a tailor-made curriculum based on best available practices, as well as being able to adapt it to any emerging threats. While government agencies and conservation partners work on the long-term solution, more needs to be done on providing refresher training and specialised short-term courses to frontline staff in line with global standards (Appleton, 2016). Also, there is a need for more holistic training that not only covers technical skills but also concurrently

supports ranger wellness and resilience to help build capacity in 'soft skills' that help enable career advancement, improve self-management and the ability to deal with challenges faced.

The results from this study confirm much of what was previously only anecdotally known about the poor and dangerous working conditions of rangers, especially for the regions of Asia and Latin America where there is a dearth of ranger information. However, it also highlights the urgent need for further studies to improve current knowledge on rangers and the issues they face. Further studies on the threats rangers face and training received will not only allow for deeper understanding of the context behind the results of this study, they also provide the baseline information required for many of the recommendations mentioned. WWF and partners have been conducting a detailed phase II survey and have recently released the Life on the Frontline 2019 report (Belecky et al., 2019). The report covers the results of a global survey of the working conditions of 7,110 public-sector patrol rangers, surveyed at hundreds of sites across 28 countries. Further analysis of this report along with the results of this survey will continue to better inform and galvanise future action to improve the lives of rangers who work so tirelessly to preserve the world's biodiversity.

ENDNOTES

[1]The authors of this paper do not endorse the borders of this map shown in this publication, nor any political position related to territorial claims.

SUPPLEMENTARY ONLINE MATERIAL

1 - Ranger Perceptions, Asia
2 - Ranger Perceptions, Africa
3 - Ranger Perceptions, Latin America
4 - Survey Questionnaire
5 - Chitwan Declaration, 9th World Ranger Congress

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RESUMEN

Los guardaparques desempeñan un papel importante en la gestión y protección de la biodiversidad de la que depende el bienestar humano para los servicios de los ecosistemas. En el desempeño de sus funciones en condiciones difíciles, a menudo con equipo insuficiente e inadecuado, los guardaparques de muchos países están bajo la amenaza constante de los encuentros con la vida silvestre y los cazadores furtivos. Para comprender mejor las percepciones de los guardaparques sobre sus condiciones de trabajo, se realizó un estudio de 1742 guardaparques de 293 sitios de conservación en 40 países de Asia, África y América Latina. Aunque los resultados difirieron entre las regiones, los resultados generales mostraron que cuatro de cada cinco guardaparques se han enfrentado a una situación potencialmente mortal, más de una cuarta parte vio a su familia durante menos de cinco días en un mes y una proporción importante considera que no está adecuadamente equipada o capacitada para cumplir con los requisitos de su trabajo. La cercanía a la naturaleza se indicó como la motivación principal para los guardaparques, mientras que el salario bajo y/o irregular y las condiciones de trabajo peligrosas se identificaron como los peores aspectos de un guardaparques. Este estudio es la primera instantánea a gran escala de las percepciones de los guardaparques; le seguirán otros estudios y análisis detallados.

RÉSUMÉ

Les gardes forestiers jouent un rôle important dans la gestion et la protection de la biodiversité dont dépend le bien-être humain pour les services écosystémiques. Tout en accomplissant leurs tâches dans des conditions de terrain difficiles, souvent avec un équipement insuffisant et inadéquat, les gardes forestiers de nombreux pays sont constamment à risque lors de rencontres avec la faune et les braconniers. Pour mieux comprendre leur perception à l'égard de leurs conditions de travail, 1.742 gardes forestiers de 293 aires de conservation à travers 40 pays d'Asie, d'Afrique et d'Amérique latine ont été interrogés. Bien que les résultats diffèrent selon les régions, les résultats globaux ont montré que quatre gardes forestiers sur cinq ont été confrontés à une situation potentiellement mortelle, plus d'un quart voit leur famille pendant moins de 5 jours par mois et une grande proportion ne se sentent pas suffisamment équipés ou formés pour s'acquitter de leurs responsabilités professionnelles. La proximité avec la nature a été indiquée comme la motivation principale des gardes forestiers, tandis qu'un salaire bas et/ou irrégulier et des conditions de travail dangereuses ont été identifiés comme les pires aspects du métier de garde forestier. Cette enquête est le premier aperçu à grande échelle des perceptions des gardes forestiers et sera suivie par d'autres enquêtes et analyses détaillées.

OPPORTUNITIES FOR INVESTMENT IN THE SOCIETAL VALUES PROVIDED BY SANJAY GANDHI NATIONAL PARK, INDIA

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ABSTRACT

Sanjay Gandhi National Park (SGNP), surrounded by the megacity of Mumbai, India, is subject to high anthropogenic pressures. However, it constitutes an important 'green lung' and water source, supporting biodiversity, tourism, recreation, and additional benefits both locally and remotely. To safeguard and enhance the park ecosystem, there is a need to recognise and demonstrate the diversity of values associated with these multiple benefits, identify potential conflicts, and establish the management measures necessary to protect them. This study explores outcomes from SGNP across a systemically connected range of ecosystem services, and the geographical scales over which service benefits accrue. This informs potential novel 'payment for ecosystem services' (PES) opportunities. The protected status of the landscape is reflected in low values from provisioning services (material or energy exploitation), but substantial values from supporting (such as habitat for wildlife), regulating (including global climate, microclimate and hydrological regulation) and cultural (particularly tourism) services. However, direct resource exploitation by communities inhabiting the park is limited. Some ecosystem services were identified as ready for PES implementation (for example, water supply), others require further development (including contributions to the peripheral urban microclimate), while many services have no or limited PES potential (such as wood or aggregate extraction, prohibited under park regulations).

Key words: Ecosystem services, payment for ecosystem services, values, Mumbai, conservation, protected areas

INTRODUCTION

Ecosystems and ecosystem services are constantly changing, driven by demographic, economic, socio-political, technological, climatic and behavioural trends. The Millennium Ecosystem Assessment (2005) reported that 60 per cent of ecosystem services are degraded globally. Continuing and accelerating deterioration of ecosystems and their services erodes the foundations of economies, livelihoods, food security, health and quality of life (Brondizio, 2019). Protected areas tend to change more slowly than landscapes subject to more direct human pressures, serving important roles in conservation of species and landscape diversity, ecosystem services and wider societal benefits (Secretariat of the Convention on Biological Diversity, 2008). Ecosystem service production by protected areas can be significant. For example, an ecosystem service study found that India's Tiger Reserves provide a wide range of ecological, social and cultural benefits of substantial cumulative economic value (Verma et al., 2015). Although Hummel et al. (2019) concluded that an ecosystem services approach has scarcely been used in protected area management, and contested uses of ecosystem services may contribute to a 'conservation against development' model in some places (Martín-López et al., 2011), Figgis et al. (2015) document increasing convergence between biodiversity conservation and ecosystem service protection in protected area planning and management. Protection of natural capital and ecosystem services can constitute a cost-effective means to sustain the benefits of protected areas to human wellbeing (Ekins et al., 2003). Nevertheless, disbenefits may result when people are displaced, denied traditional resource use rights, or where there is uneven distribution of benefits and disbenefits between societal sectors (Brockington & Wilkie, 2015).

Historically, many ecosystem benefits have been regarded as 'free' and so have often been overlooked, unintentionally or wilfully, compromising conservation and development goals. Early conceptions of 'payment

Sunrise over Sanjay Gandhi National Park, India © Mark Everard

for ecosystem services' (PES) were as voluntary markets providing financial incentives for management practices aimed at protecting or increasing production of desirable services (for example Wunder, 2005), embodying the concept that those who provide services should be paid for doing so by those who consume them (Engel et al., 2008). By 2010, thousands of PES or PES-like arrangements addressing a range of service types were established globally at scales from the local to the international (OECD, 2010; Pattanayak et al., 2010). Environmental and forest policies have expanded the use of PES principles to address multifunctional objectives of ecosystem management (Merlo & Briales, 2000; Wunder et al., 2005; Cubbage et al., 2007), including increasing use of PES to address conservation and environmental goals. Examples include the Miaro Forest Corridor project in Madagascar (WWF, 2009) and the Pago por Servicios Ambientales (PSA) scheme in Costa Rica (FAO, 2007). PES may also span and reconcile rural lifestyles and livelihoods (Hubermann, 2009), for example in management of Nyungwe National Park in Rwanda (Gross-Kamp et al., 2012). However, potential conflicts can arise in terms of distributional equity, for example as demonstrated in a case study in SGNP exploring denial of access of tribal communities to the natural resources and their estrangement in favour of the values of more privileged constituencies (Sen & Pattanaik, 2015).

The thinking about PES and its growing application across the global South has evolved to recognise wider aspects of the valuation of nature, the development needs of rural communities, the creation or engagement of relevant institutions, and dialogue about the distribution of benefits (Shapiro-Garza et al., 2020a). This is in recognition and accommodation of substantially varying global and local perspectives relating to relative values and distributional benefits of PES mechanisms (Nelson et al., 2020). PES programmes based on narrow neoclassical economic principles risk conceptualising ecosystems as 'factories' for desirable commodity production, Shapiro-Garza (2020b) favouring instead a Compensation for Ecosystem Services (CES) model offering compensation for sustainable stewardship and labour of rural communities. As one example, Vietnam's Payments for Forest Environmental Services policy differs substantially from the original simplistic market model, incorporating strong state involvement in transfers of money to households in upland watersheds targeted for forest protection (McElwee et al., 2020). In this Vietnamese model, payments are not linked to market rates, and are also non-conditional, albeit that clarity about outcomes is hampered by lack of monitoring.

Jackson and Palmer (2014) argue that a fundamental reshaping of the PES concept is required, challenging

what is valued and by whom, to better resolve different scales of benefit realisation from natural systems. There is consequently a growing call for more nuanced analyses of the ways in which PES can become co-produced, to better integrate benefits for both nature and the needs and values of local communities, including non-market values, addressing diverse manifestations of power (Upton, 2020). Consequently, PES programmes are increasingly evolving to reflect multiple stakeholder demands, now rarely operating in pure market form and instead addressing rural development particularly of historically marginalised groups in delivering linked sets of goals (vonHedemann, 2020). Potential conflicts introduced by PES arrangements between conservation and development may be resolved by negotiation, facilitated by appropriate institutions between those focused on high-level outcomes, such as erosion regulation or water-yielding upper catchment protection, and the livelihood needs and values of rural stakeholders (He, 2020; Joslin, 2020). 'Wise use' of ecosystems (*sensu* Ramsar Convention Secretariat, 2007) can, for example in a case study of rubber tapping in Brazil, provide economic value to local people whilst facilitating wider forest protection (Greenleaf, 2020). However, lack of, or weak, local institutions can fragment buy-in to PES arrangements by affected local communities, creating problems in areas of uneven land tenure (Corbera et al., 2020).

This study addresses the perceived ecosystem services provided by Sanjay Gandhi National Park (SGNP), popularly known as Borivali National Park, located in Borivali, Mumbai, in the Indian state of Maharashtra (Figure 1). Surrounded on three sides by the cities of Mumbai and Thane, SGNP is subject to high anthropogenic pressures. This creates a biologically fragmented 'fenced island' ecosystem that is, nonetheless, rich in biodiversity, tourism and recreational values. It also represents a 'green lung' within the intensively urbanised surroundings, and serves as a water source for the city as well as encompassing the sources of the four rivers of Mumbai. SGNP provides additional societal benefits, locally and more remotely, though prohibitions on resource use by communities within the park may be perceived as limiting the benefits they derive. Government investment in SGNP is significant, as are visitor numbers and revenues. However, there is a need to explore opportunities for investment from non-traditional sources, comprising beneficiaries of formerly unrecognised ecosystem services, to further recognise, safeguard and enhance the diversity of societal values provided by the park.

Many of the societal values generated by SGNP are currently substantially underappreciated or, more commonly, entirely overlooked, even by those that benefit substantially from them. This represents a major market failure. Inclusion of ecosystem service benefits within payment mechanisms for management activities in protected areas can potentially reduce dependence on government grants, ideally generating surplus money for reinvestment in community development activities. Analysis of the feasibility of establishing PES approaches in SGNP provides an opportunity to ascribe values to previously un-priced ecosystem services and their generally formerly overlooked societal and economic benefits. This study consequently aims to identify, in a semi-quantitative way, perceptions of the range of ecosystem services produced by SGNP, who benefits from them, and to identify services for which it may be possible to develop PES arrangements.

METHODS

The study site

SGNP occupies 103.68 km² between longitude 72° 53" E to 72° 58" E and latitude 19° 8.8" to 19° 21" N; 44.44 km² in Thane District and 59.24 km² in Mumbai Suburban District of Maharashtra State (Figure 1). An eco-

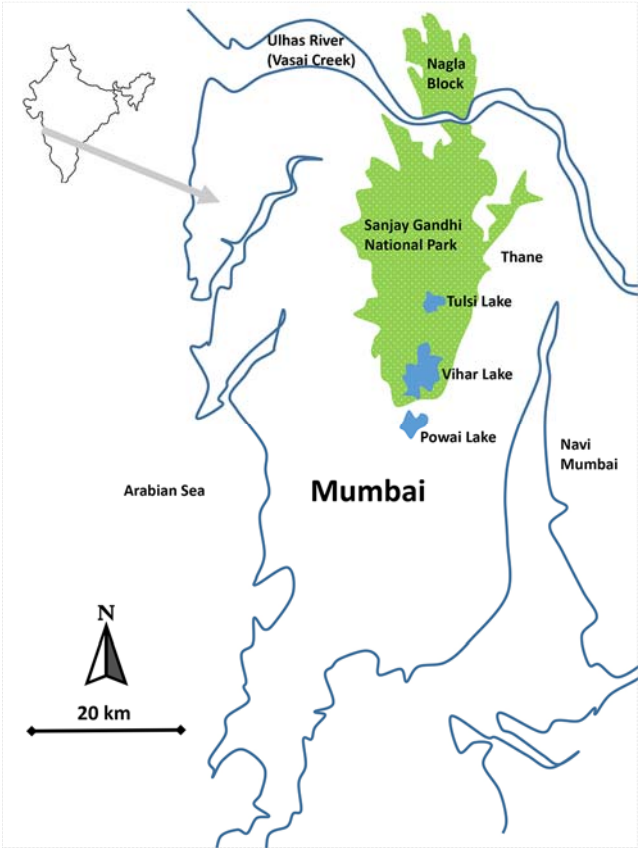

Figure 1. Location map of Sanjay Gandhi National Park

sensitive zone around the parkland area was declared in January 1996 by Maharashtra Government Resolution No. WLP/1094/ OR 177/F-1, finally notified by the Ministry of Environment, Forest and Climate Change, Government of India, in December 2016 (MoEF, 2016). The entire park area is now under the administrative control of the Additional Principal Chief Conservator of Forest (Wildlife), Borivali.

Location is a key part of SGNP's unique characteristic. SGNP represents a tiny green tract amid a densely populated surrounding megacity. The city exerts multiple pressures from unplanned economic development, industrialisation and vehicular emissions contributing to escalating air pollution, and lacking sufficient green belt areas providing open spaces for people and the regulation of climate and air quality. Yet, though fragmented in places, the park encompasses substantial faunal and floral diversity. This includes a number of endangered species, and the park harbours one of the highest global densities of leopard (*Panthera pardus*), as well as providing recreational values scaling from local to national significance. The park is situated within the northern Malabar Coast of the Western Ghats biogeographic zone, one of the least represented by protected areas. It encompasses a diversity of forest types – moist teak forest, mangroves, mixed deciduous forest and sub-tropical hill forest – and grasslands.

The park's contribution to the water resources of Mumbai and Thane is highly significant. Two lakes and their catchment areas – Vihar Lake and Tulsi Lake neither ever drying up – are located within SGNP. Both supply water and provide water security during delayed monsoons. Four rivers of Mumbai – the Mithi, Poisar, Oshiwara and Dahisar Rivers – originate from SGNP. However, whilst clean within the park, all four rivers become grossly polluted once flowing into the surrounding city. SGNP's vegetation also plays important roles in reducing atmospheric pollution from urban anthropogenic activities, absorbing or helping break down aerial pollutants and settling fine particulate matter, thereby improving surrounding air quality, regulating local temperatures and sequestering substantial amounts of carbon (IUCN, 2015).

Forty-three padas (hamlets) comprising 1,795 families are located within the park (SGNP, 2012). Tribal residents are allotted rights to land and other resources under India's Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (also known as the Forest Rights Act or Tribal Rights Act). This Act redresses rights perceived as denied under former colonial-era forest laws.

Assessment of societal values provided by SGNP

Ecosystem service flows from SGNP were reviewed to assess opportunities for PES development. The framework of provisioning, regulating, cultural and supporting services, defined by the Millennium Ecosystem Assessment (2005) and adapted in the RAWES (Rapid Assessment of Wetland Ecosystem Services) approach adopted by the Ramsar Commission (Ramsar Convention, 2018), formed the conceptual framework. Although redefined as functions and omitted to avoid 'double-counting' in some reclassifications (for example TEEB, 2010; Braat & de Groot, 2012), supporting services were explicitly considered recognising their importance in decision-making contexts due to their vital roles in the functioning, resilience and capacities of ecosystems to generate other services. Though developed as a rapid wetland assessment approach recognising practical time and resource constraints (McInnes & Everard, 2017), RAWES is essentially adapted from a wider approach used extensively for a range of habitat types (for example by Everard, 2009; Everard & Waters, 2012). RAWES enables the integration of different available and observable forms of knowledge (quantitative, qualitative, interviews with local stakeholders, expert judgement, etc.), informing semi-quantitative judgements of the perceived significance of each

Table 1. Interviewees and the semi-structured interview approach

Stakeholder group	Numbers and composition of interviewees
Villagers living in SGNP	N = 43 (One randomly selected household from the 43 padas identified in the SGNP (2012) Management Plan; 22 female and 21 male respondents)
Ground staff of SGNP	N = 6 (2 forest guards from each of the Park's three ranges)
Officers of SGNP	N= 6 (District Forest Officer, two Assistant Forest Officers and three Range Forest Officers)
Tourists visiting SGNP	N = 16 (10 female and 6 male, randomly selected)
People living in the close vicinity of SGNP	N = 9 (heads of families living in the vicinity of the park, 5 male and 4 female)

Tulsi Lake, Sanjay Gandhi National Park, India © Mark Everard

ecosystem service on a systemic basis, including geographical scales of benefit realisation. RAWES assessments can serve as an initial screening providing systemic context for subsequent quantitative assessments of targeted ecosystem services. They may be used in local or national policy frameworks and decision-making processes such as environmental impact assessments, and can provide a basis for identification of potential PES opportunities (McInnes & Everard, 2017).

Evidence-gathering to populate this ecosystem services assessment was derived from the literature cited in this report (particularly in Supplementary Online Material 1), interviews with SGNP stakeholders, and the expert knowledge of the assessment team. Interviewees (N=80), described in Table 1, were interviewed by the research team. Semi-structured interviews were conducted primarily in Hindi, where this was the interviewee's native language. Interviewees were asked about their use of each ecosystem service, though these were introduced in conversation in locally relevant terms rather than through a rigid questionnaire to better account for cultural differences between researchers and local people and the diversity of views of the interviewee group (following Everard et al., 2019). This approach enabled interviewees to respond freely rather than asking them to rigorously adhere to precise questions. Gender sensitivity was considered by selecting informal interviewers of the same gender as interviewees. Interviewees were asked for their consent to use their responses in anonymised form for research purposes, and were informed of their rights to withdraw from the study by contacting the interviewers.

Summarising production of the four ecosystem service categories at SGNP, the semi-quantitative importance of each service was scored on a scale from +1.0 (significantly positive) to -1.0 (significantly negative) with intermediate points at 0.5 (positive), 0 (neutral) and -0.5 (negative). Responses of 'not relevant' and 'unknown' were removed from analysis. Groups of ecosystem services were summed and divided by the number of relevant services per service category to derive an ecosystem services index (ESI), based on similar index methods by Butchart et al. (2010) and applied by McInnes and Everard (2017) and Everard et al. (2019). ESI is calculated using Equation 1, where 'nTOTAL' was adjusted to remove services that were not relevant in this specific context (e.g. waste disposal or fire regulation within SGNP). The potential ESI range is from +1 to -1, calculated for each of the four ecosystem service categories, or as a compound value for all services.

Equation 1.

$$\mathrm{ESI} = \frac{\sum(n_{+1.0}+n_{+0.5})+\sum(n_{-1.0}+n_{-0.5})}{\sum n_{\mathrm{TOTAL}}}$$

This equation was also used to calculate ESIs for the four geographical ranges used in this assessment (local, city, national, international) for all 30 relevant services. Total ESIs for geographical scales can exceed 1.0 where benefits accrue across multiple scales.

RESULTS

The RAWES approach integrated evidence from publications cited in the body of this paper and Supplementary Online Material 1, stakeholder interviews and expert judgement, recognising perceived ecosystem service benefits and the geographical scales over which benefits arise. The various ecosystem services are enjoyed not only by tourists, researchers and educators within the park but, significantly, by the entire city of Mumbai and Thane. Many more benefits extend over national and international scales. These findings are summarised in Supplementary Online Material 2 with explanatory comments on how judgements were made.

Table 2 outlines ESI scores by ecosystem service category, and Table 3 outlines ESI scores for the geographical scales at which services accrue.

The ESI for provisioning services (0.42, accounted for by significant exploitation of water and limited use of food, fibre, fuel and ornamental resources) was the lowest for all ecosystem service categories, reflecting the policy of withholding exploitation of natural resources such as timber, aggregates, food, medicines and biochemicals, energy harvesting and waste disposal within the park. This clearly has substantial benefits in protecting the functioning of the park's diverse ecosystems and production of other services (maximum ESI of 1.00 for supporting services with 0.92 for regulating services). Cultural services are also substantial (0.79), addressing a range of values expressed as cultural heritage, tourism and recreation, aesthetics, spiritual and religious values, artistic inspiration, social relations, and education and research, experienced in varying ways and over different spatial scales by stakeholders including park residents, adjacent urban residents and other national and, in the case of tourism and research, international communities. It was not possible within the scope of this study to differentiate the perspectives of different stakeholder groups. Nor was it possible to conduct a sensitivity analysis as to whether, or to what degree, further controlled use of provisioning services by Indigenous communities under tribal rights could influence the flows of all ecosystem services.

ESIs for the geographical scales at which benefits accrue emphasise the substantial scale of benefit realisation locally (ESI = 0.75) and to the adjacent city (ESI = 0.67), with lower scores for national and international scales (ESIs of 0.23 and 0.22 respectively) for services that are nonetheless important (such as global climate regulation and tourism resource). The substantial ESI of 1.87 for combined scales demonstrates that many

Table 2. ESI scores for ecosystem service categories as defined by the Millennium Ecosystem Assessment (2005)

Ecosystem service category	Cumulative importance scores	Number of relevant services (out of total in category)	ESI
Provisioning	2.5	6 (out of 9)	0.42
Regulating	10	11 (out of 14)	0.91
Cultural	5.5	7 (out of 7)	0.79
Supporting	6	6 (out of 6)	1.00
Combined services	24	30 (out of 36)	0.85

Table 3. ESI scores across the four geographic benefit realisation ranges

Ecosystem service benefit realisation range	Cumulative importance scores	Number of relevant services (out of total services)	ESI
Local	22.5	30 (out of 36)	0.75
City	20	30 (out of 36)	0.67
National	7	30 (out of 36)	0.23
International	6.5	30 (out of 36)	0.22
Combined ranges	56	30 (out of 36)	1.87

benefits accrue at multiple geographical scales. Again, the influence of potential local exploitation under the Tribal Rights Act was not assessed within the current study.

DISCUSSION

At the very least, representation of the value of the range of ecosystem services provided by SGNP, both in monetary and non-monetary terms, challenges the commonplace undervaluation of many ecosystem services and the consequent frequency with which they are overlooked in decision-making (Sutherland et al., 2018).

Benefits and beneficiaries of services generated by SGNP

ESI analyses, illustrative as they are at ecosystem service category level, highlight the diversity and multiplicity of societal values that stem from current management of SGNP. Controls on exploitation of provisioning services play a role in retaining ecosystem structure and functioning, enhancing flows of a range of desired and co-beneficial supporting, regulating and cultural services. Benefits accrue at scales from the local to the international, weighted towards local/city scales but with important benefits right up to global scale. Many provisioning and some cultural services have established financial values, however lack of market valuation of most supporting and regulating services represents a major market failure contributing to unsustainable exploitation (Science for Environment Policy, 2015).

Table 3 outlines the beneficiaries of services produced by SGNP. On the basis of these findings, Supplementary Online Material 3 breaks down services identified as relevant to SGNP into the eight categories of:

1. Tangible and monetisable services amenable to market development;
2. Tangible services requiring more work to develop and/or hard to quantify;
3. Tangible but technically illegal services, such as fuelwood and timber extraction, that nonetheless are currently utilised;
4. Tangible but banned services for which highly controlled market expansion could be considered;
5. Services for which there are already de facto PES or PES-like arrangements (the state recirculates taxpayer revenues for public good);
6. Services for which further research is required to understand benefits and possible PES or PES-like arrangements;
7. Services that are both banned and inappropriate; and
8. Services that should not be marketed due to risk of double-counting of benefits.

PES as a potential contributor to addressing pressures on the SGNP ecosystem

Major threats to the SGNP ecosystem described in the SGNP (2012) Management Plan include:

1. Destruction of natural habitats due to encroachment and illicit tree cutting;
2. Activities of communities in padas within SGNP disturbing adjacent areas (Wildlife and We Protection Foundation, 2018), though rights remain unclear under the Tribal Rights Act;
3. Disturbances to natural habitats by mining (mainly stone quarrying) in areas immediately adjacent to the park's external boundaries;
4. Human–animal conflict, mainly involving leopards (panthers); and
5. Insufficient space for leopards, compounded by attraction to peripheral garbage and domestic animals, leading to the dispersal of young panthers outside the protected area, contributing to increased mortality (for example by speeding vehicles), and other problems.

Despite the diversity and value of services produced by the SGNP ecosystem, almost all are overlooked in the SGNP (2012) Management Plan. Demonstration of the full range of values provided by SGNP, both economic and non-monetary including some clearly used by local communities, can contribute to curbing these and other threats through their integration into positive management. When forest ecosystem services are regarded as free and are consequently ignored or underestimated, forest use, management or conversion contributes to substantial forest degradation and loss observed globally (Jenkins & Schaap, 2018). Conservation and effective management of ecosystems for sustaining services requires innovative approaches and enabling policies. PES approaches, applied to identified beneficial services, offer an additional approach for recognition and management of services provided by SGNP.

Opportunities for PES development

Cells in the right-hand 'Recommendations' column of Supplementary Online Material 3 are colour-coded using a three-colour 'traffic lights' approach, also annotated with status: READY (green) signifies ready for market development; FURTHER DEVELOPMENT (amber) indicates that further research or dialogue is necessary to explore potential PES arrangements; whilst NO POTENTIAL (red) indicates no potential for

development of PES arrangements. In each cell is a recommendation for PES development, further exploration of potential PES arrangements, or abandonment of the notion of PES development for each service.

In practice, contractual arrangements for many PES schemes globally are 'input-based', founded on agreed practices deemed by partners in the PES arrangement as likely to produce the desired benefit(s), rather than 'output-based' (geared directly to quantified outcomes) (Smith et al., 2013). Further major challenges remain over the quantification and attribution of ecosystem services and their link to the values of different social groups in complex social-ecological systems at relevant spatial and temporal scales (Spash, 2009; Reed et al., 2015). Monetary valuation of ecosystem services has been widely used to place values on ecosystem services in the context of PES. However, monetisation techniques tend to overlook the value of cultural services, as well as the values of ecosystem services that are shared by different social groups as opposed to the aggregation of individual values (Kenter et al., 2015). Assignment of monetary values also tends to overlook the ways in which values may change over time for different groups, for example due to environmental, social, economic or technological change. Bundling and layering help to resolve issues of quantification and attribution in PES schemes by quantifying and valuing a number of different ecosystem services at the same time, linked to a specific intervention (Smith et al., 2013). Despite progress in recent years towards the development of bundled and layered PES schemes seeking to resolve conservation and rural development goals, four important challenges remain unresolved when considering potential PES arrangements in SGNP:

1. PES schemes have often incentivised management activities to maximise production of a narrow outcome, or set of outcomes. This is due both to knowledge gaps about the impacts on linked ecosystem services, as well as the asymmetric influence of PES scheme proponents (Pattanayak et al., 2010);
2. Interdependencies between ecological and social systems have often been overlooked, with the primary focus of PES design then potentially resulting in negative social outcomes (for example Roe et al., 2013). Contributory factors include: i) measurement issues related to the intangible nature of many cultural services (Chan et al., 2012); ii) ontological issues related to whether values for these services are held individually or collectively, and hence whether a single value can be ascribed to an ecosystem service in any given location addressing the perspectives of all societal groups (Kenter et al., 2015); and iii) philosophical issues over whether cultural services could or should be monetised via PES schemes (Fourcade, 2011);
3. Governance of PES schemes in such complex social-ecological systems remains challenging (Farley & Costanza, 2010; Bennett & Gosnell, 2015), relating to the inter-connected and quite different spatial and temporal scales at which different ecosystem services are typically managed (Schomers et al., 2015; Jones et al., 2016). PES schemes are most effective when developed with bottom-up involvement of local communities, particularly in international development contexts (e.g. Milder et al., 2010) and involving linking institutions (Shapiro-Garza et al., 2020a; He, 2020; Joslin, 2020); and
4. The current focus on excluding resource extraction can conflict with indigenous rights under the Tribal Rights Act, so some accommodation of limited and controlled resource extraction, zoned or otherwise guided to protect important and vulnerable ecosystems and processes, may represent a means to resolve conservation and tribal rights priorities.

This study identifies ecosystem services for which it may be possible to develop PES arrangements, though it does not detail the necessary follow-on stages of actual PES development. In practice, identifying ecosystem services with clear potential providers and consumers and then resolving institutional, legal and technical issues can be highly complex. Further research is required to determine the distributional benefits and costs of management options, resolving the rights and priorities of different stakeholders some of which are currently regarded as conflicting. Key features to be integrated into PES design include accounting for knowledge gaps, ensuring additionality (cost-effectively providing ecosystem services that would not have otherwise been provided), avoiding 'environmental leakage' (preventing additionality within the project area in ways that displace impacts to other areas), ensuring permanence of outcomes and payments, avoiding transaction costs disproportional to the intended benefits, and establishing PES arrangement where there is a low level of, or uncertain, land ownership or rights. Stepwise approaches are therefore necessary requiring adequate resourcing, including time, financial investment and appropriate expertise, including involvement of institutions effective in engaging and integrating different stakeholder groups. A stepwise approach to PES development was published by the UK Government (Smith et al., 2013), with an alternative 10-step approach to assessing the feasibility of PES provided by Fripp (2014). Correctly framed, PES arrangements can

not only secure public benefits, but also address poverty alleviation. Carefully designed and implemented PES schemes represent just one of a range of policy tools that can synergistically complement environmental policy mixes. Consequently, the majority of PES schemes in developing countries tend to be government -financed on behalf of a range of public beneficiaries, with progressive schemes integrating conservation and development goals.

CONCLUSIONS

Sanjay Gandhi National Park hosts a wealth of biological and geological diversity and cultural history, conferring a wide range of benefits locally, into the surrounding city, nationally and internationally, and spanning a diversity of values from the tangible and tradeable to the cultural and spiritual.

The ecosystem services framework provides a useful basis for stratifying the diverse and qualitatively differing benefits generated by SGNP, the RAWES (Rapid Assessment of Wetland Ecosystem Services) approach helping identify the perceived values of all linked services in semi-quantitative terms.

Ecosystem services were assessed as either: closer to PES implementation and development; requiring further research or dialogue to explore potential PES arrangements; or with no potential for development of PES arrangements.

The RAWES approach also enables articulation of the range of geographical scales over which SGNP provides benefits to society, demonstrating the value of continued or increasing protection and management of the park's natural and heritage assets.

Impacts of a variety of pressures on the park could have deleterious effects on the park ecosystems and their associated values, though there may be scope for limited and carefully controlled resource extraction for the subsistence needs of indigenous communities.

SUPPLEMENTARY ONLINE MATERIALS

SOM 1 - Opportunities for investment in the societal values provided by Sanjay Gandhi National Park, India
SOM 2 - RAWES-based analysis of perceived ecosystem service benefits, geographical scales, potential PES arrangements and some explanatory comments.
SOM 3 - Consideration of potential PES arrangements for service generated by the Sanjay Gandhi National Park, India

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RESUMEN

El Parque Nacional Sanjay Gandhi (SGNP, por sus siglas en inglés), rodeado por la megalópolis de Bombay, India, está sujeto a altas presiones antropogénicas. Sin embargo, constituye un importante "pulmón verde" y una fuente vital de agua, que apoyan la biodiversidad, el turismo, la recreación y otros beneficios tanto a nivel local como remoto. Para salvaguardar y mejorar el ecosistema del parque, es preciso reconocer y demostrar la diversidad de valores asociados a estos múltiples beneficios, identificar los posibles conflictos y establecer las medidas de gestión necesarias para protegerlos. Este estudio explora los resultados del SGNP a través de un abanico de servicios de los ecosistemas conectados en forma sistemática, y las escalas geográficas en las que se obtienen los beneficios de dichos servicios. Esto informa acerca de posibles nuevas oportunidades de “pago por los servicios de los ecosistemas” (PSE). La condición de protección del paisaje se refleja en los bajos valores de los servicios de aprovisionamiento (explotación energética o de materiales), pero en valores sustanciales en términos de los servicios de apoyo (como el hábitat para la vida silvestre), de regulación (incluyendo el clima mundial, el microclima y la regulación hidrológica) y culturales (particularmente el turismo). Sin embargo, el aprovechamiento directo de los recursos por parte de las comunidades que habitan el parque es limitado. Se identificaron algunos servicios de los ecosistemas como listos para la implementación de PSE (por ejemplo, el suministro de agua), otros requieren un mayor desarrollo (incluyendo las contribuciones al microclima urbano periférico), mientras que para muchos servicios el potencial de PSE es nulo o limitado (como la extracción de madera o de agregados, que está prohibida en virtud de los reglamentos del parque).

RÉSUMÉ

Le parc national de Sanjay Gandhi, entouré par la mégapole de Mumbai en Inde, est soumis à de fortes pressions anthropiques. Cependant, il constitue un important ‘poumon vert’ ainsi qu’une source d’eau, soutenant la biodiversité, le tourisme, les loisirs et de nombreux autres avantages à portée à la fois locale et plus distante . Pour sauvegarder et améliorer l'écosystème du parc, il est nécessaire d’identifier puis de mettre en évidence la diversité des valeurs associées à ces multiples avantages, de repérer les conflits potentiels et d'établir les mesures de gestion nécessaires pour les protéger. Afin d’explorer les résultats du parc, cette étude examine une gamme de services écosystémiques interconnectés et les échelles géographiques auxquelles les avantages de ces services reviennent. Cela met en lumière de nouvelles possibilités de ‘paiement pour des services rendus par les écosystèmes’ (PSE). Le statut protégé du parc se manifeste à travers la faible valeur attachée aux services de fourniture (exploitation matérielle ou énergétique), contrairement à la valeur substantielle attachée aux services de soutien (à l’habitat de la faune par exemple), à la réglementation (y compris le climat mondial, le microclimat et la régulation hydrologique) et aux services culturels (en particulier le tourisme). Cependant, l'exploitation directe des ressources par les communautés habitant le parc reste limitée. Certains services écosystémiques sont considérés comme prêts pour la mise en œuvre du PSE (par exemple l'approvisionnement en eau), d'autres nécessitent un développement supplémentaire (telles les contributions au microclimat urbain périphérique), tandis que de nombreux services ont un potentiel de PSE inexistant ou limité (comme l'extraction de bois ou d'agrégats, interdit en vertu des règlements du parc).

FINANCIAL STRUCTURING OF PROTECTED AREAS ACCORDING TO THE CONSERVATION MEASURES PARTNERSHIP CLASSIFICATION SYSTEM OF ACTIONS

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ABSTRACT

Protected areas represent the cornerstone of biodiversity conservation. While their governance can take many forms, optimising their management is essential to achieve their protection, restoration, and sustainable use. This requires that concepts and methodologies are applied in a standardised way in both their financial planning and the management of their conservation actions. In order to describe the financial structure of protected areas in a globally accepted language, the financial information of 19 randomly chosen public Colombian protected areas was analysed and their institutional management actions were standardised based on the Conservation Measures Partnership (CMP) classification of actions. The financial plans were built based on the budgetary implementation reports, management effectiveness assessments and management plans of each protected area; the institutional management actions were taken from the three components of the current management plans and the institutional policies of the government administrative body. Eight cost categories were standardised from 17 institutional management actions in accordance with the CMP classification; and a total funding gap of US$ 47,547,554 was calculated. Protected areas around the world follow a similar financial structure, however, a wide variety of management actions is reported among them. Standardisation of cost categories according to the CMP classification of actions would support comparative investigations in financial sustainability and allow analyses of the financial needs of protected areas worldwide.

Key words: Funding gap, protected areas, management, strategic planning, financial planning, biodiversity conservation, Conservation Measures Partnership

INTRODUCTION

The Convention on Biological Diversity (CBD), signed in 1992, recognised biological diversity as a priceless global commodity for the survival of present and future generations, and sought to establish effective measures to be implemented at a global level in order to achieve its conservation. One of the commitments adopted by the CBD member countries and reiterated in subsequent meetings was to foster the creation of complete, effectively managed and ecologically representative systems of protected areas (CBD, 2004).
In 2010, one of the priorities established in the Strategic Plan for Biological Diversity and the Aichi Targets was to deepen efforts in providing adequate financial resources, mainstreaming the issues and values related to biological diversity, and effectively applying adequate policies (CBD, 2010). To this end, Achim Steiner, Executive Director of the UN Environment Programme, highlighted that one of the key areas for significantly reducing the rate of biodiversity loss and to achieve sustainability in the 21st century is the integration of economics in the conservation of biological diversity and ecosystem services (Secretary of the CBD, 2010).

These economic aspects include the adequate development of protected area strategic planning, which forms the basis for the structuring of financial plans and to calculate the funding gap. Financial structuring sets out the needs and income in a time horizon separated at the level of the operation costs, investment and income by source of funding.

The IUCN guidelines on sustainable financing of protected areas (Emerton et al., 2006) provide a basis for promoting homogeneity in the financial structure of protected areas worldwide based on government

revenue and cooperation, and operational and investment needs. This structure also allows linking the priorities of the protected area to available resources (Worboys & Trzyna, 2015; Thomas & Middleton, 2003).

The operational needs are defined as the requirements for all of the activities necessary to operate the protected area; such as the personnel required, infrastructure and basic supplies, services to the public, travel costs and allowances. The investment needs are the significant costs, along with those incurred for the protected area to finance its future development, including those costs of establishing the baseline or basic protected area information as a starting point for strategic actions (species inventories, community censuses, etc.) (TNC, 2005). Funding gaps for protected areas can be calculated by quantifying the financing needs of a single protected area or a system of areas. For this, it is necessary to compare the currently available financial resources, which are taken as the baseline and the resource needs under different scenarios (FAO-OAPNN, 2010).

In Colombia, the CBD was ratified in 1994, and from this date the government has worked to align its conservation actions towards established international commitments. The Colombian National Natural Parks System (PNN) plays a vital role in meeting these commitments, as it is the governmental entity responsible for the administration of the protected areas, which are prioritised for in situ conservation of biodiversity. Currently, there are 59 protected areas within the PNN located throughout the country, totalling 174,670 km² (RUNAP, 2018). The Colombian protected area classification is regulated by Decree 2372 of 2010 and the protected areas managed by PNN include IUCN management categories I to III, (RUNAP, 2018; DANE, 2015; Dudley, 2008). The PNN also coordinates the National Protected Area System made up of public and private protected areas, social and institutional actors and the management strategies and instruments that define them, which together contribute to meeting the general conservation objectives of the country (Decree 2372 of 2010) and currently total 310,304 km² protected in different categories (RUNAP, 2018).

The protected areas managed by PNN contribute 0.9 per cent (US$ 2.77 billion) to GDP annually; protect four of the country's six most important water catchments and more than 62 per cent of national aquifer sources; supply water to 25 million people in cities such as Bogota, Cali, Manizales, Neiva, Santa Marta and Valledupar; provide at least US$ 884 million by way of water supplies to the agricultural sector; and provide around 50 per cent of the country's hydroelectric energy, contributing at least US$ 502 million to the energy sector (PNN, 2014).

Many countries have analysed the income and financial resource needs of their protected areas and their variation over time (Balmford et al., 2003; Bezaury et al., 2011; Binet et al., 2015; Bovarnick et al., 2010). In doing so, they estimate funding gaps using different levels of analysis and methodological focuses, as well as forming scenarios which allow decision makers to direct resources to protected area needs and develop funding mechanisms. Once the funding gap has been calculated, the identification, design and implementation of sustainability strategies are facilitated, and it becomes possible to prioritise resource allocation and management to achieve them (FAO-OAPNN, 2010). However, a standardised language is yet to be adopted that would allow the conservation community to apply a more systematic approach to financial structuring and which could, as a result, be easily shared and replicated among different categories of protected areas around the world.

The Conservation Measures Partnership (CMP) classification system of actions was an initiative of IUCN and a consortium of internationally-recognised conservation organisations, whose mission is to improve biodiversity conservation practice by developing and promoting common standards for the conservation process and measuring its impact. From 2002 onwards, these organisations carried out a number of independent projects on conservation practice (Salafsky et al., 2002; CMP, 2005; IUCN, 2005a; IUCN, 2005b; IUCN-CMP, 2006; IUCN-CMP, 2007). Recognising that it was more effective to have one globally-accepted classification of actions and threats, they published an article in 2008 entitled "A Standard Lexicon for Biodiversity Conservation: Unified Classifications of Threats and Actions" (Salafsky et al., 2008). As described in this study, the generalised adoption of these classifications would aid project groups to identify appropriate threats and actions more systematically, help managers to define priorities and assign resources more efficiently, and, more importantly, facilitate the learning and development of a systematic science of conservation.

Clearly, the financial structuring of protected areas should be accomplished in line with the strategic actions proposed in the management or conservation master plans. The CMP classification system represents an internationally-accepted system for classifying these

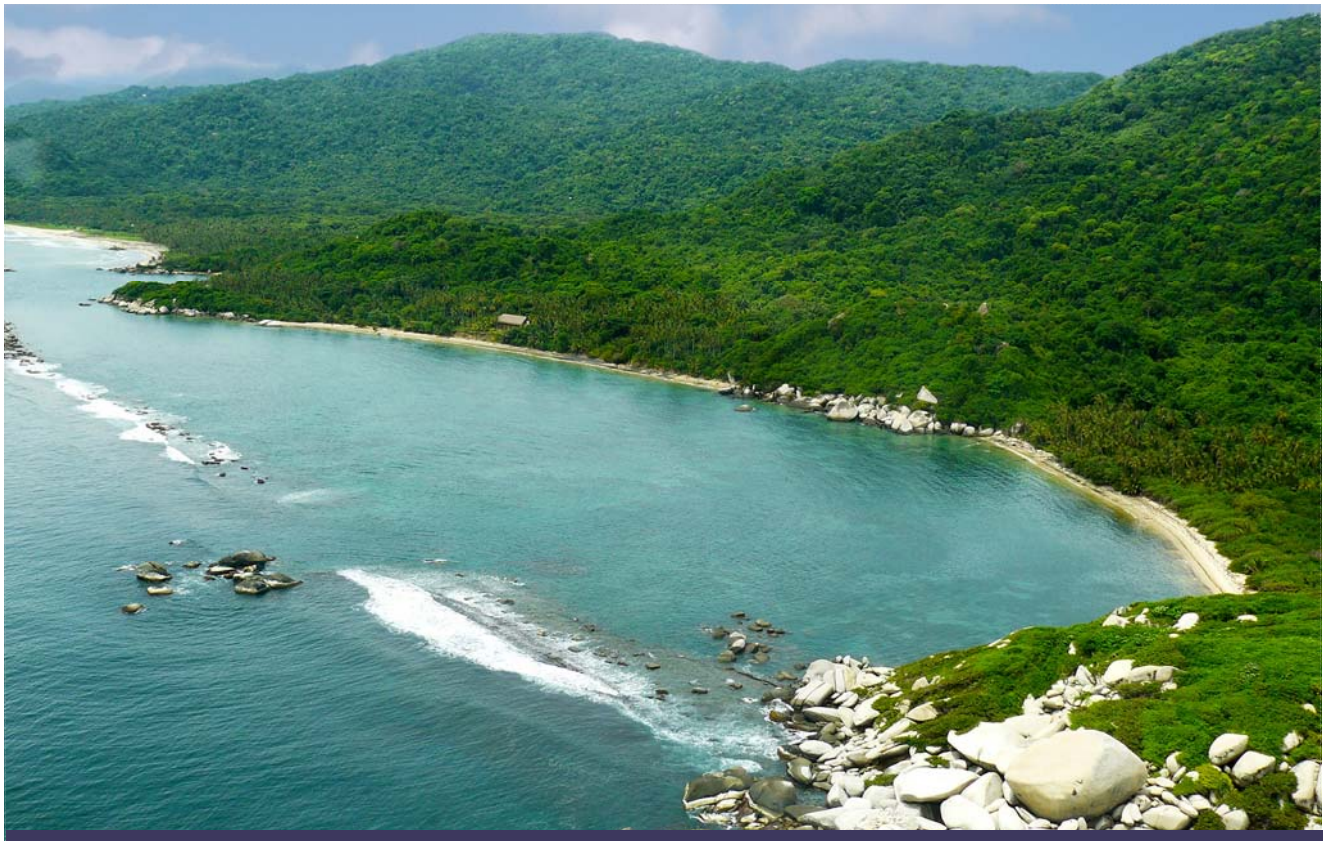
actions to optimise conservation practice and data coding by using a common language. Therefore, the goal of this study was to establish the financial structuring of the protected areas managed by PNN by aligning the institutional actions with the CMP classification system of actions in the design of financial plans and calculating the funding gap.

METHODS

The financial structuring was undertaken for the period 2017–2021, with 19 randomly chosen marine and terrestrial protected areas within the PNN, corresponding to IUCN management categories Ib, II and III. It was carried out in three stages: the development of financial plans, the standardisation of actions, and the calculation of the funding gap. The results of the financial plans and calculation of the funding gap were analysed by descriptive statistics and presented in US$ and percentages that represent the proportion of the total (per cent), respectively.

Information from the following technical and financial planning instruments of the protected areas were used to develop the financial plans: Integrated Financial Information System budgetary implementation reports from March 2017; financial information of the International Affairs and Cooperation Office of PNN from 2012 through 2016; Analysis of the Effectiveness of the Management of Protected Areas with Social Participation (AEMAPPS) reports for 2012, 2013, 2014 and 2016 from the Departments of Human Resource Management and Resource Management; and protected area management plans or the legal declaration of the protected area for those that did not have an adopted management plan. The Integrated Financial Information System reports were used to determine the income component, for which the current approximation for each protected area was projected as a real growth of 3 per cent based on the inflation projected by the country's central bank (Republic of Colombia Bank, 2018) and the financial information of the International Affairs and Cooperation Office of PNN was used to determine the extent of external technical, scientific or financial support expressed in monetary terms.

The AEMAPPS reports were used to quantify the operating needs, which included required personnel, infrastructure, office and field equipment, services to the public, fuel, travel costs and provisions. This tool



The last remnants of tropical dry forest that remain in Colombia are preserved in Tayrona National Park © Julia Miranda

allowed additional operation requirements for the next annual period of the protected area management to be included in the study. A protected area coefficient of management (Figure 1) was developed to ensure that the values assigned for the operating needs were adjusted according to the distance of the protected area to the closest regional city providing supplies for the operations, relative transportation costs and the cost of living expressed by the Consumer Price Index of the region where the protected area was located.

Management plans were used to determine investment needs. For protected areas that did not have a current management plan, investment needs were calculated by the unit value per hectare affected by human pressure (US$/ha), by taking into account the management information contained in the legal declaration of the protected area: the conservation status, ecosystems present, conservation targets and actions and their technical correspondence with a reference protected area having an adopted management plan (Appendix 1 Supplementary Online Material).

For the standardisation of actions, the actions described in each of the components of the management plan

$$PA\ coefficient\ of\ management = \frac{\text{km of PA from capital city}}{\text{Average km TD}} \times \frac{\text{CPI City PA}}{\text{Average CPI TD}} \times \frac{\text{Average fuel efficiency of means of transport TD}}{\text{Average fuel efficiency of means of transport TDs}} + 1$$

Where,

km of PA from capital city	Corresponds to the distance in kilometres from the PA's operating centre or the closest reference point to the PA - to the closest capital city registered by National Department of Statistics (DANE) in the variation of the Consumer Price Index (CPI)
Average km TD	Corresponds to the average distance in kilometres from the PA's operating centres by Territorial Direction or closest reference points to these PA - to the closest capital cities registered by DANE in the variation of the CPI
CPI City PA (%)	Variation of the CPI of the closest capital city to the PA, in the years 2012-2017 registered by DANE.
Average CPI TD (%)	Average variation of the CPI of the closest capital cities registered by DANE by Territorial Direction.
Average fuel efficiency used by the means of transport TD (km/gal)	Average value of fuel efficiency of the means of transport used in Territorial Direction, defined as a regional administrative unit of the PNN
Average fuel efficiency used by the means of transport TDs (km/gal)	Average value of fuel efficiency of the means of transport used in the Carribean and North-Eastern Andean Territorial Directions

Figure 1. Equation for calculating the updated values coefficient by protected area

(Diagnostics, Zoning and Uses, Strategic Planning) were collected and grouped in categories and subcategories according to their conceptual bases in the institutional policies currently in place (Appendix 2 Supplementary Online Material). Finally, the categories and subcategories were compared and contrasted with the CMP current classification system of actions, consisting of three larger groups (level 0) of independent but complementary actions, which in turn contain two further levels (1 class and 2 category) and a proposal of a comprehensive sub-level 3 that contains concrete examples of actions to facilitate the conceptual alignment in the practice of conservation (IUCN-CMP, 2006; CMP, 2016) (Figure 2).

To calculate the funding gap, the difference between the operation costs and the allocated resources was established. It was then possible to estimate the difference between the operation and investment needs and the total resources of the protected areas in the study. The results for values obtained for 2017 were then adjusted to 2019, taking into account the increase in prices in Colombia for 2018 and 2019, being 3.18 per cent and 6 per cent, respectively.

RESULTS AND DISCUSSION

The financial plans of the protected areas in the study display financial information on the operation and investment needs, and the income from, and investment in, the operation (Table 1). In the present study, the financial plans were analysed through six operation categories (equipment, personnel, travel costs and allowances, infrastructure, maintenance, public services) and nine investment categories (institutional strengthening, environmental authority, eco-tourism, education and communication, risk management, investigation and monitoring, restoration, sanitation, sustainable systems for conservation) (Table 2).

As an effectiveness analysis, the AEMAPPS used in the present study constitutes a realistic tool that complements protected area operational planning as it is applied on a regular basis by protected area teams at the regional and national level. It is also considered a versatile tool as the itemised needs can be incorporated in the following annual work plan. There is a direct relationship between the effectiveness analysis and the scope of protected area planning. The planning incorporates the management plan or legal protected area declaration variables and their compatibility with other planning tools such as annual operating plans, planning level, zoning and limits (Zambrano et al., 2007; Cifuentes et al., 2000).

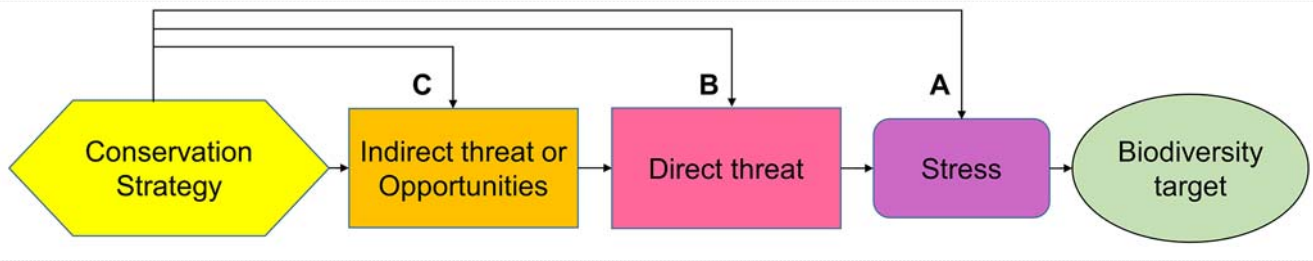


Figure 2. Conceptual diagram of the different levels of conservation actions: actions which directly reduce stress on the conservation target (A), actions for the reduction of direct threats (B), and actions which intervene on the indirect threats or opportunities favouring the conditions for actions A and B to take place (C). (Modified from CMP, 2016)

Table 1. Financial plans of the 19 PNN protected areas expressed in US$

Protected Area	Management categories of UICN, International Union for Conservation of Nature	Needs		Incomes		
		Operation	Investment	Operation	Investment	Cooperation
Estoraques	III	1,391,022	1,038,504	417,068	181,227	198,887
Bahía Portete	II	207,909	1,135,574	44,371	697,665	101,113
Catatumbo Bari	II	359,286	1,394,733	325,416	242,066	0
Corales de Profundidad	II	708,986	1,296,793	51,468	398,938	32,801
El Cocuy	II	4,039,527	4,354,342	1,034,344	3,284,991	672,117
Macuira	II	2,903,064	594,554	516,646	644,512	269,936
Old Providence	II	1,597,378	2,420,908	599,820	301,705	72,833
Pisba	II	1,719,309	2,610,045	499,859	247,168	0
Sierra Nevada de Santa Marta	II	4,156,135	2,951,823	608,992	619,590	114,805
Tamá	II	1,490,953	1,031,314	561,497	332,057	89,423
Tayrona	II	4,313,740	59,683	596,761	1,924,173	233,471
Acandí		364,630	197,186	274,686	460,719	0
Cienaga Grande de Santa Marta	Ib	1,723,961	2,836,109	550,725	349,296	119,750
Corchal	Ib	2,015,333	815,068	540,315	139,753	95,522
Flamencos	Ib	1,698,134	999,228	496,771	222,770	0
Guanentá	Ib	1,441,837	2,443,184	588,505	575,123	363,106
Iguaque	Ib	1,886,308	2,352,391	563,118	180,596	165,022
Los Colorados	Ib	1,156,057	2,186,135	592,068	362,867	232,011
Vía Parque Isla de Salamanca	III	1,920,156	3,335,201	602,962	1,143,410	339,190
Total US$ to 2017		35,093,724	34,052,775	9,465,394	12,308,626	3,099,987
Total US$ updated to 2019		**37,690,681**	**36,572,701**	**10,165,839**	**13,219,472**	**3,329,387**

In standardising the PNN actions according to the classification of actions of the CMP, the correspondence between categories of actions in PNN financial plans and CMP actions was determined (Table 2). Although there are many publications on the use of the unified classification of actions of the CMP in the practice of conservation (Kapos et al., 2010; Redford et al., 2018), no studies have incorporated this classification into the financial structuring of protected areas. Rather these studies represent a more conceptual and methodological application of the classification of actions of the CMP regarding the planning of conservation projects or strategies; primarily as part of the implementation of adaptive management using the Open Standards for the practice of conservation (CMP, 2013). However, the 'implementation and monitoring of actions' step of these standards involves a detailed development of action plans and ensuring sufficient resources for the planned actions; in other words, a financial structuring in line with the strategic plan. For example, Salafsky et al. (2002) emphasise that effective conservation requires clarity concerning its goals, the actions necessary to achieve them, the method to measure progress, and an analysis of the results which allows feedback and adaptation of management. However, these efforts would not be effective if there is a lack of consistency between the needs and the availability of resources to carry out these actions.

Finally, a funding gap of 30 per cent was calculated for Colombia's protected areas from the study estimates in the timeframe of five years, the annualised figure would be 0.0014 per cent of GDP. These calculations also show that the funding gap would be scarcely 0.007 per cent of the direct foreign investment associated with the mining and petroleum sector (Table 3).

Different protected areas around the world have similarly analysed their financial information based on planning tools such as the annual planning or management plans, however, they do not incorporate management effectiveness assessments as an input to estimate the operation needs. In the case of Guatemala, six cost categories of operation were identified (personnel, materials and supplies, transferences, property, plant, equipment and intangibles, transport and training), and investment was determined according to twelve cost categories (land tenure, communication plan, management capacity, conflict resolution, environmental education plan, master plan, necessary personnel, resources of the protected area in the management plan, investigation programmes, legal

Table 2. Correspondence of PNN actions with the CMP classification system of actions

Categories of actions of the PNN protected areas financial plans	Correspondence with the CMP system of actions (CMP, 2016)		
	Level 2	Level 1	Level 0
Restoration	1.2. Ecosystem and Natural Process (Re)Creation	*1. Land/Water Management*	A. Target restoration/stress reduction actions
Eco-tourism	1.1. Site/Area Stewardship		
	5.5. Non-monetary values	*5. Livelihood, Economic & Moral Incentives*	B. Behavioural change/threat reduction actions
Environmental Authority	5.1. Linked Enterprises & Alternative Livelihoods		
	5.2. Better Products & Management Practices		
	5.3. Market-Based Incentives		
	5.4. Direct Economic Incentives		
Sustainable Systems for Conservation	4.1. Detection and arrest	*4. Law Enforcement & Prosecution*	
	4.2. Criminal Prosecution and Arrest		
	4.3. Non-Criminal Legal Action		
Education and Communication	3.1. Outreach & Communications	*3. Awareness Raising*	
	9.2. Training & Individual Capacity Development	*9. Education & Training*	C. Enabling condition actions
Sanitation	6.1. Protected Area Designation &/or Acquisition	*6. Conservation Designation & Planning*	
	6.2. Easements & Resource Rights		
Infrastructure Maintenance Public Services	6.5. Site Infrastructure		
Research and Monitoring	8.1. Basic Research & Status Monitoring	*8. Research & Monitoring*	
	8.2. Evaluation, Effectiveness Measures & Learning		
Equipment Income Personnel Travel Costs and Allowances Institutional Strengthening	10.1. Internal Organisational Management & Administration	*10. Institutional Development*	
Risk Management	10.3. Alliance & Partnership Development		

Table 3. Funding gap in the PNN protected areas for the different actions standardised according to the CMP classification system

Protected areas management actions of the PNN aligned to CMP actions	Funding Gap %	Funding Gap US$
Institutional Development	53.68	23,767, 323
Conservation Designation & Planning	16.98	7,515,544
Land/water management (referred to restoration)	4.90	2,169,063
Land/Water Management and Livelihood, Economic & Moral Incentives (both referred to eco-tourism)	4.43	1,962,473
Awareness Raising, Education & Training (both referred to Education and Communication)	1.68	745,588
Research and monitoring	4.38	1,939,837
Law enforcement and prosecution	13.94	6,171,612
Total US$ to 2017	100	44,271,440
Total US$ updated to 2019		**47,547,554**

status, legal registration, and long-term financing plan) (USAID, 2009; PNUD, 2018). In the United States, the calculation of costs of protected areas was estimated through six categories, namely control and surveillance, enlargement of protected areas, administration, participative planning, community development and environmental education (TNC, USAID and WCS, 2001).

Costa Rica and Chile used other methodologies related to the structure of their protected area financial plans. In Costa Rica, the methodology of the Financial Sustainability Scorecard of the UNDP was used through the implementation of surveys to determine the level of operation and investment needs and the different financing sources. In Chile, the needs were established from the conservation categories of the National System of Protected Wildlands of Chile according to the requirements of the management plans, third-party conservation monitoring, and conservation monitoring with trained rangers (Bovarnick et al., 2010).

In Mediterranean and North African countries, the structure of the financial plans was formed from surveys in 2014, in order to obtain the activities and components included in the current management of the protected areas, including the costs of the activities necessary to achieve the areas' goals. Likewise, samples of protected areas were selected for the survey with respect to their ability to provide information about the costs associated with their establishment, the costs associated with identified 'effective' management parameters and the income arising from their resources (Binet et al., 2015).

With respect to Guatemala, the funding gap calculated for 2008 for the eight protected areas came to US$ 12.7 million, and it was determined that the item which most required resources was personnel. In Costa Rica, the gap for public protected areas was calculated at US$ 11.7 million; the most important item being the operation of protected areas including personnel (69 per cent). For Chile, the funding gap was calculated at US$ 36 million for its public protected areas in 2012, with personnel accounting for 56 per cent. In this study, it was estimated that the funding gap for the 19 protected areas amounted to US$ 8.8 million for the year 2017, and that personnel corresponded to 52 per cent of the gap (USAID, 2009; Bovarnick et al., 2010). Similar to our study, a study conducted in Mexico calculated the funding gap using financial information from an effectiveness analysis tool, which considers changes in the availability of resources as variations in management needs due to environment changes and incorporates historical real data from the budget spent by the protected area. It showed that when more financial information is included in the calculation of the funding gap as described in the effectiveness analysis, more accurate results are obtained for the protected area funding gap (Bezaury et al., 2011).

All these exercises are valuable to evidence the funding gap of an individual protected area. The funding gap should be considered as a snapshot of the needs and income of a protected area at a point in time, being constantly updated for practical aspects (Cifuentes et al., 2000). However, Balmford et al. (2003) highlight that there is a wide variability when comparing the funding gaps between protected areas worldwide, due to the wide variability in the criteria used to determine the needs of protected areas. Funding gaps are calculated to range from US$ 0.1/km² in the Russian Arctic, an average of US$ 20/km² for the Amazon or the Himalayas, to US$ 130/km² to US$ 5,000/km² for Latin American, African and Asian protected areas located close to populated cities, to more than US$ 1,000,000/km² in some protected areas in Western Europe. Moreover, this variation is also related to the severity of the anthropogenic pressures and the management conservation actions required as a result. It is essential to obtain conceptual homogeneity of conservation actions if we are to build and compare financial data on protected areas around the world.

CONCLUSION

The structuring of financial plans for calculating the funding gap of protected areas in different countries is grounded on the knowledge acquired in the implementation of adaptive management in these countries that generates financial information, but currently this does not follow a specific standardised system. The use of standardised financial plans based on actions in CMP's classification system, and calculating the funding gap using this common language, allows one to understand and demonstrate consistency between the

Local community members assist in identifying the conservation values of the Guanentá Alto Río Fonce Flora and Fauna Sanctuary, as part of a policy of social participation adopted by the National Natural Parks of Colombia. This protected area has the largest number of Espeletia species in the country and constitutes an important water factory for the municipalities of Boyacá and Santander © Karina Vilés

strategic planning and financing of protected areas. If such a standardised approach was adopted it would be possible to perform not only retrospective, comparative or experimental analyses between protected areas, but also would research on financial sustainability within the conservation scientific community.

Without underestimating the particularities and complexity of individual protected areas around the world and their management, a precise database of threats and actions is increasingly required, not only for biodiversity monitoring and research but for financial management. Currently, an important series of IUCN guidelines have been published and are widely used as the basis for protected areas' conservation management worldwide. However, the CMP unified classification of conservation actions and threats based on the Open Standards is still rarely used due to it lacking a broad description in these guidelines. It would represent a significant contribution for the IUCN to facilitate the understanding and in-field application of this approved and standardised lexicon of conservation actions by including the CMP classification in the current conservation guidelines.

SUPPLEMENTARY ONLINE MATERIAL

Appendix 1 Calculation of investment needs for protected areas without a management plan. An example

Appendix 2 Process for the definition of categories and subcategories in the PNN

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RESUMEN

Las áreas protegidas representan la piedra angular de la conservación de la biodiversidad. Si bien su gobernanza puede adoptar muchas formas, la optimización de su gestión es fundamental para lograr su protección, restauración y uso sostenible. Para ello es necesario que los conceptos y las metodologías se apliquen de forma estandarizada tanto en cuanto a la planificación financiera como a la gestión de sus acciones de conservación. Para describir la estructura financiera de las áreas protegidas en un lenguaje internacionalmente aceptado, se analizó la información financiera de 19 áreas protegidas públicas colombianas elegidas al azar y se estandarizaron sus acciones de gestión institucional con base en la clasificación de acciones establecida por la Alianza para las Medidas de Conservación (CMP, por sus siglas en inglés). Los planes financieros se construyeron a partir de los informes de ejecución presupuestaria, las evaluaciones de la eficacia de la gestión y los planes de gestión de cada área protegida; las acciones de gestión institucional se tomaron de los tres componentes de los planes de gestión actuales y de las políticas institucionales del órgano administrativo gubernamental. Se estandarizaron ocho categorías de costos a partir de 17 acciones de gestión institucional de acuerdo con la clasificación de la CMP; y se calculó un déficit de financiación total de USD47.547.554. Las áreas protegidas de todo el mundo siguen una estructura financiera similar; sin embargo, entre ellas existe una amplia variedad de acciones de gestión. La estandarización de las categorías de costos de acuerdo con la clasificación de acciones de la CMP apoyaría las investigaciones comparativas en materia de sostenibilidad financiera y permitiría analizar las necesidades financieras de las áreas protegidas en todo el mundo.

RÉSUMÉ

Les aires protégées constituent la pierre angulaire de la conservation de la biodiversité. Bien que leur gouvernance prenne souvent de nombreuses formes, l'optimisation de la gestion s'avère essentielle pour assurer leur protection, leur régénération et leur fonctionnement durable. Cela exige une application normalisée de concepts et de méthodologies, aussi bien dans leur planification financière que dans la gestion de leurs actions de conservation. Afin de présenter la structure financière des aires protégées dans une langue acceptée à l'échelle mondiale, nous avons analysé les informations financières de 19 aires protégées publiques colombiennes choisies de manière aléatoire, puis leurs actions de gestion institutionnelle ont été normalisées sur la base de la classification du Partenariat de l'UICN pour les mesures de conservation (CMP). Des plans financiers ont été élaborés pour chaque aire protégée en fonction des rapports d'implémentation budgétaire, des évaluations de l'efficacité de gestion et des plans de gestion. Les mesures de gestion institutionnelle ont été basés sur les plans de gestion actuels et les politiques institutionnelles de l'organisme administratif gouvernemental. Huit catégories de coûts ont été normalisées à partir de 17 mesures de gestion institutionnelle conformément à la classification CMP, et un déficit de financement total de 47.547.554 $ US a été calculé. Les aires protégées à travers le monde suivent une structure financière similaire, cependant il existe une grande variété d'actions de gestion parmi elles. Une normalisation des catégories de coûts en fonction de la classification de ces actions pourrait faciliter des études comparatives sur la viabilité financière et rendrait possible l'analyse des besoins financiers des aires protégées à travers le monde.

IMPLEMENTING A LANDSCAPE APPROACH IN THE AGORO-AGU REGION OF UGANDA

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ABSTRACT

Landscape approaches are intended to resolve conflicts and address land and resource scarcity and competition. Often guided by 10 principles, numerous examples exist in the field but remain poorly documented. As a result, it remains difficult to learn about their implementation. This paper provides an example of the implementation of a landscape approach in a protected area landscape. We ask: How were landscape approach principles used in the implementation? What were the challenges and opportunities of using the landscape approach? We focus on the Agoro-Agu Landscape in the East Acholi area of Uganda. We find that some principles were critical for guiding the process, while others were outcomes of the landscape approach. Challenges included inadequate data, difficulties in addressing multiple planning units, limited resources to implement multi-stakeholder workshops, and politicisation of some issues. Opportunities included the mainstreaming of agreed actions into strategies and plans, increased resident capacity, conflict resolution, and clarified roles and responsibilities. Based on this example, landscape approaches may be used in future governmental projects.

Key words: Landscape approach, Agoro-Agu Central Forest Reserves, Agoro-Agu, East Acholi, conservation practice, Uganda, management, protected areas

INTRODUCTION

Historically, most game and forest reserves were established in the early 1900s for colonial interests in natural resources when Uganda was under British colonial rule (Howard et al., 1997). Nature conservation was not the objective of protected areas (Petursson et al., 2013), and communities were excluded from resource use and decision-making (Anderson & Grove, 1987). Centralised and decentralised conservation approaches to nature conservation (Hutton et al., 2005) and the inclusion of local people in the conservation policy process (Adams & Hulme, 2001) emerged in the 1980s and 1990s. Forest policy in Uganda followed a similar trend, with participatory approaches occurring in the last two decades (Turyahabwe & Banana, 2008), including through a decentralisation policy and forest sector reform (Figure 1). Participatory processes were introduced for the following reasons: to recognise improvements in efficient management through cooperation with local communities, to reduce conflict, to reduce management costs, to commit to human rights, to support sustainable use, and to move towards decentralised forest management (Turyahabwe et al., 2012). These processes extend engagement with stakeholders to the landscape level.

Within Uganda's protected areas, protected forests fall under Central Forest Reserves (CFRs) managed by the National Forestry Authority (NFA), and Local Forest Reserves managed by the District Local Governments. All CFRs in the Agoro-Agu Management Plan Area in northern Uganda, the focus of this paper, are held and protected in trust for the people[1]. These areas have a hybrid form of governance involving the state and customary authorities (Kapidžić, 2018), with 93 per cent of lands in Acholiland under customary tenure (Hopewood, 2015).

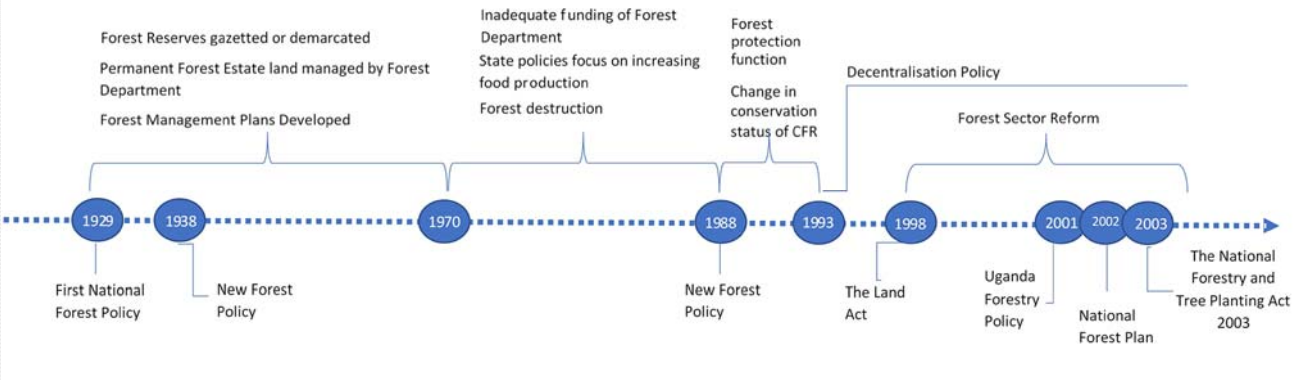


Figure 1. Timeline showing main events in forest and land policy in Uganda

Management of these areas is challenging due to conflict in the mid-1980s that displaced an estimated two million people (Roberts et al., 2008), disrupted health services and eroded traditional and family structures (Ministry of Health, 2005 in Chi et al., 2015). The legitimacy of customary leaders, or Rwot, is challenged by community members, including youth (Kobusingye, 2018). Acholiland is experiencing land disputes due to increasing land value, the rarity of permanent markers of land boundaries, lack of documents proving land ownership[2] and complex socio-economic, legal and political factors.

In 2018, the Agoro-Agu Landscape CFRs Management Plan in the Agoro-Agu sector and the Agoro-Agu Landscape Strategic Management Plan were due to be revised. In the past, the process only involved experts from forestry institutions. However, this approach had limited participation of stakeholders and an alternative, participatory approach was sought, in keeping with Uganda's trend towards participatory policy processes. At the encouragement of IUCN-Uganda, Uganda's NFA and the Forestry Sector Support Department of the Ministry of Water and Environment decided to use a landscape approach, a method which brings together stakeholders from different sectors to address a common issue at the landscape scale through decision-making processes (Reed et al., 2015). In contrast to the previous approach, using a landscape approach in the management plan revision process means that stakeholders are systematically included (Table 1). The implementation of the landscape approach in the Agoro -Agu Landscape is an attempt by the Government of Uganda to strengthen connectivity between the CFRs, community managed forests and agricultural lands through participatory dialogues that strengthen collaboration in forest resource management and improve livelihoods.

Implementation of a landscape approach is often guided by the paper 'Ten Principles for a Landscape Approach to Reconciling Agriculture, Conservation, and Other Competing Land Uses' (Sayer et al., 2013). These principles are:

- continual learning and adaptive management;
- common concern entry point;
- multiple scales;
- multi-functionality;
- multiple stakeholders;
- negotiated and transparent change logic;
- clarification of rights and responsibilities;
- participatory and user-friendly monitoring;
- resilience; and
- strengthened stakeholder capacity.

However, few landscape approaches are well-documented (Reed et al., 2017), making it difficult to learn from and improve implementation. This paper documents the implementation of a landscape approach in a protected area landscape in Uganda, and its use in revising participatory management plans. We ask "How were the landscape approach principles used in the implementation? What were the challenges and opportunities of using the landscape approach?"

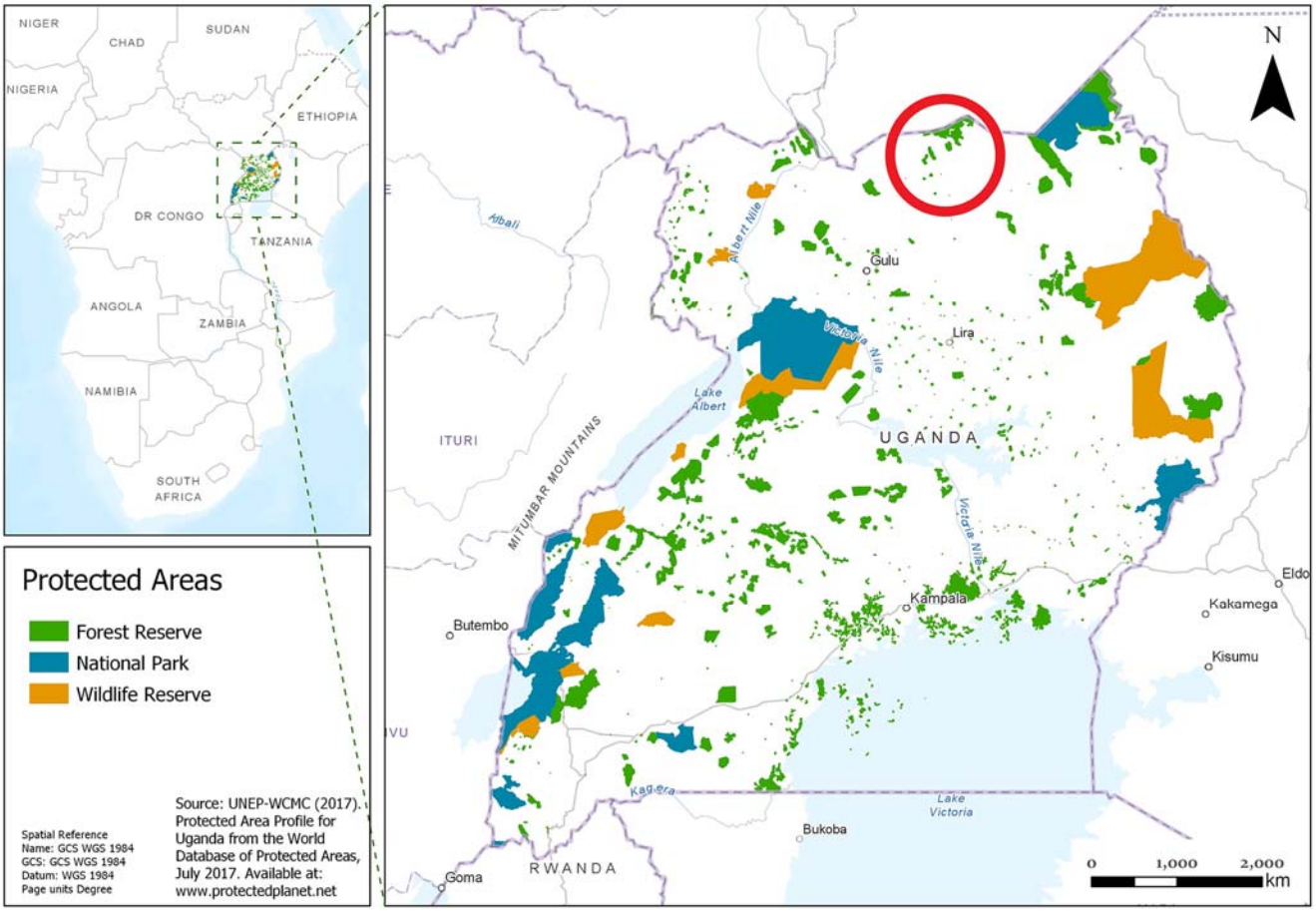
CONTEXT AND BACKGROUND

Study site

The Agoro-Agu Landscape is located in northern Uganda and forms part of the Acholi subregion[3] (Map 1), spanning the Lamwo, Pader, Kitgum and Agago districts in East Acholi. The northern border is bounded by South Sudan. The Acholi are the main ethnic group in the Agoro-Agu Landscape (Amone & Muura, 2014). The 16 CFRs within the Agoro-Agu Landscape cover 65,548 ha under one Forest Management Planning Area, the Agoro-Agu Sector; these are managed with a common

Table 1 Differences between Uganda's traditional planning process and the recently adopted landscape approach

Steps	Traditional Practice	Landscape Approach
Step 1: Planning team establishment	Experts from the forestry sector	Forestry sector staff, private sector, Civil Society Organisations (CSOs), Central Government staff, District Local Government technical staff, political leaders, opinion leaders, etc.
Step 2: Data collection	Within the Forest Reserve	Considers entire landscape (district, sub-county, parish, village levels), connectivity with agricultural land systems, wildlife conservation areas, wetlands, other land use practices
	Meetings with Government of Uganda officials	Multi stakeholders' dialogues and community meetings
Step 3: Data processing	Internal	District technical staff, CSOs, political representatives are present
Step 4: Drafting the plan	Internal within Planning Unit	'writeshop' with relevant stakeholders (District Technical staff, CSOs, private sector, political representation)
Step 5: Planning workshop and validation	Internal	Stakeholders invited to validation meeting
Step 6: Final drafting	Internal	Peer reviews by partners, CSOs and private sector
Step 7: Plan final validation and approval	Limited stakeholder engagement	Pre-requisite to involve other stakeholders such as the District Councils
Step 8: Plan implementation	Responsible body	All stakeholders have a role to play
Step 9: Plan monitoring and revision	Internal	Participatory, joint monitoring based on a monitoring and evaluation plan



Map 1. The Agoro-Agu Landscape

The Agoro-Agu Landscape © C.D. Langoya

Forest Management Plan (Republic of Uganda, 2019). The three main land use types in the Agoro-Agu Sector are small-scale cultivation (37.5 per cent), grassland (12.5 per cent) and woodland (43.8 per cent).

Uganda is a biodiverse country with 1,742 terrestrial vertebrate species (Plumptre et al., 2019), 4,816 plant species (Luke & Beentje, 2016 in Kalema et al., 2016), 1,300 species of butterflies and 260 dragonfly species (Plumptre et al., 2019). There are two Key Biodiversity Areas (Ogili and Nyangea-Napore Forest Reserves) (Plumptre et al., 2019) in the landscape. The vegetation of the Agoro-Agu Landscape includes Afromontane forests, shrublands, woody grasslands and bamboo (Zhao et al., 2018). Protected areas covering four per cent of the Agoro-Agu Landscape shelter an estimated 95 per cent of the animal and plant species (Gizachew, 2018). The Agoro-Agu CFR is one of the top 20 Forest Reserves for species richness in Uganda (Howard et al., 2000).

Uganda lost half of its overall biodiversity value from 1975 to 1995 (Pomeroy et al., 2017) due to habitat loss, agricultural encroachment and expansion, climate change effects, over-harvesting of resources, among others. In the Agoro-Agu CFR and its adjacent area, forest and woodland underwent progressive cover changes to bare land, with more pronounced changes between 2001 and 2010 (Obegiu, 2012).

Landscape approach method

Following the landscape approach principles, the project team sought a common concern entry point: balancing the competing interests in the landscape. The implementation process of the landscape approach included four overarching elements, detailed below.

Establishing and training a Core Planning Team

The project team, working with the NFA and Forestry Sector Support Department Managers, identified key stakeholders at the national, regional and local level and from public and private institutions and civil society. These stakeholders nominated representatives that constituted the Core Planning Team and included representatives from the Forest Sector Support Department, NFA, Uganda Wildlife Authority, and District Local Government (political and technical leaders including the District Planner, District Physical Planner, District Community Development Officer, District Forestry Officer, District Natural Resources Officer, and Secretary for Production). To build confidence and trust in the selected members, chosen for their skills in landscape planning, the project team organised an orientation meeting to introduce them to the forest and landscape management planning guidelines, the general approach to be used, and training on participatory rural appraisal tools.

Gathering primary and secondary data, problem identification and prioritisation
The Core Planning Team collected landscape data (biophysical, social and economic). They also raised awareness about the need for joint planning (to identify issues, priorities, actions) and led stakeholder consultations and dialogues from district to village level using the skills acquired during the orientation workshop.

Activities included building a landscape planning knowledge base, conducting land use planning analysis (with participatory rural appraisal and geographical information system), completing a social and strategic environmental assessment, and understanding the spatial-temporal changes. We designed a number of tools prior to field data collection including interview guides, focus group discussions, presentations to district and sub-county level meetings, planning matrices for environment action planning and forest resources evaluation and valuation matrix, timeline for tracking historical trends, and resource maps for each district.

Developing actions based on an established vision
With stakeholders, we tried to establish what the future of the landscape should look like and identify what needed to change to achieve that vision. At the District Local Government level, stakeholder engagement and dialogues were conducted for each district. The identification of participants was done in collaboration with District Local Government officials and members of the Core Planning Team. At the sub-county level (also known as Lower Local Government), consultations involved parish chiefs, cultural leaders and CSO representatives. For all these meetings, the Forest Sector Support Department, NFA and Uganda Wildlife Authority were represented. The process included consultations with the Aswa River Hydro Power Project, the Apirit Border Post and Revenue Collection Point, the Agoro Irrigation Project, the Palabek Refugee Settlement, individual tree growers, Collaborative Forest Management, and Community Forest Groups.

Consultations and participatory planning with Sub-county level Technical Staff and Political Leaders © C.D. Langoya

Development and validation of the Forest and Landscape Management Plans
The final stage encompassed the development of the management plan through a 'writeshop'[4]. The writeshop brought together members of the Core Planning Team to write the management plans based on the data collected. The team built options, analysed the desired future change, and developed projects for change.

The process led to the development and validation of two complementary plans for the landscape (the CFRs Management Plan and the Agoro-Agu Landscape Strategic Management Plan for areas outside the CFRs) based on the Government of Uganda legislative framework on protected areas.

Approval of Forest and Landscape Management Plans: The NFA Board of Trustees and the Minister of Water and Environment approved the CFRs Management Plan. All four District Local Government Councils of East Acholi approved the Landscape Management Plan and agreed to integrate the priority actions in the Landscape Management Plan into their District Development Plans and budgets.

IMPLEMENTING THE LANDSCAPE APPROACH

Adoption of the landscape approach principles

The adopted landscape approach used many of the ten aforementioned principles. Here, we emphasise the principles such as Adaptive Management, Resilience, Multiple Scales and Multifunctionality that were the most important for guiding the process. Other principles were outcomes of the process and are not discussed in detail. Adaptive management resulted from the shift from exclusive planning at the site level to participatory planning at the landscape level. This landscape level planning resulted in a multi-scalar process across multifunctional landscape units, leaving a more resilient landscape. The resulting approach was supported by the local communities. We document this process elsewhere, where we focused on monitoring perceptions of landscape governance (IUCN, 2020).

Common concern entry point
The common concern entry points included addressing poverty, food security, climate change, water scarcity,

deforestation and loss of biodiversity at the local level. Balancing the competing interests of different stakeholders in the Agoro-Agu Landscape was of paramount importance in order to: (i) protect, restore and promote sustainable use of protected areas and ecosystems; (ii) ensure availability of forest products and services (for current and future generations); (iii) promote inclusive and sustainable economic growth and development; (iv) ensure food supplies through sustainable agriculture; and (v) combat climate change and its impacts.

Multiple stakeholders and negotiated and transparent logic chain

The Core Planning Team included representatives of many stakeholder groups. Throughout the process, the project team engaged forest-adjacent communities in discussing issues in the landscape and specific issues related to the forest reserves. The team used consultation and information approaches to inform the communities about the landscape approach and why it was needed. This provided an opportunity for participants to engage from an informed point of view. Engagement with existing platforms in Lamwo District, such as the Agoro-Agu Forest Landscape Platform, helped identify critical issues across the districts that needed joint planning across the landscape. The development and use of the platform demonstrates the long-term involvement of multiple stakeholders in the landscape. The platform includes District Local Governments, Line Government Ministries, Departments and Agencies, CSOs, public sector organisations, cultural institutions, faith-based organisations, academic and research institutions, and community groups such as Collaborative Forest Management Associations.

At the District Local Government level, the team conducted stakeholder engagement and land use dialogues and meetings in each district. The project team, in collaboration with District Local Government officials, identified participants. At the sub-county level (e.g. Lower Local Government), consultations involved parish chiefs, cultural leaders and CSO representatives. For all these meetings, the Forest Sector Support Department, NFA and Uganda Wildlife Authority were represented. The team consulted with private sector partners, such as those working in energy, irrigation and plantations.

Four district level meetings and 42 sub-county level meetings were conducted and 68 people attended the validation meeting. Out of these 68 people, 16 per cent were elected officials, 15 per cent were CSOs/NGOs/ private sector representatives, and 24 per cent were women leaders.

Clarification of rights and responsibilities

This principle was considered important due to the challenges in the region over land rights. The team conceived a governance framework and delivery mechanism for the plan. Key stakeholders were identified and their roles, including the role of the Agoro -Agu Forest Landscape Platform, were developed. Stakeholders' roles included the following: 1) NFA holds a leading role in the Core Planning Team and provides expertise on forestry, leads the comprehensive consultations with District and Sub-county leaderships and communities neighbouring the CFRs, and implements the Forest Management Plan in collaboration with other actors; 2) The Higher District Local Governments (Districts) manage the collaboration at the sub-national level and ensure the integration of outputs into the District Development Plans and budgets for sustainability; 3) The Lower District Local Governments (sub-county and parish level) manage the collaboration at the community level and ensure the integration of outputs into the Sub-county and Parish Development Plans to create ownership and sustainability at grassroots level; 4) The private sector provides expertise and guides the planning process in relation to economic enterprises; and 5) The CSOs have a representative in the Core Planning Team and provide outputs to civil society networks.

Participatory and user-friendly monitoring

The Agoro-Agu Forest Landscape Platform includes a set of targets to achieve a shared goal and objectives, and a participatory engagement plan to work towards the targets. For example, the Agoro-Agu Landscape Strategic Management Plan includes a section on monitoring with defined roles and tasks for stakeholders.

The plan's objectives include: (i) to keep planned activities on track and monitor what has been achieved; (ii) to ensure that the planned activities are carried out by those identified; (iii) to reflect critically on progress and facilitate adaptive management based on lessons learnt, generating ideas for making improvements; (iv) To provide information on the social, economic and environmental impacts as a result of implementing the planned activities. The system was developed in harmony with other schemes for monitoring district level plans; therefore, it is compliant with and will operate through decentralised implementation service delivery reforms and the sectoral programme development policies of the Government of Uganda.

Monitoring occurs on a continual basis. The implementation of this plan will be evaluated annually and at the end of the plan. Annual evaluations will assess performance and provide the opportunity to reflect on the gaps and suggest improvements.

Strengthened stakeholder capacity

Creation of resident capacity initially happened within the government institutions and CSOs that were part of the Core Planning Team. These stakeholders were trained and participated in the planning process from its inception to its end. The 45 Core Planning Team participants were trained in forest management planning using a landscape approach, dialogues, data collection and collation (based on data collection tools). During the management planning process, the stakeholders agreed to expand and strengthen the Agoro-Agu Forest Landscape Platform beyond the Lamwo District to cover the Districts of Kitgum, Pader and Agago. This is intended to operationalise the landscape management approach and to ensure a coordinated management approach for NFA managed CFRs, Forestry Sector Support Department and District Local Government managed Local Forest Reserves, community managed forests, wildlife migratory corridors, agricultural lands and other fragile ecosystems. This will occur through dialogues that resolve conflicts over natural resource access rights and will strengthen community-based natural resource management. The Agoro-Agu Forest Landscape Platform developed a Memorandum of Principles to provide for governance, membership, co-ordination and operation of the platform; it includes a General Assembly comprising all members of the platform, a Steering Committee and a Secretariat.

Challenges and opportunities

We observed the following challenges:

Limited resources: Given the need for detailed consultations and planning with multiple stakeholders and at different scales and levels, commensurate resources are required. The landscape approach needs time and the appropriate implementation and uptake at each level and by many institutions. For example, in Uganda, obtaining the four District Council's Resolutions for the Landscape Management Plan approval process may take six steps. Many levels are consulted for approval, and debates are required to develop and approve reports at each stage. In most instances, the NFA representative, Forestry Sector Support Department and project leaders must be present at key Council meetings.

Core Planning Team during Writeshop to review the Draft Landscape Management Plan © Joseph Odong, IUCN

Inadequate data: Spatial data for the landscape is insufficient or lacks the required quality, limiting analysis.

Complexity addressing multiple planning units: Fragmentation of the landscape into small administrative units complicates the planning process, increasing coordination time. Each unit demands and has the right to know its obligation, mandate and contribution.

Politicisation: Politicisation around issues (e.g. encroachment, boundary conflicts) distorts consensus building, creating unnecessary delays. For example, activities intended to resolve protected area encroachment may be used by some politicians to criticise authorities and discredit an opponent participating in the process by suggesting that the approach promotes land grabbing. Politicisation frequency is increasing due to Uganda's upcoming national elections in 2021.

Benefits and opportunities observed during the application and adoption of the landscape approach include:

Case for learning: The process followed throughout the landscape approach demonstrates how to build capacity and strengthen institutions in forest management planning, which can then be used for implementation elsewhere in Uganda. The landscape approach may help in the review process of the Uganda Forestry Conservation Master Plan.

Stronger resident capacity: The landscape approach fosters the creation of resident capacity within local government, CSOs, local political leaders and the community. The Agoro-Agu Forest Landscape Platform offers a forum for stakeholders to share an understanding of landscape issues, agree on the inter-sectoral linkages and create synergies for strategic

interventions that enhance positive change in community livelihoods and ecosystem integrity. The platform also provides space for stakeholders to coordinate and jointly engage in lobbying, advocacy and fund raising with a collective voice and provides the members with opportunities for capacity building through peer learning and information sharing.

Conflict resolution: The landscape approach created an opportunity to resolve conflicts (encroachment, boundary challenges, etc.) and an opportunity to clarify cross-sectoral and trans-boundary issues. For example, encroachment into protected areas creates conflict between management authorities and encroachers. GPS technology was used to clarify boundaries, areas of encroachment and community lands. Most District Councils of the Agoro-Agu Landscape are in agreement with swapping encroached forest areas with intact, forested areas. It is a long process, but once completed, will reduce conflict.

Mainstreaming of agreed actions into strategies and plans: The landscape approach strengthens natural resources management at the sub-national level through the inclusion of proposed actions into the District Development Plans for implementation. Most District Councils have passed resolutions to integrate priority actions into their Development Plans and budgets.

Clarity on mandates, roles and responsibilities: The stakeholders became aware of mandates, roles and responsibilities.

Co-development of proposals: The landscape approach process supports the co-development of proposals for joint monitoring and evaluation, law enforcement, governance and trade.

Higher landscape connectivity: The adoption of the principles provides the opportunity to create connectivity between protected areas, agricultural lands and other areas.

CONCLUSION

The implementation of the landscape approach in the Agoro-Agu Landscape was possible because of the interest of the Government of Uganda to use more participatory tools for landscape planning. This, in turn, helped bring all stakeholders to the table. Select principles guided the process that culminated in the creation of two plans for the landscape. One plan, the Integrated Landscape Management Plan, contributes to the achievement of a variety of governmental policies and internationally ratified treaties, conventions and agreements to which Uganda is a signatory. As a strategic document, this Integrated Plan represents a paradigm shift from sectoral forest management planning to an integrated approach. Another relevant result includes the Agoro-Agu Forest Landscape Platform that was instituted to foster multi-stakeholder arrangements.

In addition to offering a learning case, the benefits and opportunities observed throughout the application of the landscape approach principles include mainstreaming agreed actions into strategies and plans, increased resident capacity, conflict resolution, definition and clarity on mandates, roles and responsibilities, higher landscape connectivity and opportunities for policy influence.

The application of the principles also revealed some challenges, namely, inadequate quantity and quality of data, complexity addressing multiple planning units, limited resources to implement the required workshops, and issue politicisation. Despite the amount of time and resources required to implement a landscape approach in this context, the resulting participatory process supported by many stakeholders is significant. We hope that bringing awareness to these challenges will help other researchers and practitioners to improve the application of the landscape approach.

ENDNOTES

[1.] As stipulated by article 237(2) (b) of the Constitution of the Republic of Uganda, 1995.

[2.] Before the Land Act of 1998, there was no requirement or legal procedure in place to register customary land.

[3.] In this paper, we use the name 'Agoro-Agu Landscape', as used by the National Forestry Authority (NFA) and how it is referred to in all Government documents. It is also called the East Acholi landscape by the local community, with Agoro-Agu being the largest CFR located in Lamwo District and, from which, NFA derives the official name of the landscape.

[4.] A writeshop is an intensive process bringing together relevant stakeholders and publishing specialists to produce a publication in a short time.

CONFLICT OF INTEREST

None.

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RESUMEN

Los enfoques basados en el paisaje tienen por objeto resolver conflictos y abordar la escasez de tierras y recursos y la competencia. A menudo guiados por 10 principios, existen numerosos ejemplos sobre el terreno pero se hallan mal documentados. En consecuencia, sigue siendo difícil obtener información acerca de su implementación. En el presente documento se ofrece un ejemplo de la implementación de un enfoque basado en el paisaje en una zona protegida. Nos preguntamos: ¿Cómo se utilizaron los principios del enfoque basado en el paisaje en la implementación? ¿Cuáles fueron los desafíos y oportunidades relacionados con la utilización del enfoque basado en el paisaje? Nos centramos en el paisaje Agoro-Agu en la región oriental de Acholi en Uganda. Consideramos que algunos principios fueron fundamentales para orientar el proceso, mientras que otros fueron resultados del enfoque basado en el paisaje. Entre los problemas que se plantearon cabe mencionar la insuficiencia de datos, las dificultades para abordar las múltiples dependencias de planificación, los recursos limitados para llevar a cabo talleres con múltiples interesados y la politización de algunas cuestiones. Las oportunidades incluyeron la incorporación de las medidas acordadas en las estrategias y planes, el aumento en la capacidad de los residentes, la resolución de conflictos y la aclaración de las funciones y responsabilidades. Sobre la base de este ejemplo, en futuros proyectos gubernamentales se podrían utilizar los enfoques basados en el paisaje.

RÉSUMÉ

Les approches paysager de la conservation visent à résoudre les conflits, à lutter contre la pénurie des surfaces cultivables et des ressources naturelles, et à répondre aux problèmes de concurrence. Souvent guidé par 10 principes, de nombreux exemples d'approche paysagère existent sur le terrain mais peu sont documentés. En conséquence, il s'avère difficile d'évaluer leur mise en œuvre. Le présent article fournit l'exemple d'une mise en oeuvre d'approche paysagère au sein d'un paysage qui comprends des aires protégées. Nous examinons de quelle manière les principes sont utilisés dans le processus de réalisation d'une approche paysagère au sein du paysage de Agoro-Agu dans la région d'Acholi Est en Ouganda. Quels sont les défis et les opportunités liés à cet approche ? Nous constatons que certains principes ont été essentiels pour guider le processus, tandis que d'autres résultaient de l'approche même. Parmi les défis, mentionnons l'insuffisance des données, les difficultés à traiter plusieurs unités de planification, les ressources limitées pour mettre en place des ateliers multipartites et la politisation de certaines questions. Les opportunités comprenaient l'intégration des stratégies et des plans dans les actions, l'augmentation de la capacité résidentielle, la résolution des conflits et la clarification des rôles et des responsabilités. Sur la base de cet exemple, des approches paysagères pourront être utilisées lors de futurs projets gouvernementaux.

THE UN DECADE ON ECOSYSTEM RESTORATION (2021–2030): WHAT CAN PROTECTED AREAS CONTRIBUTE?

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ABSTRACT
Those developing the forthcoming UN Decade on Ecosystem Restoration stress the importance of ecosystem conservation whilst addressing the need to reverse ongoing losses to biodiversity and ecosystem services that have serious impacts on human livelihoods. We suggest six ways in which area-based conservation (protected areas and other effective area-based conservation measures) could play a key role in the decade: 1. Best practice in restoration within protected areas and OECMs; 2. Using area-based conservation as a component in specific restoration approaches; 3. Maintenance of reference ecosystems and important species; 4. Bringing experience to ensure that all biomes are adequately represented in restoration; 5. Inclusion of a focus on species restoration; and 6. Support for restoration of ecosystem services. It is therefore important to ensure that area-based conservation is fully integrated into the planning and implementation of the Decade.

Key words: restoration, UN Decade, ecosystem restoration, protected area, OECM

INTRODUCTION
On 1 March 2019, the UN General Assembly declared 2021–2030 to be the UN Decade on Ecosystem Restoration, aligning with the last decade of the Sustainable Development Goals, with the objective of massively scaling up the restoration of degraded or destroyed ecosystems. The Decade aims to use restoration to address issues related to the climate crisis, food and water security, biodiversity loss and others integral to the SDGs. Efforts during the decade will accelerate existing restoration goals, particularly the Bonn Challenge and associated forest initiatives and will also support wider efforts at ecosystem restoration across terrestrial and marine biomes. Planning is underway, but there is already debate about what can be achieved (e.g. Young & Schwartz, 2019). This paper identifies ways in which area-based conservation can play a positive role in the Decade on Ecosystem Restoration.

BACKGROUND
Multiple studies highlight the urgent need for upscaling restoration efforts. In 2018, the New York Declaration of Forests concluded: "*… natural forests continued to disappear at an increasing rate. Relative to 2001–13, the average gross annual rate of global tree cover loss was 42 percent higher in 2014–17*" (Forest Declaration, 2018). Natural grasslands and savannahs may well be disappearing even faster than forests (UNCCD, 2017). Where data are available, wetlands have declined by 35 per cent since 1970 (Ramsar Convention, 2018). And marine areas face massive pressures; for example, ocean acidity has increased by 30 per cent since the Industrial Revolution (UNEP, 2010). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services found that land degradation has reduced productivity of 23 per cent of the global land surface (IPBES, 2019). Ecosystem loss and degradation has multiple knock-on effects, with massive losses to

Restoration of reedbeds, Trent Valley, UK © Nigel Dudley

ecosystem services. Even where ecosystems are left largely intact, selective removal of economically or socially valuable species can lead to less visible impacts, such as the "empty forests" syndrome (Redford, 1992).

The following discussion includes both protected areas and "other effective area-based conservation initiatives" (OECMs) (IUCN-WCPA Task force on OECMs, 2019), which together represent a major proportion of the world's area-based conservation. The conservation community brings a range of tools and skills to maintain protected areas, and dedicated areas of land and water to help advance the aims of the Decade. We identify six general areas of work for the protected area and restoration communities.

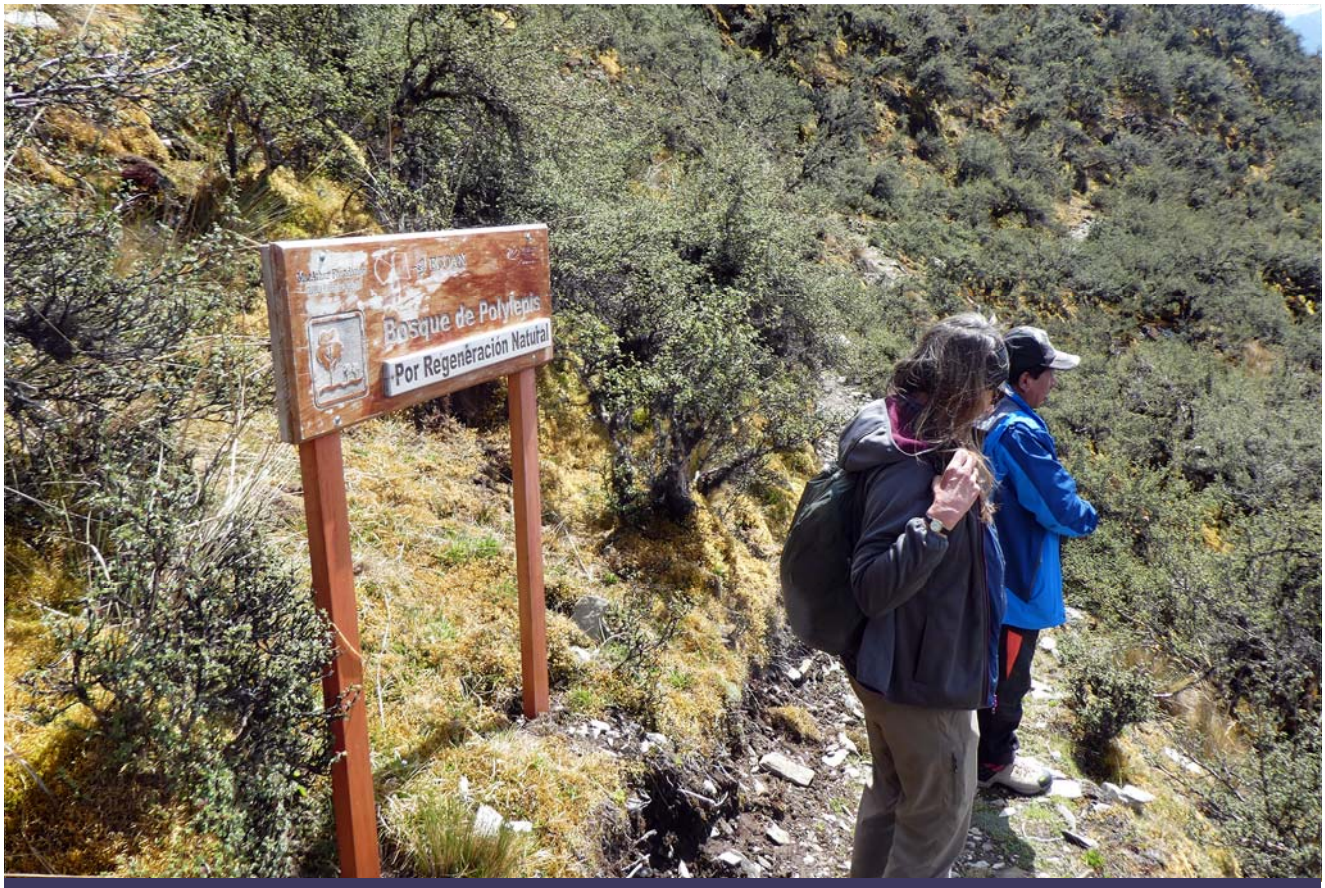
1. Best practice in restoration in and around protected areas and OECMs. Although designed to protect areas of high biodiversity value, many protected areas require restoration themselves, either to reverse changes that took place before establishment or due to continuing degradation pressures, from illegal use, from more complex causes such as climate change and other pollution, or due to ecological isolation. Some countries or regions have few undegraded ecosystems left and therefore restoration is needed as a key stage in establishing protected areas. The first imperative is therefore to provide leadership in restoration approaches in and around protected areas (Keenleyside et al., 2012) and highlight the role of restoration in protected area management.

Along the continuum of restorative activities from remediation to ecological restoration, restoration offers the best outcomes for ecological health and biodiversity and the greatest potential to enhance ecosystem services (Gann et al., 2019). Restoration practitioners apply the most appropriate and effective treatment given the ecological, social and financial conditions of their sites. Complete recovery (ecological restoration) is most likely to be achieved in protected areas where there is technical expertise and typically less ecological damage. The conditions provided by area-based conservation initiatives can provide lessons in restoration applicable to the wider landscape and seascape and expertise developed in protected areas can be applied more widely to other area-based conservation measures.

2. Using area-based conservation as a component in specific restoration approaches. Strategically placed, sometimes quite small, protected areas can help facilitate restoration over a much larger area in a number of ways. Examples include protecting slopes or maintaining dryland forests to stabilise soils and prevent soil erosion and desertification over a wider area (Dudley et al., 2014); protecting areas of coastal waters to allow damaged coral reefs to regrow (Abelson et al., 2016); protected areas to restore continuity along migration flyways; and protection and reforestation of steep slopes (McShane & McShane-Caluzi, 1997) and coastal mangroves (e.g. Vuik et al., 2016) to reduce flooding risks. Managed use of traditional agriculture in IUCN category V protected landscapes and in many OECMs can help to recover degraded rangeland and hill pastures (Phillips, 2002).

3. Maintaining and linking reference ecosystems and species. Although profound climate change impacts are likely, reference ecosystems continue to be needed as sanctuaries for and sources of species, including important socioeconomic resources like wild relatives of crop plants, and to provide restoration specialists with data on the composition and ecological processes in ecosystems. Many such places are on indigenous, traditional and sometimes privately-owned lands, so that their conservation requires a range of approaches. Although there have been attempts to form alliances of strict forest reserves serving as reference ecosystems, for instance in Europe (Parviainen et al., 2000), there is no global database that distinguishes protected reference ecosystems around the world. Developing such a network could be a valuable contribution to the Decade.

4. Bringing experience to ensure that all biomes are adequately represented in restoration. One risk of a global restoration movement is the promotion of simplistic approaches. Many of the commitments to restoration efforts such as the Bonn Challenge are for plantations (Pearce, 2019), with only very limited ecosystem benefits; while afforestation of natural grassland can have negative impacts on many ecosystem services and is increasingly identified as a problem with generalised forest restoration targets (e.g. Brancalion &



Restoration of *Polylepis* forests in a private protected area, Peru © Nigel Dudley

Savannah restored from former pulpwood plantation, South Africa © Nigel Dudley

Chazdon, 2017; Temperton et al., 2019). Restoration programmes need to be based on more than site-based analyses. Even landscape-scale forest restoration planning tools such as ROAM (IUCN and WRI, 2014) provide guidance on choosing optimal places for forest restoration but little in the way of checks to avoid unintended damage to other ecosystems. Approaches developed for protected area planning, including gap analysis (Dudley & Parrish, 2006), Key Biodiversity Areas (IUCN, 2016), and systematic conservation planning (Smith et al., 2018) could all usefully be employed in landscape-scale restoration planning.

5. Focusing on species restoration as well as ecosystem restoration. The main emphasis of the Decade will probably be on restoration of ecosystems, particularly forests, mangroves and possibly coral reefs. However, restoration that focuses purely on vegetation types without ensuring that constituent species are present will risk creating an inherently unstable ecosystem. Ensuring that the focus of the Decade encompasses species, including both particular endangered species and threatened groups of species such as amphibians and insects, is likely to increase the resilience of the ecosystems restored. Experience within protected areas and OECMs could be particularly useful in terms of both case studies in understanding and reversing long-term species decline, and in identifying and developing indicator species to monitor how well the overall ecosystem is recovering.

6. Supporting restoration of ecosystem services. Although only a secondary protected area objective, ecosystem service management is expected of many protected areas. Protected areas are increasingly established in part for ecosystem services (Stolton & Dudley, 2010), which will also often be the main objective in OECMs. All forms of area-based conservation have the opportunity to contribute to nature-based solutions, with a particular emphasis on climate stabilisation, disaster risk reduction and food and water security. For example, National Marine Conservation Areas in Canada demonstrate how protection and conservation practices can be

harmonised with resource use in marine ecosystems. Their management requires the development of partnerships with regional stakeholders, coastal communities, Indigenous peoples and different levels of government (Parks Canada, 2017).

CONCLUSIONS

The UN Decade on Restoration could create a fundamental shift in the way that humanity views ecosystems and a much-needed impetus for renewal on a global scale. But an overly narrow focus could dissipate many opportunities and waste resources; there have been many failed restoration projects. The Decade needs to look at ecosystem restoration at the broadest scale, considering all biomes and both natural and cultural landscapes and seascapes. Building strong links with area-based conservation is one important way of ensuring these critical broader issues are fully addressed.

ABOUT THE AUTHORS

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RESUMEN

Quienes participan en el desarrollo del próximo Decenio de las Naciones Unidas sobre la Restauración de los Ecosistemas subrayan la importancia de la conservación de los ecosistemas al tiempo que abordan la necesidad de revertir las pérdidas de biodiversidad y de los servicios de los ecosistemas que tienen graves efectos negativos en los medios de subsistencia. Sugerimos seis formas en las que la conservación basada en áreas (áreas protegidas y otras medidas eficaces de conservación basadas en áreas) podrían desempeñar una función fundamental en el decenio: 1. Buenas prácticas en materia de restauración dentro de las áreas protegidas y OECM (otras medidas eficaces de conservación basadas en áreas); 2. Utilizar la conservación basada en áreas como un componente en enfoques específicos sobre restauración; 3. Mantenimiento de ecosistemas de referencia y especies importantes; 4. Aportar experiencia para garantizar que todos los biomas estén adecuadamente representados en la restauración; 5. Énfasis en la restauración de especies; y 6. Apoyo para la restauración de los servicios de los ecosistemas. De ahí la importancia de garantizar que la conservación basada en áreas quede plenamente integrada en la planificación e implementación del Decenio.

RÉSUMÉ

Les responsables de la prochaine Décennie des Nations Unies pour la restauration des écosystèmes soulignent l'importance de la conservation des écosystèmes tout en s'attaquant au besoin d'inverser la décroissance continue de la biodiversité et des services écosystémiques, qui ont de graves répercussions sur les moyens de subsistance des populations humaines. Nous suggérons six façons par lesquelles la conservation par zone (aires protégées et autres mesures efficaces de conservation par zone) pourrait jouer un rôle clé au cours de la décennie : 1. Appliquer les meilleures pratiques de restauration dans les aires protégées et autres mesures efficaces de conservation par zone; 2. Utiliser la conservation par zone comme composante dans les approches spécifiques de restauration; 3. Maintenir des écosystèmes de référence et des espèces importantes; 4. Apporter de l'expertise pour garantir une représentation adéquate de tous les biomes dans la restauration; 5. Mettre en avant le rétablissement des espèces; et 6. Soutenir la régénération des services des écosystèmes. Il est important donc de veiller à ce que la conservation par zone soit pleinement intégrée dans la planification et le processus de mise en œuvre de la Décennie.

BOOK REVIEWS

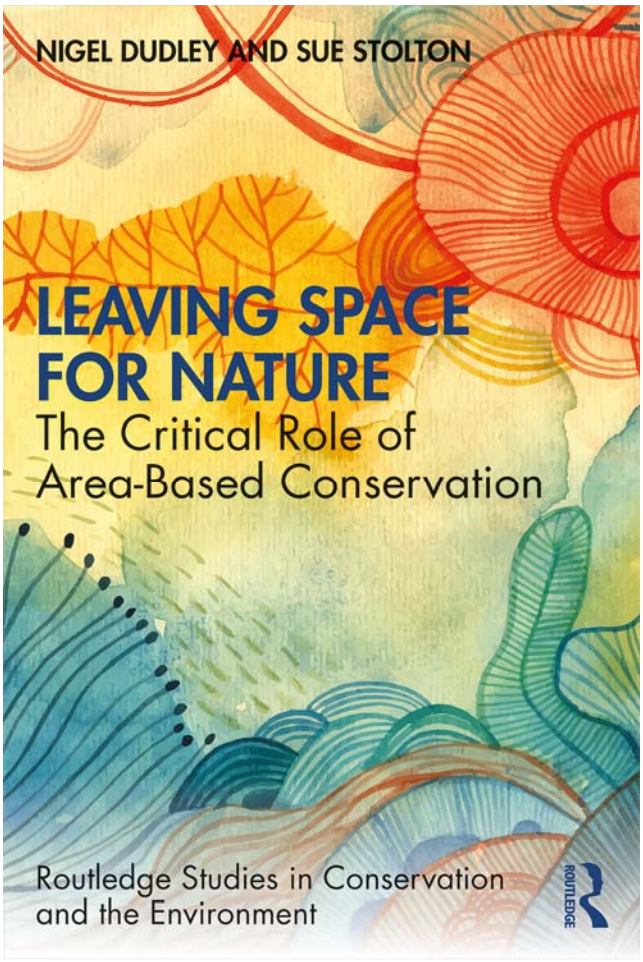
Leaving Space for Nature: The Critical Role of Area-based Conservation By Nigel Dudley and Sue Stolton (2020) Routledge Studies in Conservation and the Environment, UK. 194 pp. ISBN 9780367407537 £27.99 Reviewed by Adrian Phillips

Conservation Biology in Sub-Saharan Africa By John W Wilson and Richard Primack (2019) Open Book Publishers, Cambridge, UK. 694 pp. Free to download. ISBN: 9781783747528 Reviewed by Geoffroy Mauvais

World Heritage Sites of Australia By Peter Valentine (2019) National Library of Australia Publishing Canberra, ACT Australia. 300pp. ISBN: 9780642279422 $49.99. Reviewed by Marc Hockings

LEAVING SPACE FOR NATURE: THE CRITICAL ROLE OF AREA-BASED CONSERVATION – BY NIGEL DUDLEY AND SUE STOLTON

This book was written in anticipation of COP15 of the CBD in Kunming, China. But, like practically everything else, the conference has been postponed because of COVID-19. However, this does not diminish in any way the value of Leaving Space for Nature. I have though added a few thoughts at the end of this review on what the coronavirus pandemic, and our response to it, might mean for the lessons that Nigel Dudley and Sue Stolton spell out.



As WCPA members will know, Nigel and Sue (forgive the familiarity: it does not imply a lack of respect) have long provided much of the intellectual heft behind the Commission's programme. They have also supported the work of many other conservation bodies. Their two-person consultancy has been around for 30 years and 10 years ago their contribution to protected areas was recognised when they were awarded the Kenton Miller prize. The protected area community owes them a huge debt: their work has helped us organise our thinking and deepen our understanding of protected areas and the challenges that managers face at a time of rapid change. Their advice has ranged from the very practical help given to individual park managers in the field so that they can better measure the success of their efforts, to developing the theoretical models that we use in international meetings to understand if the global community is making progress in saving nature.

Now Nigel and Sue have consolidated much of their experience, and the knowledge of the many colleagues whose work they have read, or collaborated with, in this impressive synthesis of the current state of the art of protected areas planning and management. They draw on a wide range of first-hand experiences from around the world to illustrate the points they make, while returning again and again to their home between the Welsh mountains and coast to "ground truth" their observations. As always, the writing is lucid and the story highly readable. They feel passionately about the subject but they are commendably balanced in how they

address such thorny issues as the rights of Indigenous peoples in respect of the natural resources upon which their livelihoods depend.

Leaving Space for Nature has a logical structure: setting the scene; what we have achieved; why it is not enough; and what needs to be done. Nigel and Sue trace the protected areas story from an initial focus on strictly protected areas (Categories I-IV) to the efforts in the 1990s to complement this with more attention on Categories V and VI. And then in recent years the widening of the focus further to include OECMs and ICCAs – noting that our knowledge of the effectiveness of these "new" area-based conservation measures is poor and that questions about their governance, as well as that of protected areas, are now centre stage. They are rightly alive to the danger of endorsing all kinds of area-based conservation without being assured of their effectiveness. They manage to tell this story and make these points while moving up and down the scale from global trends to the reality of working on the ground with local communities.

In the last section, the authors offer a way forward. The key is to widen our approach in several ways: from protected areas to area-based conservation; from management to stewardship; from a narrow to a broad view of the benefits that protection offers; and to connecting conservation efforts through the wider landscape. To which they add a stronger focus on delivery and a call for much more nature restoration. It's an inspiring agenda but I sense that Nigel and Sue are themselves daunted by what they see as necessary – their closing declaration of cautious optimism seems more defiant than rational when set against the state of the word as we now see it. Their declared vision is that most of the world's lands and waters should function as diverse, resilient ecosystems. Looking around at the speed with which that vision is being laid waste, it's hard to summon up hope. But then, as they say, an optimistic, long-term vision is going to be an important factor in success.

My only criticism is the lack of illustrations. Nigel and Sue have collected a lifetime's wealth of photographs they could draw on to underline their message; and they could have included some diagrams to convey some of the conceptual ideas. It is sad that the publishers were not ready to invest in some visuals. And a glossary would be helpful too as ever more acronyms are brought into use in the conservation debate. However, these are small points: Leaving Space for Nature is a superb drawing together of contemporary knowledge and fusion of current thinking into a book that everyone in the protected areas business should read and use to help shape or influence practice and policy.

But what of COVID-19? Surely the experience of recent weeks is a dramatic sign of how the numbers and behaviour of people have turned nature from being a friend into a threat. Just as human-driven climate change comes back to hit us in the form of floods, storms, fires and droughts, so our destruction of natural ecosystems exposes us to new health dangers. UNEP chief, Inger Andersen, draws on her IUCN background when she points out that never have so many opportunities existed for pathogens to pass from wild and domestic animals to people. Three-quarters of all emerging infectious diseases come from wildlife – and the next one may not have a mortality rate of "only" 2 or 3%. Hence the call for an end to the illegal global wildlife trade and a renewed effort to protect nature. At the same time the lockdown shows something else: every human being – but especially the more than half of us who must live in towns and cities - needs contact with nature.

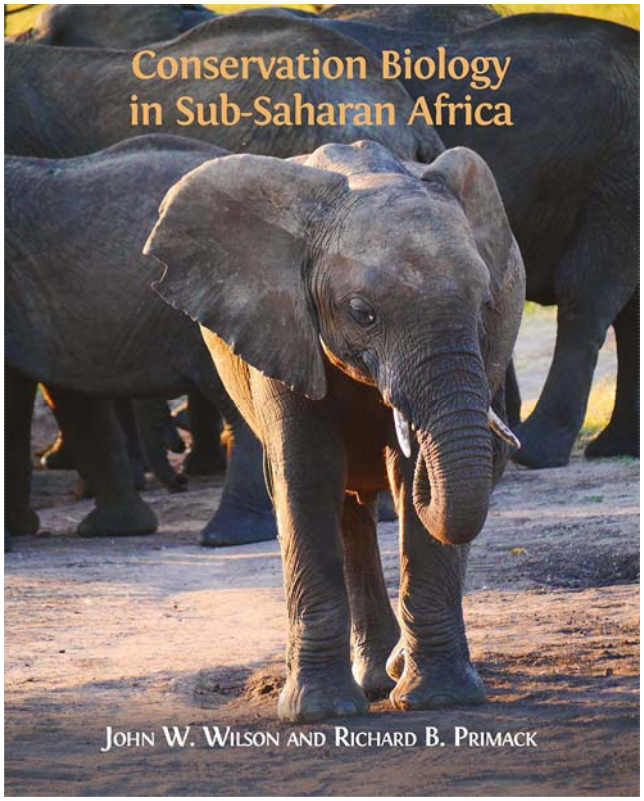
So COVID-19 massively reinforces the urgency of the message that Nigel and Sue have set out in their book: we need functioning and resilient natural ecosystems if we are to survive and we need effective area-based conservation on a far bigger scale than we have achieved so far to deliver that. If any good is to come from the pandemic, it is that humanity wakes up to its dependence on nature before nature - whether through climate chaos or new diseases - destroys civilisation as we know it. This book, conceived at an easier point in time, shows with great clarity what we must now do to avoid that outcome.

Adrian Phillips

CONSERVATION BIOLOGY IN SUB-SAHARAN AFRICA - BY JOHN W WILSON AND RICHARD PRIMACK

Conservation Biology in Sub-Saharan Africa is an open access textbook written by John W. Wilson and Richard Primack, who are both renowned biologists with a long track record of publications in this field and an extensive knowledge of the subject, in Africa and beyond.

At first glance, the book may discourage you. It's a 696-page work that you will definitely not take along with you in the field! However, as soon as you start reading, you will embark on an exciting journey and find yourself unable to leave the book until you've gotten to the last page.



This book is specifically designed for people working in the field of conservation in Africa, but it could definitely be used elsewhere as well. Its purpose is to provide students and practitioners the keys to understand conservation biology and to embrace the challenges that nature, in particular in Africa, faces. Most importantly, its aim is to explore suitable solutions if and when they exist.

The textbook is organised in fifteen chapters that broadly cover all essential topics, beginning with a comprehensive presentation of conservation biology and its features. It presents the specificities of sub-Saharan Africa and raises questions about what biodiversity entails and why it should be protected. The main threats such as land conversion, global warming, pollution, invasive species, etc. are explained and their final consequences (i.e. species extinction) are documented. This is followed by possible responses to these challenges, an overview of the knowledge needed to master population biology, and the necessity to prioritise ecosystems' preservation and to prevent extinctions. Finally, the textbook discusses some of the tools we can apply to this end: laws and conventions, protected areas, other territories that may contribute to nature conservation, new approaches and technologies that the authors call the 'agenda for the future'.

This textbook is definitely easy to read even for a non-native speaker. It is composed of a balanced mix of theory and concrete examples of conservation practice, all coming from the field and well documented. There are many boxes offering a broad overview of the African context, together with lots of recommended reading and an extensive bibliography.

This book has been designed to be practical and user-friendly. Each chapter ends with a set of questions to ask yourself or put to your students (if you teach). Remember, the main purpose of the book is to build capacities and it is definitely a great support for any course on conservation issues. We will certainly add it to our recommended reading for all our MOOCs on Protected Areas Management (see www.mooc-conservation.org).

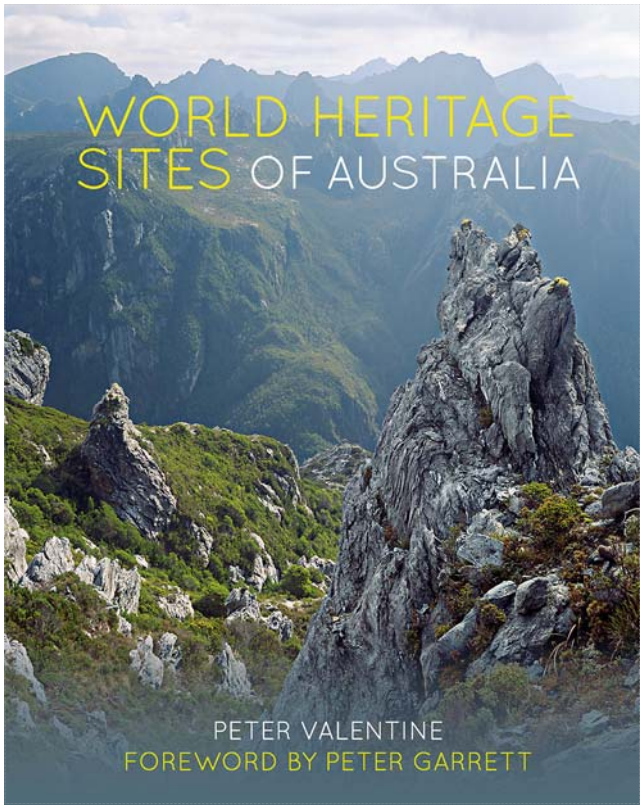
To note, most of the experts and examples used are from Anglophone Africa. This is quite understandable considering the language background of the authors, but efforts have been made to bring some light from Central and Western Africa. However, the reader interested by the entire diversity of practices on the continent would be advised to dive into the recommended reading to gain a fuller picture – as there are different approaches in different areas of the continent, linked to different cultures, land tenure issues, rules of laws, etc. and they merit being known more widely.

Last but not least, this opus is freely available online, which makes it easily accessible to all students in Africa, and beyond, to all people with a deep interest in the conservation of African nature.

Geoffroy Mauvais, IUCN, Coordinator - Pan-African Protected Areas (South Africa)

WORLD HERITAGE SITES OF AUSTRALIA - BY PETER VALENTINE

Recognition of the outstanding universal value of sites placed on the World Heritage List is a testament to the significance of places of natural and cultural importance. Since the first site, Galapagos Islands, was added to the list in 1978, the number of sites has grown to over 1,100 across 167 countries in 2019, with the majority (869) being cultural sites. The first sites in Australia were listed in 1981 at the fifth session of the World Heritage Committee that was, appropriately, hosted in Sydney, Australia. This book by Peter Valentine provides a fascinating journey through the nineteen sites in Australia that were added to the World Heritage List in the years up to 2018. Since then, one



site, Budj Bim Cultural Site has been added, as foreshadowed in the final chapter on potential additions to the World Heritage List for Australia.

Peter Valentine is extremely well placed to provide a commentary on World Heritage sites in Australia. He has wide experience as an academic geographer after nearly 40 years at James Cook University in North Queensland Australia where he remains an Adjunct Professor since retirement. Valentine is however no ivory tower academic and maintains an active role in advising natural resource management groups in North Queensland. He has had a long and intimate association with the Wet Tropics of Queensland World Heritage Area as a member of their Scientific Advisory, Committee, as a Wet Tropics Board Director and as Chair of the Wet Tropics Authority from 2010-2013. In 1997, along with Bing Lucas (a former Chair of the IUCN World Commission on Protected Areas and a legendary figure in World Heritage circles) and two others, Peter authored a seminal report on the Outstanding Universal Value of the Great Barrier Reef World Heritage Area. This work was pivotal in bringing a much more rigorous approach to understanding and defining the attributes that underpin "Outstanding Universal Value" that is the requirement for World Heritage listing. The approach, embodied in this report, has positively influenced the way in which World Heritage values are viewed and documented all around the world.

The book is in 'coffee table' format and hence, is beautifully illustrated (although I would have liked to see more of Peter's own splendid bird photographs that delight so many of us on social media). But to label this as a coffee table book would be misleading.

Each World Heritage site in Australia is dealt with in turn, first introducing the site in a way that leads you to an appreciation of why the place is special. As a geographer and a splendid naturalist, he is of course well equipped to do this in a way that is both scientifically accurate but also engaging. For many of the sites there then follows a section titled "Path to World Heritage" that details the often long and hard-fought history that led to the listing of each site. For me, this was, perhaps, the most interesting material in the book. Australia is notable for the number of listings of Natural World Heritage sites that have been the subject of often acrimonious debates about the management of these areas. These disputes have played a pivotal role in legal decisions about the relative powers and responsibilities of Federal and State governments in Australia in the environmental arena and beyond.

Throughout the book, Peter includes small snippets of his own interaction with the sites, past visits and experiences that he has had in visiting most of the World Heritage areas in Australia. The vignettes speak to his love of natural places and his abiding interest in World Heritage and its conservation.

Marc Hockings, IUCN WCPA, Australia