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IUCN PROTECTED AREA DEFINITION, MANAGEMENT CATEGORIES AND GOVERNANCE TYPES

IUCN defines a protected area as:

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

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

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

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

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

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

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

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

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

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

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

IUCN defines four governance types.

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

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

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

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

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

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

- exchanging information on practical management issues, especially learning from case studies of applied ideas;
- serving as a global forum for discussing new and emerging issues that relate to protected areas;
- promoting understanding of the values and benefits derived from protected areas to communities, visitors, business and others;
- ensuring that protected areas 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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Cover photo: Said Mkinga, Wildlife Ranger in Selous Game Reserve, on monitoring patrol at Kidai Ranger Outpost. Said has worked in Selous since 1979. His main duties are to carry out anti-poaching and rhino monitoring activities in the reserve. Selous, Tanzania. © Greg Armfield / WWF

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THE 'HEALTHY PARKS–HEALTHY PEOPLE' MOVEMENT IN CANADA: PROGRESS, CHALLENGES, AND AN EMERGING KNOWLEDGE AND ACTION AGENDA

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ABSTRACT

In this article, we outline progress and challenges in establishing effective health promotion tied to visitor experiences provided by protected and conserved areas in Canada. Despite an expanding global evidence base, case studies focused on aspects of health and well-being within Canada's protected and conserved areas remain limited. Data pertaining to motivations, barriers and experiences of visitors are often not collected by governing agencies and, if collected, are not made generally available or reported on. There is an obvious, large gap in research and action focused on the needs and rights of groups facing systemic barriers related to a variety of issues including, but not limited to, access, nature experiences, and needs with respect to health and well-being outcomes. Activation of programmes at the site level continue to grow, and Park Prescription programmes, as well as changes to the Accessible Canada Act, represent significant, positive examples of recent cross-sector policy integration. Evaluations of outcomes associated with HPHP programmes have not yet occurred but will be important to adapting interventions and informing cross-sector capacity building. We conclude by providing an overview of gaps in evidence and practice that, if addressed, can lead to more effective human health promotion vis-à-vis nature contact in protected and conserved areas in Canada.

Key words: protected areas, conserved areas, human health, well-being, promotion, policy, equity, inclusion, nature

INTRODUCTION

Human health and the health of nature are inextricably linked. Beyond the fundamental life-support services that ecosystems provide, nature contact supports human health and well-being across physical, psychological, cognitive, social, economic and spiritual spheres (Capaldi et al., 2017; Lovell et al., 2018). Among other benefits, contact with nature aids in recovery from stress and attention fatigue, encourages physical activity, provides settings to enhance social networks, stimulates development in children, and fosters nature connectedness and a sense of place (Louv, 2008; Maller et al., 2009; Romagosa et al., 2015). Despite these recognised benefits, human actions continue to drive unprecedented declines in ecological integrity (Ceballos et al., 2017). Consequently, nature's capacity to provide crucial health related benefits to humans is declining (Díaz et al., 2019), while both chronic non-

communicable diseases (NCDs) (e.g. cardiovascular disease, cancers and diabetes) and mental health disorders are on the rise (Frankish et al., 2018).

Along with ecosystem decline, recent research has demonstrated inequities in nature provision and visitation to protected areas (Finney, 2014; Stanfield et al., 2006). In the Canadian context, Black people report being seen as out of place in nature, report experiences of violence, and generally feel unsafe and unwelcome in natural areas (Conway & Scott, 2020). Indigenous Peoples in Canada and elsewhere have often had their lands expropriated and have been denied access to their traditional territories (Spence, 2000). This disconnection from the land and attempts to control movements of Indigenous Peoples have resulted in loss of language and culture and substantial health inequalities (King et al., 2009).

Just as environmental degradation and differential exposure to environmental harms are frequently the cause of poor human health, ecosystem protection can positively contribute to health and well-being outcomes (Millennium Ecosystem Assessment, 2005). The Healthy Parks–Healthy People (HPHP) movement recognises this, and the crucial role that protected and conserved areas (PCAs) across the nature continuum can play in nurturing linked human–ecosystem health (Camp et al., 2020). Backed by a growing body of empirical evidence (Lovell et al., 2018; Maller et al., 2009; Townsend et al., 2015), the movement was brought to global prominence in 2010 at the inaugural International HPHP Congress in Melbourne, Australia. The Promise of Sydney policy statement that arose from the 2014 IUCN World Parks Congress further elevated this agenda, marking an important milestone recognising protected and conserved area agencies as central actors in health partnerships and global health initiatives (IUCN, 2019).

Approached through various fields (e.g. psychology, recreation and leisure, economics and medicine), the HPHP framework is rooted in key human–nature theories (i.e. biophilia, attention restoration theory, place-based theories) (Townsend et al., 2015), and on the premise that nature is essential for human health. This view reflects the World Health Organization's (WHO) recognition of health promotion as "the process of enabling people to increase control over, and to improve, their health" (World Health Organization et al., 1986). Effective HPHP policy therefore engages PCA and visitor management programmes to enable equitable access to human health outcomes and to build community awareness such that people will advocate for, invest in and ultimately support conservation (Parks Victoria, 2017).

Set against the above context, this paper draws on our collective expertise and experience in nature–health interactions to assess programmes and research supporting the HPHP movement. Our goal was to understand current progress and challenges in establishing effective, equitable and inclusive health promotion tied to PCAs, areas conserved by Indigenous Peoples and local communities, and other relevant designations. Most of the research in this realm has focused on urban parks and very little is known about how Canada's more than 9,000 PCAs contribute to human health and well-being. Considering this, we outline research needs in our discussion and supplementary online material (SOM). We argue that these needs must be addressed if evidence-based policy and planning is to continue to unfold in a manner that maximises both ecological and human health.

In the following sections we discuss three important domains of mounting evidence (drawn where possible from the Canadian experience) that are relevant to HPHP: 1) nature and health interactions; 2) nature connectedness; and 3) equity and social dimensions of health and nature. Following this, we review areas of implementation and action, where we describe efforts in building advocacy and awareness for PCAs and health, activating programmes and informing cross-sector policies. Finally, we discuss the challenging and complex, but necessary, work needed to mobilise the HPHP movement in support of desired socio-economic and conservation outcomes.

BUILDING KNOWLEDGE AND EVIDENCE: NATURE AND HEALTH INTERACTIONS

For reasons described above, PCAs are gaining global recognition for their role as a point of nature access and human health and well-being (Leung et al., 2018). Despite growing bodies of evidence in Australia, the United Kingdom (UK) and some parts of Europe (Lovell et al., 2018), as of 2022 few studies on nature and health interactions within PCAs have been conducted in Canada. Among these limited studies, research shows that anticipated human health and well-being benefits, such as physical, psychological, spiritual and social, are a major motivating factor to visit such areas (Lemieux et al., 2016). It is well known that specific attributes (i.e. environment type, quality) and experiences (i.e. swimming, hiking, etc.) can drive visits to parks. However, Lemieux et al. (2016) found visitors to Alberta Parks reported unique health and well-being benefits based on distinct, but broad ecosystem types (e.g. alpine

areas, boreal forest, coastal area). More recently, Reining et al. (2020) linked visitation to an Ontario provincial park to high restorative outcomes irrespective of finer-scaled ecosystems. Consistent with a study in the UK by Wyles et al. (2019), they also found a strong relationship between perceived ecosystem quality and restorative outcomes.

Although the Canadian evidence base is limited, a growing number of studies outside of Canada have similarly linked health and well-being improvements to visitation. Visits to protected coastal and rural environments have been associated with greater restoration than visits to unprotected sites (Puhakka et al., 2017; Romagosa, 2018), and in national parks across the US, Buxton et al. (2021) affirmed that natural sounds improve health, increase positive affect, and lower stress and irritation of visitors.

Building knowledge and evidence: Nature connectedness

Nature connectedness (NC) refers to the degree to which individuals include nature as part of their identity. NC can be thought of as a sense of oneness with the natural world and is correlated with increased happiness, greater concern for living things, sense of community and future generations, as well as heightened ecological awareness, attitudes and behaviours (Martin et al., 2020). As a construct and a tool, NC offers a means to operationalise a complex realm of people–place relationships that examines the ontological and phenomenological connectedness humans experience with the natural environment (Manzo, 2003). In many ways, the construct seeks to capture a sense of relationality long understood in Indigenous communities. Ignace and Ignace (2017), for instance, provide a view into an Indigenous perspective on the nature–identity relationship, stating that, "[t]he Secwépemc sense of landscape goes hand in hand with the way that the Indigenous landscape names and classifies, and thus shapes in the mind, the perception of landscape".

In many regards, Canada has been a leader in revealing how NC relates to health and well-being benefits, with one of the most frequently cited assessment scales emanating from Canada (Nisbet et al., 2009). Research on visitation to Canadian protected areas has revealed that perceived health motivations and benefits are strongly correlated with NC, and are positively related to age, frequency of visits, life satisfaction, and perceived state of physical and mental health (Lemieux et al., 2016). Canadian research also shows that intentional nature contact (e.g. through hiking in the park) is pivotal for developing NC (Wright & Matthews, 2015), and studies outside of Canada have shown use of protected areas is associated with higher levels of NC compared to use of urban parks (Restall et al., 2021).

One notable limitation in the extant literature specific to PCAs is the predominant focus on adult populations, and comparatively few studies of childhood and adolescent NC. The implications of a widening disconnect from nature are regarded as more significant for children because they are still growing psychologically, physically and behaviourally (Chawla, 2020). It has been shown, for instance, that childhood participation with nature may set an individual on a trajectory towards pro-environmental behaviour in adult life (Wells & Lekies, 2012). While focused on an urban park context, a recent study by Piccininni et al. (2018) suggested a potential protective role of nature contact against the development of symptoms of poor mental health among Canadian adolescents. For female adolescents, the authors found that spending time outdoors may be a critical avenue for promoting mental well-being. Similar studies are required in PCAs in Canada and elsewhere.

Building knowledge and evidence: Equity and social dimensions of health and nature

The topic of equity, including access to PCAs and full participation in decision-making related to such areas, is complex. Evidence spanning decades has shown that use of such areas is highly differentiated, with overrepresentation by an affluent, young, white, male, able-bodied population (Frumkin et al., 2017; Scott & Lee, 2018). Beyond explanations of under-representation associated with socio-economic limitations (a marginality hypothesis), much of the literature examining barriers to visitation faced by groups exposed to systemic inequities refers to the 'ethnicity' or 'subcultural' hypothesis (Stanfield et al., 2006). As Weber and Sultana (2013) discuss, the ethnicity/subcultural hypothesis has been used within leisure scholarship to advance a view that the main barrier to greater equity in access and use of parks by Black, Indigenous and People of Colour (BIPOC+), and others, is the fact that members of these populations do not want to visit parks or wish to do so in different ways.

As a counterpoint to explaining health inequities based on the subcultural hypothesis, in many historical cases the establishment of Canadian PCAs such as national parks dispossessed and erased Indigenous Peoples from their land and fundamentally altered access to important areas, undermining healthy practices and connections with the land (Richmond, 2018). A growing number of scholars acknowledge that dispossession of Indigenous lands and forced relocation of Indigenous

Peoples to establish protected areas was a tool for expanding a white settler-colonial identity and capitalist enterprises like sport hunting and tourism (Artelle et al., 2019; Youdelis, 2016).

Barriers or constraints to visiting PCAs have been traditionally classified as structural (e.g. cost, lack of equipment) (Crawford & Godbey, 1987); intrapersonal (e.g. knowledge of parks, lack of available time, fear of nature); or, interpersonal (e.g. family demands, social group constraints) (Zanon et al., 2013). Although focused on an urban context, in their report Race and Nature in the City, Scott and Tenneti (2021) also identify language barriers and the "normalizing of whiteness as dominant culture". They note that such normalisation leads to issues of under-participation and under-representation of racialised groups in nature-based recreation (see also: Long et al., 2014). For persons with a disability (PwD), barriers to accessing Canadian PCAs include the imposition of literal physical (i.e. structural) barriers that fail to recognise the full spectrum of functional competencies within the Canadian population (e.g. campsite designs, interpretive infrastructure). Barriers also include systemic barriers embedded within services and programming (e.g. guided tours) that can stigmatise and discriminate against segments of the populations on the basis of a disability (Groulx et al., 2021).

Captured to some extent under the banners of 'attitudinal' and 'communication' barriers in the recent Accessible Canada Act (S.C. 2019, c. 10), discussion of systemic barriers perpetuated by racism, sexism and ableism in the outdoors has been comparatively limited in relation to visitation to PCAs (see Stanfield et al., 2006 and Weber & Sultana, 2013 for discussions in the US context). While the differing contexts make generalisation challenging, such research is critical as overcoming social and equity barriers will require incorporation of public opinions and values at a decision-making scale. Where access is unequal, visitation becomes a matter of health equity, shaped by social and structural determinants of health (SDOH) that condition where people live, work and play (Rigolon et al., 2021).

MAKING POSITIVE STEPS: BUILDING ADVOCACY AND AWARENESS FOR HEALTHY PARKS–HEALTHY PEOPLE

Health promotion in PCAs in Canada has been spearheaded by several organisations working at multiple levels of government, as well as non-government organisations (NGOs). As one of the earliest known examples in Canada, the Canadian Parks Council (CPC) established a HPHP Working Group in 2005 to develop a working paper focused on identifying and understanding the health and well-being links between parks and people. This national initiative has sparked similar efforts, including the 2014 Connecting Canadians to Nature report, which established a broad case for individual, familial, neighbourhood, community, societal and environmental benefits of access to PCAs (Canadian Parks Council, 2014).

At a provincial scale, the Healthy By Nature Forum in British Columbia (BC) led to the development of a Healthy by Nature Charter in 2011. More recently, the Healthy Parks, Healthy People Forum was held in Ontario in 2019, and focused on exploring evidence-based ways that nature can improve human health and ways to inspire action to integrate nature into health programming. The forum included the participation of several Canadian provincial park agencies (e.g. BC Parks and Ontario Parks) and the broader health community, providing important training opportunities for PCA staff and others to understand emerging issues and initiatives related to conservation, health and well-being.

Building on the above work, Parks for All was initiated in 2017 to set priority directives under the shared goal of HPHP (Parks Canada, 2017). The *Parks for All* initiative was supported by a partnership with the Canadian Parks and Recreation Association (CPRA) and the CPC. The goal of this initiative was to enable national, provincial and territorial collaboration around a cohesive vision of effective health promotion in parks and protected areas. While Taff et al. (2019) note that HPHP initiatives globally have tended to promote human health more than ecosystem health, Canada's *Parks for All* initiative focuses more equally on ecosystem and human health and was officially endorsed by all federal/provincial/territorial Ministers responsible for parks, protected areas, conservation, wildlife and biodiversity in 2018. The Parks for All report and action plan marked an important resource for furthering the health–nature agenda, considering a cross-sector approach to collaboration, connection, conservation and leadership.

While awareness building and advocacy efforts are underway, the programmes and related initiatives detailed above remain challenged by a lack of resources to support long-term implementation and metrics to track and assess outcomes. They also tend to be decentralised and, consequently, face ongoing challenges regarding broader health sector integration.

Making positive steps: Activating programmes

Several organisations in Canada have developed in-park programming focused on improving aspects of health

and well-being through nature contact. Ontario Parks joined the HPHP movement in 2013, launching two signature events in 2015 that continue to this day. This includes the HPHP Free Day event that raises awareness through provision of complimentary day-passes, and the HPHP 30x30 Challenge event inspired by the David Suzuki Foundation. The 30x30 Challenge encourages people to reconnect with nature by spending at least 30 minutes a day in nature for 30 days. Evaluations of the event suggest participants across Canada increased their nature contact along with levels of nature connectedness, positive emotions, vitality and fascination (Nisbet, 2015). In 2019, Ontario Parks also launched the First Day Hike initiative, modelled on the annual America's State Parks event. The objective is to promote visitation to a provincial park for a hike on New Year's Day, and to broaden HPHP programme offerings in winter. Success of the event has led to subsequent collaboration with the BC Parks Foundation (in 2020 and 2021) to extend the event to BC, then nationally.

While Ontario Parks can be considered one of the most active Crown agencies in the HPHP space, other organisations offer additional illustrative examples of programming that supports health and well-being – including through inclusion and accessibility initiatives. BC Parks' Future Strategy states that "[p]eople living with disabilities should be able to enjoy outdoor activities with no barriers" (Government of British Columbia, 2017). To this end, the agency has undertaken important first steps towards reducing exclusion by documenting barriers through accessibility audits and sharing photographs and descriptions of park sites and features on its website. Working with Power to Be, a non-profit focused on access to nature for all, BC Parks also hosted a workshop with rangers, operators and volunteers in the Omineca region on the use and experience of a TrailRider. Through its Healthy By Nature initiative, the BC Parks Foundation (the official charitable partner to BC Parks) has also

'First Day Hike' hosted by the BC Parks Foundation, Mount Seymour Provincial Park © Melissa Lem.

TrailRider is an adaptive single tyre 'wheelchair' designed to enable opportunities for outdoor recreation on trails that might otherwise be inaccessible to individuals with a disability © BC Parks.

partnered with: 1) MOSAIC BC, an immigrant and refugee settlement agency; 2) Foundry, an integrated province-wide network of health and social services centres for at-risk youth; and, 3) Parkbus, hosting guided hikes in provincial parks with health professionals for other populations with higher barriers to nature access.

Like BC Parks, Alberta Parks has centred efforts on accessibility and inclusion, implementing an inclusion plan; the only one of its kind in Canada (Government of Alberta, 2014). To activate the plan, initiatives like grief walking programmes and palliative care support for parks interventions have been developed as a collaboration among park managers, health and parks researchers, non-profit organisations and healthcare agencies (Jakubec et al., 2020). For people with a disease, disability or facing life-limiting illnesses, these HPHP initiatives have supported physical calm, a renewed sense of one's identity, enriched social relationships, and connections to greater meaning and purpose (Jakubec et al., 2020). Alberta's experience reflects the importance of non-park agencies and volunteers in activating HPHP programming. This includes efforts of the Friends of Kananaskis Country, who along with other volunteers contribute 25,000–35,000 hours of volunteer time annually to run events that inspire children and adults to get outside, pursue winter recreation, and achieve greater physical and mental well-being through physical activity in nature.

Notably, several federal and provincial parks agencies across Canada have introduced 'Learn-to-Camp' programmes, often in collaboration with private sector and NGO partners (e.g. Scouts Canada). These programmes help new generations of Canadians develop

Father and son learning how to make a campfire at a Parks Canada Learn-to-Camp pop-up booth along the Rideau Canal (Source: Sophie Deschamps / © Parks Canada / Rideau Canal National Historic Site).

skills and knowledge that support nature-based recreation. They also support awareness of the health and well-being benefits of time outdoors while shaping a life-long appreciation for Canada's protected areas. Since 2011, Parks Canada's Learn-to-Camp programme has attracted over 100,000 participants (Parks Canada, 2020) (Figure 3), while in 2019 Saskatchewan Parks' Camp Easy programme enabled over 900 visitor nights for people who do not own camping gear (SaskParks, personal communication). In Ontario, a similar Learn-to-Camp programme has educated over 26,000 people through overnight camping experiences and engaged more than 100,000 through community outreach events (Ontario Parks, personal communication). Evaluations suggest that 59 per cent of participants went on a camping trip after the programme, while 95 per cent of participants indicated they would likely go on a future camping trip (Ontario Parks, personal communication).

Despite the programmes noted above, there remains no inclusive, systematic framework for organisations across Canada to consistently activate HPHP programming. This is also very common across agencies outside of Canada (with the exceptions of the U.S. National Park Service, Parks Victoria and a limited number of other agencies). Without such a framework, implementation of programmes has ultimately been ad hoc. This is likely because many protected areas agencies and organisations in Canada lack human and financial resources to implement education, interpretation and outreach programming. Notably, these functions are often the first to be cut during government cutbacks in funding. Despite often having knowledge of community needs, managers are unable to comprehensively plan and deliver sufficient programming and events as they are dependent on available funding across all levels of government (Dearden, 2008).

Activating health benefits through programmes like those discussed above requires managers to either provide opportunities for partnerships (permits for outside groups/organisations) or generate the agency expertise required to host events, develop community programmes and connect with the wider community. To do so equitably, a systematic framework with detailed national-level data revealing where protected and conserved areas may be underserving the health and well-being needs of key populations is needed.

Making positive steps: Informing cross-sector policies and plans

The range of health and well-being benefits that PCAs provide are often acknowledged in provincial/territorial law and policy. In some cases, recognition of health and well-being was present in some of the earliest protected areas laws in Canada. The importance of health remains enshrined in Ontario park legislation today, where provincial parks "are dedicated to the people of Ontario and visitors for their inspiration, education, health, recreational enjoyment and other benefits…" (Government of Ontario, 2006). Critically, the historical context in which legislation was established to open new areas of land to the benefit of colonial-settler populations across Canada coincides with the imposition of the Indian Act of 1876 to achieve precisely the opposite for Indigenous nations by restricting their movements and rights and title (Artelle et al., 2019). Conjointly, these pieces of colonial legislation, among others, contributed to a 'green colonialism' that was accomplished in Algonquin Provincial Park, and in parks across Canada, often prohibiting hunting practices within the park boundary (Baker, 2002).

At present, the Algonquins of Ontario (AOO) are in negotiation with the Governments of Ontario and Canada to establish a modern-day treaty (Government of Ontario, 2021). In the interim, their constitutionally recognised right to harvest moose and elk has since 1991 been exercised through an annually negotiated Harvest Management Plan (Ontario Parks, 1998). The AOO regained trapping rights in nineteen registered traplines within the park in 1958 (Ontario Parks, 1998). The proposed treaty would also increase their collaborative planning role for parks and protected areas within the settlement area. As part of this treaty, it has been proposed that Lake St. Peter Provincial Park be expanded, the Crotch Lake Conservation Reserve be expanded and renamed Whiteduck Provincial Park (after an Algonquin family that traditionally lived in the area), and Bell Bay, Foy and Westmeath provincial parks be transferred to the AOO (Government of Ontario, 2021).

In recent years, several Indigenous groups have asserted their constitutional and treaty rights to the management of several protected areas throughout Canada (Finegan, 2018). This includes collaborative and cooperative management and governance arrangements established between Crown governments and Indigenous governments and organisations, and the establishment of Indigenous Protected and Conserved Areas (IPCAs) which are Indigenous led and elevate Indigenous rights and responsibilities. Canada's most recent protected areas legislation, the North West Territories' *Protected Areas Act* (SNWT 2019, c.11), emphasises that Indigenous culture and ecosystems are on equal ground, underscoring the importance of protecting biodiversity and ecological integrity to the traditional lifestyles and health and well-being of Indigenous Peoples (Government of NWT, 2019). Two recently announced examples of protected areas established under the new Act are Thaidene Nëné and Ts'udé Niłįné Tuyeta. These protected areas include collaborative and cooperative management and governance arrangements established with Indigenous governments and organisations to respect Aboriginal and treaty rights, land claims and self -government agreements. The NWT's related *Healthy Land, Healthy People* work plan further details why protecting biodiversity through a healthy conservation network can foster healthy families and create opportunities for healthy lifestyles (Environment and Natural Resources, 2016).

Although some organisations have begun mainstreaming the concept, there are only a few HPHP policy and planning initiatives underway in Canada specifically occurring within PCA organisations. The Made-in-Ontario Environment Plan (Ontario Ministry of Environment Conservation and Parks, 2018) has paved the way for the development of a draft Ontario Parks HPHP Strategic Plan that is expected to be Canada's first such plan (Box 1).

Box 1. Ontario Parks Healthy Parks–Healthy People Strategic Plan (Draft)

In the fall of 2019, Ontario Parks launched a public consultation on HPHP, inviting Ontarians to share feedback on ways to improve access to, and raise awareness of, the health benefits of being in nature. The consultation received over 2,500 submissions from individuals, groups and organisations (i.e. researchers, health practitioners, Indigenous organisations and tourism organisations) (Ontario MECP, 2021).

Participants highlighted priority directives, namely long-term protection of regional and provincial parks, conservation of biodiversity and ecology within parks, increasing events and programming (i.e. nature hikes, health events and park prescriptions) including safe access to park facilities, and ongoing communication about the health benefits of nature. Based on the feedback from the public consultation, Ontario Parks is in the process of developing a strategic plan for the next phase of the HPHP programme, including new ideas for programmes, the development of new policies, and the building of both existing and new partnerships.

It is important that PCA organisations move beyond operating in isolation and ensure that biodiversity considerations are integrated into government-wide health promotion strategies (Cook et al., 2019). Healthcare provider-driven 'Park Prescriptions' programmes like PaRx, a pan-Canadian initiative powered by the BC Parks Foundation, illustrate this need by concentrating on curriculum and training for prescribing time in nature as a wellness intervention. Early reception has been promising, with over 700 prescribers registered in the first six months of the programme (and at the time of publication of this article, over 1,000 prescribers). Each 'prescriber' is supported with tools and customisable information to connect patients of all ages to nature contact opportunities. PaRx is also developing a mobile application to track and incentivise nature time. This application will collect accurate, widespread data to inform research on nature prescription efficacy and best practices (Kondo et al., 2020).

Overall, despite some successful policy integration, the HPHP movement in Canada has somewhat stalled in its ability to successfully transition to more widespread policy and planning development and integration. There have been limited efforts to build relationships between PCA organisations (e.g. operations and visitor experience programming) and health ministries or departments. Like other regions in the world, there remain significant gaps in awareness among health practitioners and policymakers (Barnes et al., 2019; Townsend et al., 2015).

DISCUSSION AND RECOMMENDATIONS

Despite some promising signs of progress, we can conclude from our review that the HPHP movement is very much in its infancy in Canada. While a fully representative national 'stocktake' of HPHP programming across all of Canada's PCA agencies was beyond the scope of this review (but is very much needed), evidence synthesised here suggests that advancing this movement will require more effective engagement of the broader conservation and health communities. Key actors include governments working in conservation, planning and health at all levels, private organisations, civil-society groups representing equity-deserving groups, and non-governmental organisations. The necessary inter-sectoral work is highly complex, but so too are the barriers that must be addressed to ensure that all Canadians and Indigenous Peoples are empowered to achieve their health potential through the nature-based experiences available in protected and other conserved areas. Given the shifting demographics in Canada, especially in large cities where People of Colour make up most of the population, the long-term survival and relevance of park agencies may depend on making their parks a welcoming and direct part of the lives of a more diverse population now and into the future.

To address this formidable challenge, we offer several recommendations with respect to research and programme/plan development for the diverse and growing PCA community. We build on these recommendations in our supplementary material to this article. First, to address the observations related to research gaps and needs stated above, agencies need to enhance their ability to collect relevant visitor demographic data through reservation and registration systems. While the collection of such data must be approached with care, we were unable to locate intersectional visitor data for any Canadian PCA agency. By comparison, the U.S. National Park Service (NPS) regularly reports on visitor demographics, race and ethnic diversity of visitors, enabling studies that have demonstrated the equity challenges of the parks system, including the fact that Hispanics and Asian Americans each comprised less than 5 per cent of visitors to national park sites surveyed, while less than 2 per cent of visitors were African American (Scott & Lee, 2018).

Second, synthesised evidence, as well as ecosystem service evaluations focused on quantifying cost savings to the health-care system, will be required to convince decision-makers of the value of public health benefits associated with PCAs. Data from a 'green prescriptions' pilot project implemented by the UK National Health System showed that for every £1 ($1.74 CAD) invested, there was a £6.88 ($11.94 CAD) return in social benefits (Bagnall et al., 2019). While sometimes in conflict with recognising the rights of non-human actors and the innate value of ecosystems, economic evaluations have helped illustrate why public investments in PCAs are clearly worthwhile.

Third, it will be important for PCA agencies and organisations to continue to create an inclusive HPHP ethos from *within*. PCA agencies should consider hiring and/or more frequently engaging with health professionals and practitioners to advance the HPHP approach. For example, Scottish Forestry appointed a health professional to develop their health work, including the Branching Out programme (Scottish Forestry – Branching Out, n.d.). Furthermore, continued efforts to support a more inclusive environment, including shifts in behaviours, attitudes, traditions and interactions are required. This work must ensure diversity among employees and must ensure decisions made are informed by those with the lived

experience that decisions affect. The 2021 ECO Canada labour market profile for green jobs revealed a lack of diversity among staff within the growing environmental industry, including PCAs (ECO Canada, 2021). A focused assessment of diversity within PCA organisations could help identify gaps in the workforce and barriers that must be eliminated to recruit and retain a generation of leaders who reflect Canadian society. The first, crucial step is non-tokenistic hiring of staff that reflects Canada's diversity in terms of ethnicity, gender, ability and so on. This involves a commitment to the resources (staff, time, money, etc.) necessary to spearhead change. 'Guardian' programmes in the NWT offer an encouraging example linking land-based connections, employment opportunities and environmental stewardship (Indigenous Leadership Initiative, 2020).

Fourth, building solidarity between groups and movements by finding common ground and aligning goals can push forward action in creating healthy PCAs for all. Within this, it is important to understand the histories of specific groups, particularly Indigenous and People of Colour in Canada, and to centre these perspectives. It is also paramount to avoid pitting groups against one another in the push for equity, as this divisiveness only further upholds systems of oppression and social injustices. These lessons learned come from other approaches like Critical Race Theory and can be used to take an evidence-informed approach to justice, equity and inclusion within the HPHP movement (Delgado & Stefancic, 2017).

Finally, a pan-Canadian HPHP promotion strategy, with buy-in from all federal, provincial/territorial PCA agencies and organisations is needed. This strategy must be pan-Canadian so it can provide the opportunity to coordinate HPHP programming with jurisdictions across Canada, Indigenous Peoples, national to local public health units, and other government departments (e.g. education), private organisations, and relevant social, environmental and health organisations. The U.S. National Park Service has a strategic plan, science plan, community engagement guide and active transportation guidebook that supports its HPHP efforts (U.S. National Park Service, 2018). HPHP initiatives offer immense opportunity to improve both ecological and social health, but the lack of a cohesive vision for health promotion across Canada's PCAs, as well as the absence of 'best practice' guidelines for integration has limited this potential to date. Policy and programme evaluation frameworks will need to be developed to assess effectiveness. A national health promotion strategy that recognises the need to both protect and experience nature seems a logical and strategic way forward for more effective nature–health integration.

Ts'udé Nilǫné Tuyeta, a newly established Indigenous Protected and Conserved Area covering 10,000 square kilometres near Rádeyǫlıkóé, northwest of Yellowknife, NWT. Guardian programmes have an emphasis on healing, health, wellness and connecting with traditional ways for the youth who are becoming Guardians © Julien Schroeder

CONCLUSIONS

Since its inauguration in 2000 by Parks Victoria in Australia, the HPHP movement has expanded to places such as New Zealand, Korea, Finland, the United States, South Africa, Scotland and Canada. While evidence is strong globally and continues to grow, further research is needed on many aspects of PCAs and human health specific to Canada. This includes research ranging from more formal longitudinal studies examining health impacts (or outcomes) along with social-ecological considerations, to strategies for effective conservation–health policy integration and promotion. In Canada's HPHP movement, many aspects of the relationships between groups facing systemic barriers (including Indigenous Peoples, Black and People of Colour, LGBT2SQ+ communities, and others), self-determination of one's health and well-being, and parks and protected areas access also remain poorly developed.

While the HPHP movement remains in its infancy in Canada, there are several promising signs of progress, including the recent introduction of *PaRx* programmes in BC (2020), Ontario, Saskatchewan and Manitoba (2021). The launch of *PaRx* in Ontario occurred with support from major health partners such as the Ontario College of Family Physicians, the Nurse Practitioners' Association of Ontario, the Association of Family Health Teams of Ontario, and doctors, nurses and other healthcare professionals. This collaborative effort represents a significant milestone in collaboration between the parks and health sectors. Furthermore, Parks Canada's recent announcement in February 2022

to partner with *PaRx* in national parks, national historic sites and national marine conservation areas, as well as expand national urban parks to every province and territory in Canada (with a target of 15 new urban parks by 2030), has the potential to increase awareness, expand public access to nature-based health resources and ultimately improve public health. Additionally, the emergence of IPCAs promotes by design a holistic approach to cultural and environmental health. The Indigenous Circle of Experts (ICE) Report describes IPCAs as conservation economies that protect biodiversity interwoven with the well-being of Indigenous people and communities. The ICE report explicitly states that such areas "…benefit all Canadians in the form of clean air and water, improved human health, and the mitigation of risks from climate change and disease" (Indigenous Circle of Experts, 2018). Engaging in Ethical Space, which provides a venue for knowledge systems to interact with mutual respect, kindness, generosity and other basic values and principles, will be key to creating conditions for effective collaboration between Indigenous and non-Indigenous partners (Indigenous Circle of Experts, 2018).

Harnessing the power of nature as a health resource for all will not be easy. More effective collaborations with government health/public health ministries or departments would provide access to far greater financial and human resources, an increased capacity to communicate and engage with the public and, quite possibly, an enhanced ability to use the best available evidence to inform decisions that affect both ecological and human health and well-being. Relatedly, several studies have projected that there will likely be significant and lasting mental health impacts from the COVID-19 pandemic (Pfefferbaum & North, 2020), presenting an opportunity to further promote the role of PCAs in Canada in sustaining human health and well-being. A robust and inclusive pan-Canadian HPHP programme, across the nature continuum and inclusive of Canada's diverse PCAs, is a unique opportunity to tackle these mounting issues. Within this, equitable and self-determining opportunities for nature-based experiences and learning should be at the core of such an approach to ensure that access to nature is made available to all through a focus on eliminating systemic economic, physical, social and cultural barriers.

DISCLAIMER

The views and opinions expressed in this paper are those of the authors and do not necessarily reflect the official policy or position of any agency, organisation or employer.

SUPPLEMENTARY ONLINE MATERIAL

Supplemental Online Material: Evidence Gaps and Recommendations

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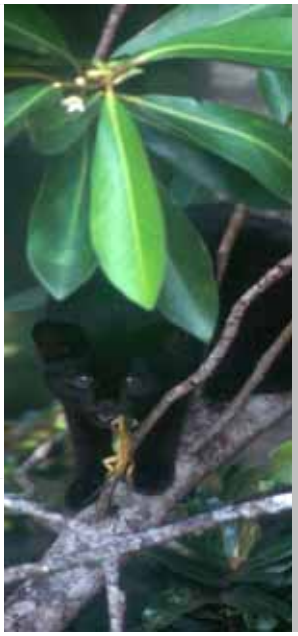
RESUMEN

En este artículo describimos los avances y retos que se plantean al tratar de establecer una promoción eficaz de la salud en las experiencias de los visitantes en las áreas protegidas y conservadas de Canadá. A pesar de la ampliación de la base de datos mundial, los estudios de casos centrados en aspectos de la salud y el bienestar dentro de las áreas protegidas y conservadas de Canadá siguen siendo limitados. Los datos relativos a las motivaciones, los obstáculos y las experiencias de los visitantes no suelen ser recogidos por los organismos gubernamentales y, si se recogen, no se ponen a disposición del público ni se informa sobre ellos. Es evidente que existe un gran vacío en la investigación y la acción centrada en las necesidades y los derechos de los grupos que se enfrentan a barreras sistémicas. Las cuales se pueden relacionar entre otras cuestiones, con el acceso, las experiencias en la naturaleza o los resultados de salud y bienestar. La activación de programas a nivel de sitio sigue creciendo, y los programas de Prescripción de Parques, así como los cambios en la Ley de Accesibilidad de Canadá, representan ejemplos significativos y positivos de la reciente integración de políticas intersectoriales. Todavía no se han realizado evaluaciones de los resultados asociados a los programas de HPHP, pero seguramente serán importantes para adaptar las intervenciones e informar sobre la creación de capacidades intersectoriales. Concluimos proporcionando una visión general de las lagunas en la evidencia y la práctica que, si se abordan, pueden conducir a una promoción más eficaz de la salud humana frente al contacto con la naturaleza en áreas protegidas y conservadas en Canadá.

RÉSUMÉ

Dans cet article, nous décrivons les progrès et les défis liés à l'établissement d'une promotion efficace de la santé liée aux expériences des visiteurs offertes par les aires protégées et conservées au Canada. Malgré l'élargissement de la base de données mondiale, les études de cas axées sur les aspects de la santé et du bien-être dans les aires protégées et conservées du Canada restent limitées. Les données relatives aux motivations, aux obstacles et aux expériences des visiteurs ne sont souvent pas recueillies par les agences gouvernementales et, si elles le sont, elles ne sont pas mises à la disposition du public ou ne font pas l'objet de rapports. Il existe une lacune évidente et importante dans la recherche et l'action axées sur les besoins et les droits des groupes confrontés à des obstacles systémiques liés à une variété de questions, y compris, mais pas limité a, l'accès, les expériences de la nature et les besoins en matière de santé et de bien-être. L'activation des programmes au niveau des sites continue de croître, et les programmes de prescription de parcs, ainsi que les modifications apportées à la Loi canadienne sur l'accessibilité, représentent des exemples significatifs et positifs de l'intégration récente des politiques intersectorielles. Les évaluations des résultats associés aux programmes HPHP n'ont pas encore eu lieu, mais elles seront importantes pour adapter les interventions et informer le renforcement des capacités intersectorielles. Nous concluons en donnant un aperçu des lacunes dans les données probantes et la pratique qui, si elles sont comblées, peuvent mener à une promotion plus efficace de la santé humaine vis-à-vis du contact avec la nature dans les aires protégées et conservées au Canada.



POTENTIAL SPECIES DISTRIBUTION MODELS CAN HELP IN THE CONSERVATION OF THREATENED SPECIES: THE CASE OF THE GUIGNA (*LEOPARDUS GUIGNA*) IN LOS ALERCES NATIONAL PARK, ARGENTINA

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ABSTRACT

The Guigna (*Leopardus guigna*) is a felid with one of the smallest geographical distributions. In Argentina, this species occurs in four national parks: Los Alerces National Park (LANP), Lago Puelo National Park, Nahuel Huapi National Park and Lanín National Park. However, because estimations suggest that, by 2050, human land use and climate change will negatively affect 40 per cent of its potential distribution, LANP is very important to the conservation of the species. With the aim to help the Argentine Administration of National Parks to define strategies to protect the Guigna, the present study aimed to: (1) map sightings reported in LANP over the last 45 years and determine the areas with confirmed presence and probable absence of Guignas, taking into account the possibility of observation in different areas of the park; (2) map the park's suitable habitats; and (3) map potentially optimal areas for the Guigna's conservation. The results identified four valleys as potentially optimal areas for the conservation of Guignas within LANP and another two as secondary suitable areas. The results also indicated that to maintain a healthy population of Guignas within LANP, the understorey structure of forest strips that connect the valleys should also be conserved, and that the main threat to this structure is the expansion of Wild Boars.

Key words: Andean forest, felids, invasive species impacts, Patagonia, conservation threats

INTRODUCTION

The Guigna (*Leopardus guigna*) (Felidae, Molina 1782), also known as Huiña or Chilean Cat, is the smallest felid in the American continent and is a species listed as Vulnerable and decreasing (IUCN, 2022). This species is endemic to Chile and Argentina and has one of the smallest geographical distributions of felids (Nowell & Jackson, 1996; Sunquist & Sunquist, 2002; 2009). In Chile, the Guigna inhabits the Valdivian forest and the Matorral, from the Andes to the Pacific coast, approximately from 30° S to 48° S, whereas in Argentina, it inhabits the area of the Patagonian Andean forest from 30° S to 44° S, in an area of less than 20,000 km² (Freer, 2004; Monteverde et al., 2019). In Chile, it is considered endangered (Acosta & Lucherini, 2008; Monteverde et al., 2019), because several human impacts such as deforestation, fragmentation, presence of farms, and forest plantations of exotic species affect its distributional range (Zuñiga et al., 2009). In addition, in agricultural areas of Chile, the Guigna is hunted and killed for being a predator of poultry (Freer, 2004). In southern Chile, where human presence is low, the altitude and mountainous relief restrict the species' dispersion and population growth (Freer, 2004). As a consequence, in the disconnected valleys of these latitudes, where the species takes refuge, the Guigna's densities and home-range overlaps increase strongly (Freer, 2004). In Argentina, this species is considered vulnerable and the most important threat is climate change (Cuyckens et al., 2015).

Some studies suggest that the distribution of Guignas is almost exclusively restricted to native *Nothofagus* forests (Acosta-Jamett & Simonetti, 2004). However, Guigna faeces have been observed in *Pinus radiata* plantations (Zuñiga et al., 2009), and some studies have shown that this species is able to inhabit substantially modified habitats as long as they provide sufficient dense vegetation for shelter and to hunt small mammals and birds (Sanderson et al., 2002; Galvez et al., 2013; García et al., 2021). However, the Guigna becomes more

difficult to detect when domestic dogs are present in an area and its densities decrease as the human population increases (García et al., 2021). Similarly to that observed for many felids within reserves, Guignas prefer dense and structured habitats (Ludlow & Sunquist, 1987; Konecny, 1989; Libereck, 1996; Lombardi et al., 2020), probably because these habitats facilitate their predatory behaviour, concealment, and stalking behaviour (Sanderson et al., 2002; Freer, 2004). When Guignas inhabit preserved habitats and have the possibility to choose, they are found in forests, mainly in thickets, avoiding open areas (Freer, 2004).

Estimations suggest that, by 2050, 40 per cent of the potential distribution of Guignas will be negatively affected by human land use and climate change (Cuyckens et al., 2015). In Chile, the main human factors likely to be responsible are deforestation of Valdivian forests (1.86 per cent per year), the growth of large cities, most of them located in the Central Matorral, as well as hunting of Guignas outside of protected areas (Cuyckens et al., 2015). In Argentina, the main factors impacting populations of Guignas are declines in rainfall and the increase in evapotranspiration in the east that restrict its distribution (Cuyckens et al., 2015). Cuyckens et al. (2015) predict that, in Argentina, the most stable populations will be within Los Alerces National Park (LANP). However, there are no studies about the Guigna in LANP and there are no conservation projects for the species in Argentina (Lucherini et al., 2018). Thus, with the aim to help the Administration of National Parks of Argentina (APN) to define strategies to protect the Guigna, the present study aimed to:

1. Map the sightings reported in LANP over the last 45 years and determined the areas with confirmed presence and probable absence of the species, taking into account the possibility of observation in different areas of the park;
2. map suitable habitats; and
3. map potentially optimal areas for the conservation of Guignas within LANP.

METHODS

Study area

The study was carried out in LANP, located in Chubut Province, Argentina (Figure 1). This national park was designated as a World Heritage site by UNESCO (Ref. 1526), because it is vital for the protection of some of the last remaining areas of continuous Patagonian Forest that are in an almost pristine state and are the habitat for several endemic and threatened species of flora and fauna. Including both park and reserve areas, LANP covers 2,596 km² (Martin & Chehébar, 2001), of

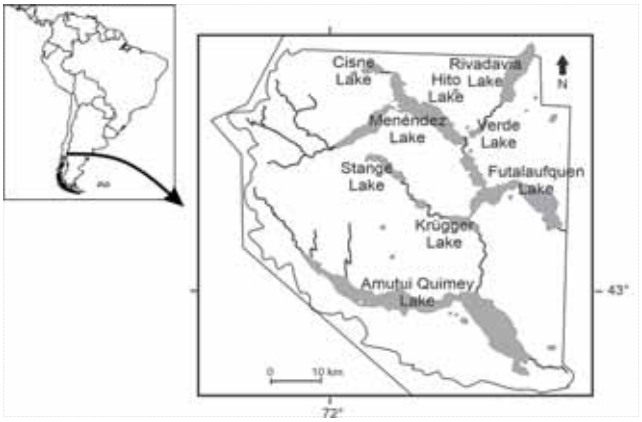

Figure 1. Location of Los Alerces National Park (LANP) and detailed map of the park showing the main lakes

which the park represents 1,973 km². In the park area, human activities are restricted to some tourism visits (Martin & Chehébar, 2001), whereas in the reserve area, some human activities such as livestock raising, tourism lodges and cabins are permitted (Martin & Chehébar, 2001).

Camera trap sampling

During our studies of seed dispersal and seed predation conducted in LANP between 2019 and 2021, we opportunistically collected camera trap records of Guignas. Our experimental stations were located at random in the forest near the following lakes: Amutui Quimey (2019, 2020 and 2021), Futalaufquen (2019, 2020, and 2021) and Verde (2021) (Figure 1). Seed dispersal and seed predation were monitored by using camera traps, totalling 16,488 trap hours. Cameras were also used to monitor the use by animals of trails closed to tourism during the autumn season (April–May). Cameras were located along three closed trails: Laguna Toro, near Amutui Quimey Lake (2020), Krugger, near Futalaufquen Lake (2021) and Alto el Petizo, near Verde Lake (2021), totalling 12,000 trap hours. To estimate the relative abundance of Guignas, records of vertebrates detected by our cameras at different locations were classified according to their frequency of detection per 100 trap/hours: low (less than 0.05 per 100 trap/hours records), medium (between 0.05 and 0.09 per 100 trap/hours) and high (0.1 or more per 100 trap/hours records).

Determination of suitable habitats and optimal areas

To determine suitable habitats, we classified areas within the park as suitable or unsuitable habitat for Guignas, based on published literature on habitat use by the species as outlined here. Native forest fragments connected by corridors within disturbed landscape are

considered suitable for the species (Sanderson et al., 2002; Galvez et al., 2013). Considering that Guignas avoid scrub, cleared areas, rocky areas and saltmarshes (Dunstone et al., 2002; Freer, 2004; Zuñiga et al., 2009), environments with these characteristics were considered unsuitable. Water bodies and areas with permanent snow and ice were also excluded (Dunstone et al., 2002). The remaining categories (all forests) were classified as suitable. We excluded unsuitable environments and joined environmental categories that were classified as suitable using Qgis 2.18 (Figure 2a).

Estimation of the presence and absence of Guignas

Records of Guignas were searched for in the Biodiversity Information System (BIS) of the APN, our records and the literature. The BIS was accessed on 31 January 2021. Records of the previous five years (2017 –2021) were classified as recent, while earlier records were classified as historical. Historical records ranged only between 1978 and 2000 because we found no records of the species between 2000 and 2016. Qgis was used to map all the Guigna records and areas with higher human activity (tourist activities, dwellings of local residents, park rangers and our experiment locations), to define areas with intense use and those with higher probability of detection. To determine whether human activities in areas with no records of the Guigna are too intensive and incompatible with wild fauna, the BIS was also searched to map records of another two species: the Pudú (Pudu puda, Cervidae), which is especially sensitive to human presence, and the Puma (Puma concolor, Felidae), a felid species with several records in the park. We took into account only the observation of animals and no other presence indicators (e.g. faeces) because Guigna traces are difficult to detect or identify. The overlaying of information allowed us to define areas where the species is absent or has low probability of presence (suitable environment, no records of the Guigna, records of other species and higher human presence) and areas with confirmed presence of the species.

Areas with potentiality to support stable populations of Guignas were identified by looking for extensions of suitable habitats, preferentially forest with preserved understorey located at low elevations (Freer, 2004) with records of the Guigna or without records but without human presence. Considering that the Guigna avoids steep slopes (Freer, 2004), these were not considered based on an elevation map (APN, 2017). We then defined the optimal areas for the preservation of stable populations in LANP and classified them as having: 'highest relevance' (less than 10 km of forest strip connecting the area with another) or 'secondary relevance' (more than 10 km of forest strip connecting the area with another).

RESULTS

Our cameras detected the presence of several native and exotic animals (Table 1). Guignas showed low frequency with recent records of the Guigna in areas where it had been historically reported, namely forests on the margins of the Rivadavia and Verde Lakes (Figure 2a). All records in locations that had not been reported

Table 1. Frequency of detection per 100 trap/hours of native and exotic species by camera trap in Los Alerces National Park, Chubut, Argentina. * Exotic species

Species detected	Frequency of detection /100 trap hours		
	Low <0.05	Medium 0.05 – 0.09	High ≥ 0.1
Mammals			
Leopardus guigna	X		
Oncifelis geoffroyi	X		
Puma concolor		X	
Lycalopex culpaeus			X
Conepatus humboldtii	X		
Chaetophractus villosus	X		
Pudu puda	X		
Dromiciops gliroides	X		
Micro rodents			X
Bats			X
Sus scrofa *			X
Cervus elaphus *	X		
Birds			
Milvago chimango			X
Glaucidium nanum	X		
Campephilus magellanicus	X		
Aphrastura spinicauda			X
Pteroptochos tarnii	X		
Schelorchilus rubecula			X
Elaenia albiceps		X	
Turdus falcklandii			X
Phrygilus patagonicus		X	

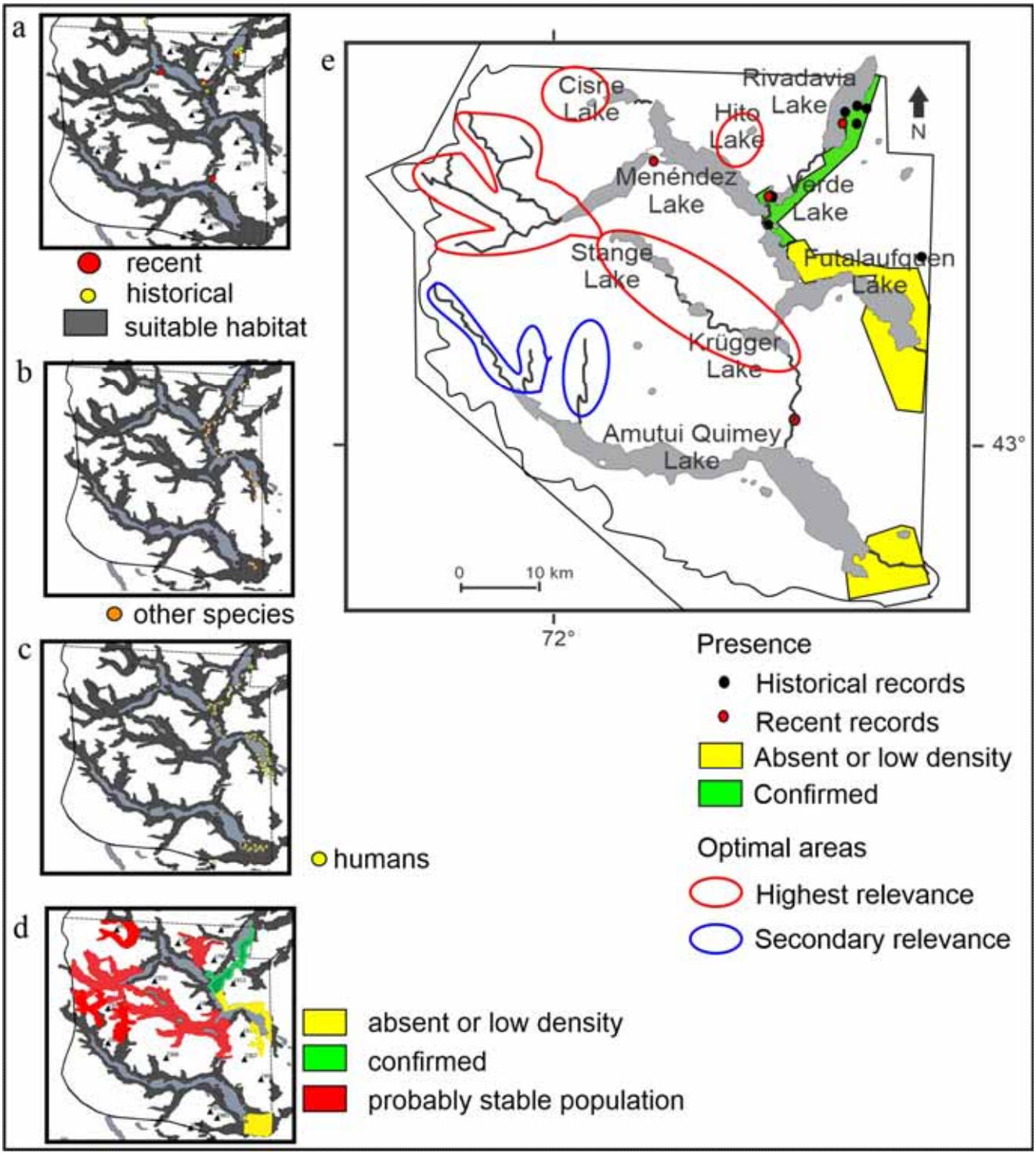

Figure 2. 2a. Map of suitable habitats defined by the authors, showing historical and recent records of the Guigna (*Leopardus guigna*) within LANP; 2b. Map showing records of other species (*Puma concolor* and P*udu puda*) within LANP; 2c. Map showing the location of human presence and activity within LANP; 2d. Map of suitable habitats showing areas where the species is absent, areas where its presence is confirmed, and areas that might potentially support stable populations; 2e. Map of areas with confirmed presence, absence or presence at low densities of the Guigna, and optimal areas with highest or secondary relevance for the conservation of the Guigna as a result of information integration.

previously, such as forests on the margins of the Menéndez Lake and Frey River, were sites without human activities. Guigna were recorded in both the more strictly protected park area as well as in reserve areas (west coast of lakes).

All records of the Guigna were within the suitable habitat as defined in the literature (Figure 2a). A GIS overlay of records of the Guigna (Figure 2a), other species (Figure 2b) and human presence (Figure 2c) allowed us to determine areas where the Guigna might be absent or at very low densities, areas where the presence was confirmed, and areas with potential to support stable populations (Figure 2d).

Areas where the Guigna was absent or at very low densities were: the west coast and part of the east coast of Futalaufquen Lake, and the area near the Futaleufú dam, whereas areas where the presence of Guignas was confirmed were: the east coast and part of the west coast of the Rivadavia and Verde Lakes (Figure 2e). In addition, we predicted four optimal areas for the conservation of a healthy Guigna population in LANP: the valleys at the end of the south branch of Menéndez Lake, totalling 13,000 ha and connected directly to the valleys of Stange and Krugger Lakes, totalling 23,000 ha, the valley of Cisne Lake, totalling 6,500 ha within the park and less than 2,000 ha outside the park, and the valley of Hito Lake, totalling 4,000 ha (Figure 2e). A further two areas with optimal potential (7,000 and 4,000 ha respectively) were identified in the south of the park but classified as secondary because they had the lowest connectivity to other suitable habitats (Figure 2e). All the valleys are connected by a suitable habitat strip of 1,000 to 2,000 m in width that surrounds lakes and rivers (Figure 2e). Recent records confirmed the presence of the species in this strip of suitable habitat (Figure 2e).

DISCUSSION

Both historical and recent records were located within the suitable habitats defined by us, which allowed validating our map. Characteristics of spatial use defined by Freer (2004) at the same latitude but on the other side of the Andes, in Chile, allowed us to define some valleys as optimal areas for the Guigna within LANP. In addition, studies on populations of the Guigna in Chile also highlight the importance of forest strips to connect populations because the species rarely uses open areas (Galvez et al., 2013; García et al., 2021). The Guigna avoids elevated areas, and mountains represent barriers to dispersion (Freer, 2004). As a consequence, the preservation of forest strips along the margins of lakes and rivers that connect the valleys in our study area will be very important to preserve a healthy, connected population. This is very important as, according to models that take climate change into account, the Guigna population of LANP is the most stable in Argentina (Cuyckens et al., 2015).

Despite the lack of historical records of the Guigna in valleys, recent records in the forest strips that connect them suggest that the Guigna is indeed present in valleys. The lack of presence data in areas considered

Menéndez Lake © Victor Cueto

optimal are likely a consequence of the difficult access and restrictions on human activities (Martin & Chehébar, 2001). Only some sporadic scientific research is permitted in these valleys, which constitute a great part of the suitable habitats. Only one project searched specifically for the Guigna inside the park, near Villa Futalaufquen (at the southernmost point of Futalaufquen Lake). In this project, the researchers worked during one summer (110 trap-days) and located only one Guigna (Lucherini et al., 2001; Lucherinni & Luengo Vidal, 2003). The three most recent records of the Guigna were in the context of scientific research not related to the species and it was the first time that vison traps (Gerisoli et al., 2020) and cameras were located in these areas (our study). This shows the importance of allowing, promoting and supporting the presence of researchers in the park even if they are working on issues other than identified reserve priorities.

Considering that Guignas are strongly associated with dense and structured habitats such as well conserved *Nothofagus dombeyi* forests (Sanderson et al., 2002; Freer 2004), the preservation of the forest as well as of the density and complexity of the understorey in both valleys and strips is vital. The fact that recent records of the Guigna were located in the forest strips suggests that, at present, these habitats have an appropriate structure. However, the cover and diversity of the understorey of Patagonian forest can be decreased by the expansion of introduced exotic ungulates such as domestic cows (*Bos taurus*), Red Deer (*Cervus elaphus*) and Wild Boar (*Sus scrofa*) (Relva et al., 2010; Piazza et al., 2016; Panebianco et al., 2019). In LANP, livestock is not a significant problem because populations are controlled and restricted to reserve areas. In addition, many of the Guigna records were in the area where livestock are allowed, indicating that the management of livestock within the park is probably compatible with the Guigna. However, in 2019, the presence of a small population of around 30 feral cattle were detected in the area of Stange Lake (APN, 2019), a fact that could represent a problem.

In relation to Red Deer (*Cervus elaphus*), male and female deer were detected by our cameras, only in the south part of LANP during autumn and winter. In addition, according to BIS (2021), a male deer was observed in the same area in 2011. According to the National Park personnel, this record was considered as a breeding dispersal individual, because several males disperse up to 18.5 km before the breeding season (Jarnemo, 2011) and because there is a deer hunting area less than 40 km from the park and individuals have been seen outside this area and in ranches next to the park on several occasions. Our detection of male and female deer confirms the presence of Red Deer in the south part of the park and highlights the relevance of controlling their numbers because the Guigna has been recently recorded in the area.

Guigna (*Leopardus guigna*) with lizard © Jim Sanderson

Finally, regarding Wild Boar, our cameras recorded groups of boars or solitary individuals in all the experiments and areas monitored. This confirms that boars are entering the park and are abundant in some areas where the Guigna has been historically recorded. In LANP, the movement of boars is partially restricted by the spatial pattern of roads, paths and cleared areas for public use because all these impacts are in the east area of the park where they initially dispersed (Panebianco et al., 2019). This situation suggests an apparent preference of boars for less humid eastern habitats (Panebianco et al., 2019) rather than more humid areas, which are optimal habitats for the Guigna. In fact, in the western areas defined as optimal for the Guigna, boars are absent (Schiaffini & Vila, 2012; Panebianco et al., 2019). However, the maximum potential densities of Wild Boars have not been reached yet (Sanguinetti & Pastore, 2016). In protected areas where boars have been present for longer and the pattern of roads, paths and cleared areas has helped in their dispersion, boars show preference for humid western habitats (Pescador et al., 2009; Gantchoff et al.,

2013; Gantchoff & Belant, 2015). Therefore, it will be important to maintain the characteristics that restrict the expansion of boars within LANP, for example, the access to western areas only by water and the closed structure of the forest. Finally, we consider that special attention should be paid to intentional fires common in the last decades in LANP (a cultural practice of human populations in Patagonia) because they open the habitat and help the dispersion of boars, at least temporally (Seijo et al., 2020).

To prevent potentially indirect effects of the expansion of exotic ungulates on the potentially most stable Guigna population in Argentina, it will be important to take actions to avoid the arrival, dispersion, and population increase of exotic ungulates in the priority areas defined for Guigna conservation. The present study allowed determining the potentially best areas for the conservation of the Guigna in Argentina and highlights some characteristics of the environment that should be conserved, namely the connection of valleys mediated by forest strips along the margins of lakes and rivers. The prediction of the distribution and habitat use of target species is an important preliminary step to plan conservation actions and management strategies of protected areas (Walker et al., 2000; Manel et al., 2001; Guisan et al., 2013). As recommended by Guisan et al. (2013), we also present recommendations considering social land use and potential threats such as the expansion of exotic ungulates.

CONCLUSIONS

Opportunistic records of the Guigna allowed the identification of four areas with high potential for conservation of stable populations of the species within Los Alerces National Park in Argentine Patagonia and the relevance of forest strips along waterbodies for the maintenance of connectivity. Integration of data also showed the relevance of managing the expansion of exotic ungulates in the park to prevent a change in the understorey structure.

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RESUMEN

Guigna (*Leopardus guigna*) es un felino con una de las distribuciones geográficas más reducidas. En Argentina, esta especie se encuentra en cuatro parques nacionales: Parque Nacional Los Alerces (PNLA), Parque Nacional Lago Puelo, Parque Nacional Nahuel Huapi y Parque Nacional Lanín. Sin embargo, dado que las estimaciones sugieren que, para 2050, el uso humano de la tierra y el cambio climático afectarán negativamente al 40 por ciento de su distribución potencial, el PNLA cobra relevancia para la conservación de la especie. Con el objetivo de ayudar a la Administración de Parques Nacionales de Argentina a definir estrategias para proteger a la Guigna, el presente estudio se propuso: (1) mapear los avistamientos reportados en el PNLA durante los últimos 45 años y determinar las áreas con presencia confirmada y ausencia probable de Guignas, y considerando la posibilidad de observación determinar; (2) mapear los hábitats adecuados del parque; y (3) mapear las áreas potencialmente óptimas para la conservación de la Guigna. Los resultados identificaron cuatro valles como áreas potencialmente óptimas para la conservación de las Guignas dentro del PNLA y otras dos áreas adecuadas como secundarias. Los resultados también indicaron que para mantener una población saludable de Guignas dentro del PNLA, la estructura del sotobosque de las franjas forestales que conectan los valles también debe ser conservada, y que la principal amenaza para esta estructura sería la expansión de los Jabalíes.

RÉSUMÉ

Guigna (*Leopardus guigna*) est un félidé dont la répartition géographique est l'une des plus restreintes. En Argentine, cette espèce est présente dans quatre parcs nationaux : le parc national Los Alerces (PNLA), le parc national Lago Puelo, le parc national Nahuel Huapi et le parc national Lanín. Cependant, étant donné que les estimations suggèrent que, d'ici 2050, l'utilisation des terres par les êtres humains et le changement climatique affecteront négativement 40 % de sa répartition potentielle, le PNLA est très important pour la conservation de l'espèce. Dans le but d'aider l'administration argentine des parcs nationaux à définir des stratégies de protection du Guigna, la présente étude vise à : (1) cartographier les observations rapportées dans le PNLA au cours des 45 dernières années et déterminer les zones de présence confirmée et d'absence probable de Guignas, en tenant compte de la possibilité d'observation dans différentes zones du parc ; (2) cartographier les habitats appropriés du parc ; et (3) cartographier les zones potentiellement optimales pour la conservation du Guigna. Les résultats ont identifié quatre vallées comme des zones potentiellement optimales pour la conservation des Guignas au sein du PNLA et deux autres comme des zones secondaires appropriées. Les résultats ont également indiqué que pour maintenir une population saine de Guignas au sein du PNLA, la structure du sous-étage des bandes forestières qui relient les vallées devrait également être conservée, et que la principale menace pour cette structure est l'expansion des sangliers sauvages.

REGULATION ON PROTECTED AREAS OVERFLIGHT IN SPAIN: CURRENT OUTLOOK AND NEXT STEPS

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ABSTRACT

Aviation can have impacts on wildlife that should be taken into account, especially in natural areas. Limitations on aircraft overflight in natural areas can reduce impacts and promote conservation of biodiversity. In Spain, a coordinated effort has been made by the different administrations to improve aviation regulation in protected areas. We analyse the trend in operational regulations that have been legally established in protected areas in Spain and outline a newly established framework for proposing new regulations for aviation in protected areas. There was an increase in the area under regulation from the 1980s, plateauing from the 2010s. Similarly, the growth in the number of sites with new regulations has slowed from the 1990s because regulation in protected areas has been progressively addressed and the need for regulations in new sites has declined. However, the number of sites subject to authorisation for flights has increased from the 2000s. The average minimum height established for overflight of protected areas has increased in the last two decades. Based on available evidence, we propose general criteria on heights and distances in protected areas that allow coexistence between aviation and wildlife. After consultation with the relevant groups, we got the different public administrations involved to commit to include these general criteria in their regulations. We consider our experience fully transferable to other countries.

Key words: aerial regulations, aviation, air transit restrictions, wildlife

INTRODUCTION

There are two main ways in which aviation interacts with wildlife: direct interactions of aircraft with wildlife and interactions of aviation with the environment. Direct interactions such as wildlife strike and wildlife control activities (Allan, 2002) mainly occur at and around airports. Wildlife strike has received more attention and research probably due to the associated repair costs, operational consequences and, in some cases, human fatalities (El-Sayed, 2019; Arrondo et al., 2021). Wildlife control at airports has arisen as a discipline due to its economic and safety importance. It includes many aspects concerning habitat management (Washburn & Seamans, 2004 ICAO, 2012; Blackwell et al., 2013) and especially avoiding avian perching (Avery & Genchi, 2004; Seamans et al., 2007), and relies on several areas of study such as bird physiology (Fernández-Juricic et al., 2011) and bird behaviour (DeVault et al., 2014).

However, interactions between aviation and wildlife habitats are probably more relevant to protected areas management. Due to its impact on people, noise is probably one of the best-known issues. It impacts people's health (Pepper et al., 2003; Jarup et al., 2008) and causes wildlife disturbance (Shannon et al., 2016; Sierro et al., 2017). Anthropogenic noise is present in almost every protected area (Buxton et al., 2017), causing actual and potential disturbance to wildlife (Alquezar & Macedo, 2019). The impact of such disturbance on wildlife can have both individual and population-level effects. At the individual level, noise can cause variations in behaviour, and thus an extra expenditure of energy when moving to safe areas, affecting fitness and breeding performance (González et al., 2006; Gill, 2007; Margalida et al., 2007; Glądalski et al., 2016). At a physiological level, there may also be more subtle effects, such as the activation of the stress response, producing high levels of glucocorticoids that lead to the depletion of energy reserves, generating a loss of body condition, which can affect breeding and demographic parameters (Thiel, 2007; Price, 2008; Glądalski et al., 2016). Moreover, prolonged disturbance can cause negative effects at the population level, compromising the conservation status of the affected local populations, and determining the presence or

absence of the species in a given place (Gill et al., 1996; Gill & Sutherland, 1999). High levels of disturbance can cause the simplification of communities towards subsets dominated by the most generalist and tolerant species, as well as the displacement of the most sensitive ones towards areas with fewer disturbances (Fernández-Juricic, 2002; Bautista et al., 2003). In addition, there is variability in the animal response to aircraft perturbation depending on the species, type of aircraft and its characteristics (i.e. size, shape), being greater large, noisy aircraft such as military helicopters or large Unmanned Aerial Systems (UAS hereafter).

The most common approach for analysing aviation-caused disturbance to wildlife is based on the aircraft type. As a new technology, there has been a focus on understanding the interaction between wildlife and UAS in recent times (Smith et al., 2016; Lyons et al., 2017; Mulero-Pázmany et al., 2017; Mustafa et al., 2018). Helicopter noise has also received great attention (Delaney et al., 1999; Tracey & Fleming, 2007; Grigolatto et al., 2018). There are other aircraft types with potential effects on wildlife that have been less studied, such as glider planes or hang-gliders (nonetheless see Hamr, 1988 Tobajas et al., 2022).

In Spain, aviation is regulated at a national level by Transport Department authorities, and specifically by the General Directorate on Civil Aviation, within the framework of the Single European Sky (Calleja & Mendes, 2011). Regional environmental authorities manage almost all the terrestrial protected areas. Regulations on the overflight of protected areas were introduced in 1983, and since then most of the legislation has been approved by these regional governments. In 2018, a national-level regulation established the need to harmonise these regional regulations through the definition and implementation of common criteria for aircraft overflight over protected areas. To that end, the General Directorate of Biodiversity, Forests and Desertification was responsible for coordinating the different approaches for establishing requirements for aircraft operations in protected areas and gathering them in a single proposal to be discussed with aviation authorities. The new requirements for aircraft operations in protected areas, with the purpose of avoiding harmful effects to wildlife, are proposed by regional authorities and then approved by a joint commission of Civil and Military Aviation authorities (CIDETRA). This framework is the result of collaboration between different administrations on a framework for establishing future regulations for aviation to ensure proper enforcement of nature conservation legislation in protected areas (Figure 1).

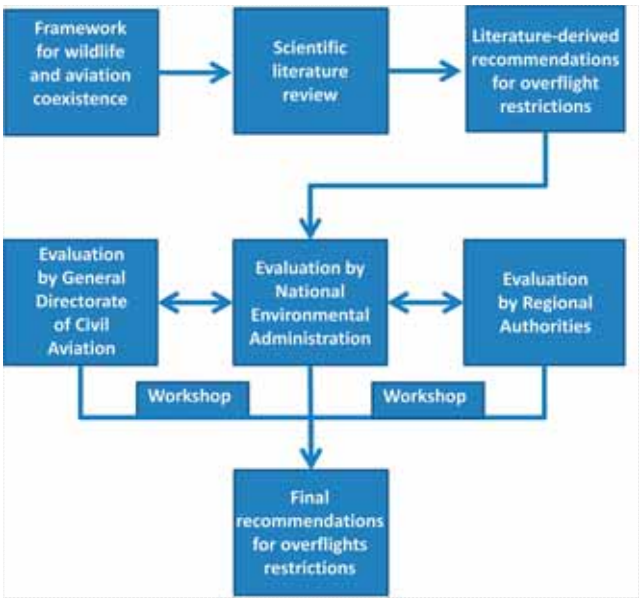

Figure 1. Overview of methodological steps followed to develop the overflight restriction proposal

Our goal in this paper is to summarise the trend in regulations to aviation in Spain and to present the newly established framework for regulations.

METHODS

Operational regulation database in protected areas

We asked the regional governments for all current in-force regulations for aviation in protected areas which included both terrestrial and marine environments. We built a database containing all sites and regulations (see Supplementary Material). We separated the different aviation types into six categories: 1) commercial aviation, 2) general aviation, 3) helicopters, 4) glider planes and hang-gliders, 5) balloons and 6) UAS (including model airplanes). We characterised the height above ground level (AGL), for which there are restrictions for each protected area and aviation type. If heights referred to an absolute value (above sea level, ASL), we looked for the highest place in each protected area and established the restriction as this height ASL minus the maximum height of the terrain. For example, in Ordesa National Park, aviation is restricted to 4000 metres ASL; as the highest peak reaches 3,355 m, we considered 645 m as the actual restriction. The database was reviewed and agreed by the regional governments.

Temporal trend of aviation regulations in Spain

In order to analyse the trend in aviation regulation, we used decades as the time units between 1980 and 2019 to show how the average flight height has evolved per aviation type, how many regulations have been

Sierra Nevada National Park, Andalusia, Spain © Marc Hockings

approved, and how the overall protected areas under regulation has increased or decreased across the period. If there were different regulations being implemented in the same protected areas, we selected the least restrictive for the aviation activity because this is the one that prevails.

Development of overflight restriction guidelines

Beyond the collection of in-force regulations, we reviewed documented disturbances to wildlife due to aviation and the minimum height and distance at which disturbances had been observed (Tobajas & Margalida, 2020). The review was designed to consider the different aviation types, the habitat, the group of species, and the effects of the disturbance. From the data provided by the review, it was possible to know the heights and distances at which different groups of species react to the flight of different aircraft types. As a result, this allowed us to establish the heights and flight distances in protected areas in order to minimise the possible negative effects on wildlife. The work resulted in several recommendations for establishing overflight restrictions considering the habitat, the species and the aviation types. Based on these recommendations, we started to draft proposals on overflight restrictions (Figure 1). These results were initially discussed between the national environmental administration (Ministry for Ecological Transition) and the General Directorate of Civil Aviation (Ministry of Transport). We then consulted the regional environmental authorities. Once we had the main remarks and constraints from the regional authorities, we discussed these changes with the General Directorate of Civil Aviation and with ENAIRE, the air navigation and aeronautical information service provider in Spain, and finally presented this last version to the regional authorities.

RESULTS

We found 603 protected areas under regulation in Spain. Of these, 36 sites were subject to two different regulations, as they were protected through a more general Natura 2000 management plan and a site-specific protected area plan. Therefore 15 per cent of the 4,086 existing protected areas in Spain are under regulation (UNEP-WCMC-IUCN, 2021), based on 234 regulations dating from 1983. In 98 per cent of sites, the regulations are defined year-round. In 84 per cent of sites, the regulations include some kind of zoning within the protected areas.

Temporal trend in aviation regulations in Spain

Data showed a steep increase in the area under regulation over time (Figure 2). The initial regulations of the 1980s were established for a very limited number of protected areas, mostly National Parks and other wetlands declared as Natural Parks. Since then, the area under new regulation has increased by up to 307,657 hectares per year to cover approximately 6.5 million hectares (13 per cent of the terrestrial surface of Spain). The number of regulations that came into force per decade also tended to increase, with the exception of the last decade (Figure 2).

The number of sites with new regulations published has decreased since the 1990s because regulation in protected areas has been progressively addressed and the need for regulations in new sites has declined (Figure 3). On the other hand, the average height and the number of sites where aviation is prohibited or subject to authorisation has increased over time (Figure 3). While there is only one site that requires authorisation for commercial aviation, the need for

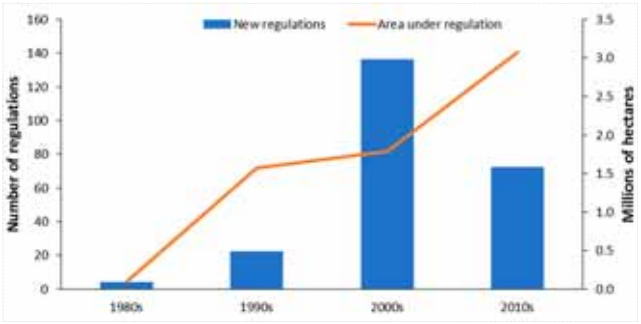

Figure 2: Number of regulations on aviation overflight for protected areas in Spain that came into force and total number of hectares under regulation. Data are grouped per decade (1980–2019)

specific procedures on general aviation and helicopters overflight followed a similar pattern: some bans in the 2000s, fewer in the 2010s, and an increase in the same period in the number of sites requiring an authorisation. This pattern is even more acute in the case of glider planes and hang-gliders, which have received growing attention through time, especially in the number of sites requiring authorisation (Figure 3).

UAS and balloons received different treatments in the 1990s. While the use of UAS and model aircraft was restricted in many sites, the use of balloons was mostly subjected to authorisation. Since the 2000s, for both aircraft types, there has been a tendency to increase the number of sites requiring authorisation and a decreasing number of new sites banning the use of these aircrafts (Figure 3).

DISCUSSION

The published information on aviation restrictions over and around natural protected areas is still scarce, and most of the published research is focused on noise disturbance in National Parks to tourists (Tal, 2001; Miller, 2008; Iglesias-Merchan et al., 2015). The effects of aircraft noise in wildlife have been extensively documented (e.g. Shannon et al., 2016; Mulero-Pázmány et al., 2017; Sierro et al., 2017), but the assessment of proposed aviation restrictions in protected areas due to wildlife protection has received less attention (see Alquezar & Macedo, 2019).

In the United States, there has been an intense debate on air tourism (Alexander, 1998; Rubenstein, 2000; Henry et al., 2000), as well as in other countries, such as New Zealand (Booth, 1999; Tal, 2004) and Australia (Hamilton, 2003; Ormsby et al., 2004). Subsequently, soundscapes have been considered as part of protected areas (Brown et al., 2011; Pijanowski et al., 2011) and taken into account when planning uses within a protected area (Miller, 2008; Brown, 2012). However, there are very large areas with no or little research on this aspect, which might be due to low noise levels in

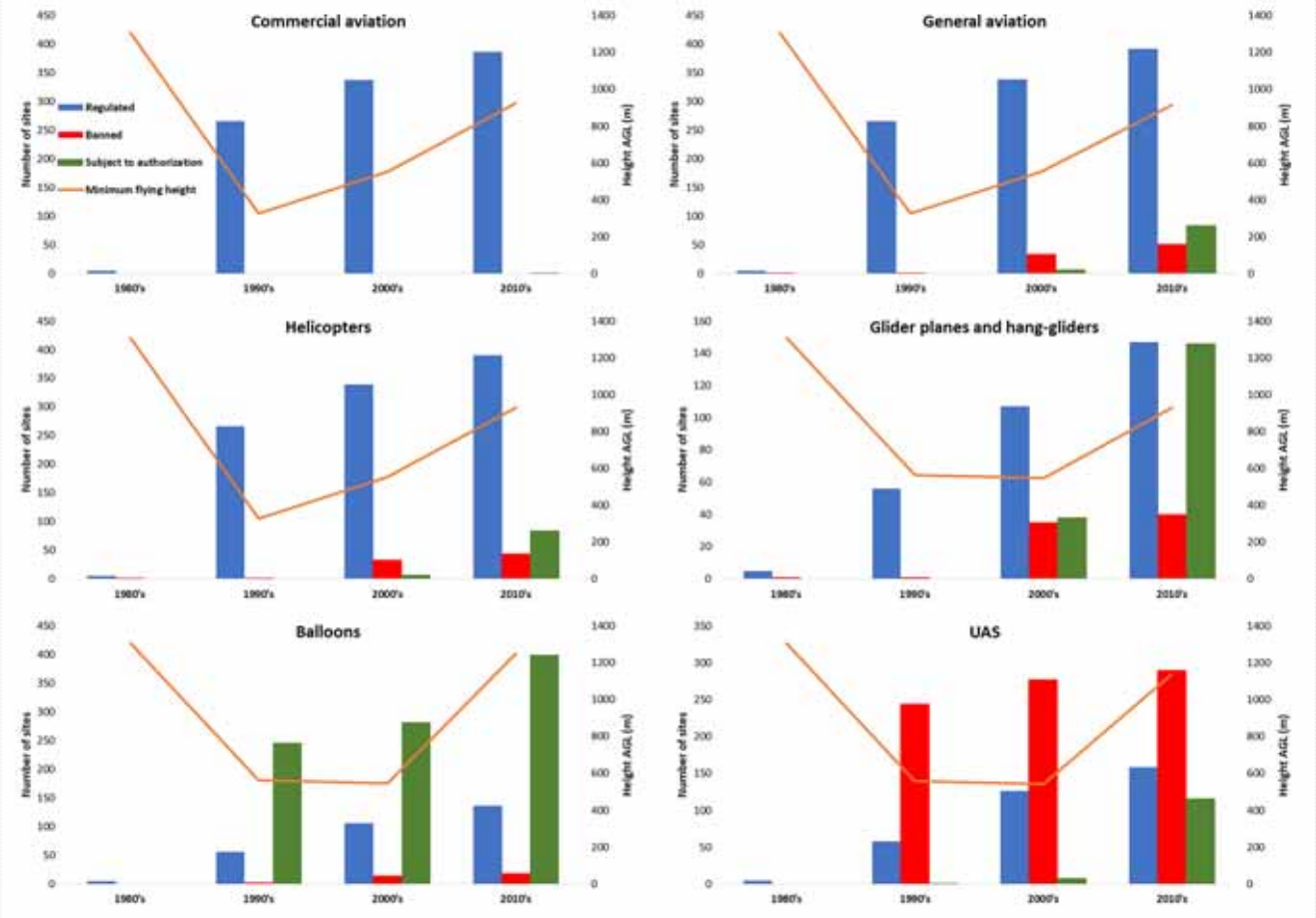

Figure 3. Trend in the average minimum height AGL established to overflight protected areas and cumulative number of protected areas (sites) where aviation is subject to regulation, banning or subject to approval. Data are shown per aviation type and decade.

these areas in relation to countries with regulation (Buxton et al., 2017), or can be due to other causes, such as this kind of tourism is not established in these parts of the world (Belsoy et al., 2012). In Europe, a specific regulation has been created to reduce the impact of airport noise on human well-being (Regulation 598/2014). However, its effects on wildlife in natural areas and on wildlife in general have not been addressed. In Spain, the impact of aviation noise in natural areas has been addressed to some extent, but from a tourist perspective rather than evaluating its effects on wildlife (Iglesias-Merchant et al., 2014; 2015). However, European institutions are promoting the creation of regulations to limit the negative effects of aviation on wildlife in protected areas (e.g. the Commission Implementing Regulation (EU) 2020/469).

Overflight restrictions in Spain

Spain has one of the densest airport networks in the world (Suau-Sánchez & Burghouwt, 2011). Tourists arriving by plane represent a crucial economic resource in many parts, especially on islands (Abeyratne, 1999; Balsalobre-Lorente et al., 2020), with many critical environmental implications (Alonso et al., 2014; Saenz-de-Miera & Rosselló, 2014). Establishing overly strict conditions for air tourism might prevent or reduce it in many regions and would not have a cost-benefit from sociological and financial standpoints. For this reason, we consider that the steep increasing trend since the 1980s in both the number and area of sites under regulations was sustained in a period of satisfactory economic development that allowed an approach that is more restrictive on aeronautical economic activities and more respectful of biodiversity conservation. Since then, positive attitudes towards the environment have grown in Spain (Zeus & Reif, 1990; Sánchez et al., 2016). Therefore, this change might have eased this process of increasing regulation.

Analysing the restrictions per aircraft type, regulations are not very specific. In Spain, the current legislation regulating maximum flying heights establishes differences among UAS (120 m AGL), balloons, glider planes and motorised hang-gliders (300 m AGL), and there is a minimal flying height for planes and helicopters (150 or 300 m AGL, depending on the flying mode; EASA, 2018). Any restriction above those heights will be, inevitably, banned by Transport Department authorities. In this sense, protected area managers should take into account the different maximum flying heights per aircraft type before setting any operational restriction. As stated before, according to Spanish legislation these restrictions exclude most aircraft types. Therefore, management plans should consider the existence of other sectorial regulation to avoid excluding certain activities that might be compatible.

The increasing trend of establishing a previous authorisation for flight activities might be a solution in many protected areas. Since the 2000s, the number of protected areas that have established this requirement has increased for almost every aircraft type, with balloons being the only exception. Defining a priori conditions for flying over the most critical places would be a solution for protected areas with a low to moderate number of operations, and there might be different aspects of the authorisation which can complicate the technical validation of these specific permits of overflight (flight paths, heights, etc.; Pinto et al., 2019). However, for larger protected areas with intense aircraft use, the authorisation process can exceed the management capacity in certain cases. In these cases, establishing global flight regulations such as those proposed in this study might be a good solution if they can be put into force.

A framework for future coexistence

Our experience has been very fruitful in this regard, with a willingness by all parties involved to achieve compatibility of the existing aviation activities and the conservation of biodiversity. The proposed general criteria should be extended to each protected area taking into account its particular characteristics and contexts. In this sense, the proposals should also take into account the existence of airports, aerodromes, bases and other existing aviation elements or established activities, as the ability of many species to get used to these activities is relatively high (González et al., 2006). Designing flight corridors or other options to concentrate disturbances might be a useful solution (Tittler et al., 2012).

Protected areas have great importance for the conservation and maintenance of biodiversity, as well as for human well-being, so as far as possible they should be protected from the impacts of aviation activity (Margalida, 2016; Moreno-Opo & Margalida, 2017). Current aviation regulations are almost exclusively focused on issues of wildlife–aircraft collision and noise impacts on humans, thus laws and their implementation relative to wildlife conservation are far from adequate (Alquezar & Macedo, 2019). Here, we show how it is possible to involve the different institutions in order to achieve a regulation that allows coexistence between aviation activities and wildlife conservation in protected areas.

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RESUMEN

La aviación produce una serie de efectos sobre la vida silvestre que deben tenerse en cuenta, especialmente en los espacios naturales. Las regulaciones y limitaciones al sobrevuelo de aeronaves en áreas naturales pueden reducir los impactos y promover la conservación de la biodiversidad. En España, se ha realizado un esfuerzo coordinado entre las diferentes administraciones para mejorar la regulación de la aviación en áreas protegidas. Analizamos la evolución de la normativa operativa que se encuentra legalmente establecida en las áreas protegidas de España y exponemos el nuevo marco establecido para proponer nuevas normativas para la aviación en áreas protegidas. Ha habido un incremento en el área bajo regulación desde la década de 1980, con un estancamiento desde la década de 2010. De igual manera, el crecimiento del número de sitios con nuevas regulaciones se ha ralentizado desde la década de 1990 debido a que la regulación en áreas protegidas se ha abordado progresivamente y la necesidad de regulaciones en nuevos sitios ha disminuido. Sin embargo, el número de áreas sujetas a autorización para volar se ha incrementado desde la década de 2000. La altura mínima promedio de sobrevuelo establecida para las áreas protegidas ha aumentado en las últimas dos décadas. Con base en evidencia científica, hemos propuesto varios criterios generales sobre alturas y distancias en áreas protegidas que permiten la coexistencia entre la aviación y la fauna silvestre. Tras ser ampliamente debatido, conseguimos que las diferentes administraciones públicas implicadas se comprometieran a incluir estos criterios generales en sus reglamentos. Consideramos nuestra experiencia totalmente exportable a otros países.

RÉSUMÉ

L'aviation peut avoir des impacts sur la faune et la flore qui doivent être pris en compte, notamment dans les zones naturelles. La limitation du survol des aéronefs dans les zones naturelles peut réduire les impacts et promouvoir la conservation de la biodiversité. En Espagne, un effort coordonné a été fait par les différentes administrations pour améliorer la réglementation de l'aviation dans les zones protégées. Nous analysons la tendance des réglementations opérationnelles qui ont été légalement établies dans les zones protégées en Espagne et décrivons un cadre nouvellement établi pour proposer de nouvelles réglementations pour l'aviation dans les zones protégées. On observe une augmentation de la superficie réglementée à partir des années 1980, pour atteindre un plateau à partir des années 2010. De même, la croissance du nombre de sites faisant l'objet d'une nouvelle réglementation a ralenti à partir des années 1990, car la réglementation dans les zones protégées a été progressivement traitée et le besoin de réglementation dans les nouveaux sites a diminué. En revanche, le nombre de sites soumis à une autorisation de survol a augmenté à partir des années 2000. La hauteur minimale moyenne établie pour le survol des zones protégées a augmenté au cours des deux dernières décennies. Sur la base des preuves disponibles, nous proposons des critères généraux sur les hauteurs et les distances dans les zones protégées qui permettent la coexistence entre l'aviation et la faune sauvage. Après consultation des groupes concernés, nous avons obtenu que les différentes administrations publiques impliquées s'engagent à inclure ces critères généraux dans leur réglementation. Notre expérience peut tout à fait s’appliquer à d’autres pays.

CONSERVATION CASUALTIES: AN ANALYSIS OF ON-DUTY RANGER FATALITIES (2006–2021)

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ABSTRACT

The ranger profession is diverse and challenging, requiring individuals to operate in risky and often life-threatening situations. The International Ranger Federation's Roll of Honour presents an opportunity to review the dangers surrounding the ranger profession by analysing the number and causes of ranger deaths on duty. Over a 16-year period (2006–2021), a total of 2,351 on-duty ranger fatalities have been recorded. Of the data analysed, felonious deaths, such as homicide, accounted for 42.2 per cent with the others a result of accident, illness, wildlife attack or other unintentional work-related casualties. Ranger casualties appear to be increasing over time and may reflect phenomena such as increasing human and wildlife conflicts, as well as changing climatic conditions. Recommendations to address these risks include improved recognition of the role of rangers, improved working conditions and access to adequate insurance.

Key words: wildlife, rangers, wildlife crime, protected area, poaching

INTRODUCTION

Rangers are at the frontline of biodiversity conservation and ecosystem management (IRF, 2019a; IRF, 2021; Singh et al., 2021). The term ranger refers to "any individual or group of individuals that play a critical role in conservation; they are responsible for safeguarding nature; cultural and historical heritage and protecting the rights and well-being of present and future generations" (IRF, 2021a). The multifaceted role of modern rangers includes law enforcement for biodiversity and habitat protection, biodiversity monitoring, conservation education, visitor management, community engagement and empowerment, firefighting, managing and controlling environment risk and providing assistance during natural calamities (IRF, 2021a; Singh et al., 2020).

Rangers often perform their duties in harsh field conditions with limited capacity and resources. Their work can involve life-threatening encounters with wildlife and armed poachers, militias or criminal groups, making it a potentially dangerous profession (Belecky et al., 2019; Belecky et al., 2021; Prakash et al., 2021; Moreto et al., 2019; Warchol & Kapla, 2012; Eliason, 2011a; Gambarotta, 2007). The Department of Justice, USA, includes rangers in the list of most assaulted law-enforcement officers (Gould & Duncon-Hubbs, 2004). The consequences of ranger fatalities are multifaceted and affect not only the families of rangers but also their co-workers and eventually the entire profession (White et al., 2019; Fridell et al., 2009). Findings of the Global Ranger Perception Survey (GRPS), a landmark research study which assessed occupational challenges of protected area rangers, indicated that being a ranger is a dangerous job due to encounter with poachers (84.8 per cent) and wildlife (68.2 per cent) (Belecky et al., 2019).

Recently there has been an increase in ranger-centred research, which brings various aspects of the dangerous and challenging nature of their work into focus. These dangers gained attention due to higher rates of loss of life in the ranger workforce (Appleton et al., 2021; Moreto et al., 2021). The studies have primarily focused on Africa and the USA, with limited research in Asia and Latin America (Leaky & Morrell, 2001; Ogunjinmi et al.,

2008; Meduna et al., 2009; Eliason, 2011b). These latter regions also face high levels of threats to wildlife and rangers (Warchol & Kapla, 2012). In 2003, at the World Parks Congress, an award symbolising the ranger line of duty deaths highlighted the fatal nature of ranger work. The International Ranger Federation (IRF) has been acknowledging this issue in its triennial World Ranger Congress from 2011 through the release of an annual Roll of Honour (IRF, 2018; IRF, 2019b; IRF, 2021b).

A combination of empirical research, combining data related to felonious and accidental casualties, offers a better reflection on the ways policies and action plans, both international and national, can contribute to making the ranger profession safer (Fridell et al., 2009). While data on non-felonious causes of death suggest that these could outnumber homicides (White et al., 2019), assessing all those factors that contribute to ranger deaths requires more research. The purpose of this paper is to provide an insight into the major causes of rangers losing their lives in the line of duty and aims to serve as a baseline by providing evidence to underpin future targeted action.

METHODOLOGY

The primary data source used for this study is the Ranger Line of Duty Death (RLODD) data gathered and owned by the IRF. These records have been actively gathered, maintained, analysed and verified by the Roll of Honour (ROH) working group of the IRF since 2006, and since 2011 have been released annually on World Ranger Day (31 July) to commemorate the dedicated effort of the world's rangers. It is the only systematic source of information on ranger casualties maintained on a global scale.

A graveyard for fallen Rangers at the Mutsora Ranger station in Ruwenzori, Virunga National Park © Brent Stirton / Reportage by Getty Images / WWF

Figure 1. Ranger casualties in 2006–2021 for the ROH database from the IRF regions: North America, Central America, South America, Europe, Africa, Asia and Oceania

The RLODD data covers both state-employed and non-state-employed in-service rangers reported to have died in the line of duty. That means any person who has died as a direct and proximate result of a personal injury or illness sustained while carrying out their duties (IRF, 2021b) as per the definition of a ranger. Whilst the IRF has been collecting, analysing, verifying and maintaining ranger deaths for the past 30 years, the data presented herein cover the 16 years from 2006 to 2021.

The data is procured through reports received from national and regional member associations of IRF, partner organisations (e.g., conservation non-governmental organisations), periodical government reports, social media reports and from data available in public forums through news websites. Each incident is recorded in the standard RLODD report with details of the person, location, cause of death and verified by the ROH working group.

Data analysis: A total of 2,351 casualties were recorded from 82 countries between 2006 and 2021 (Figure 1). However, it must be noted that 281 cases could not be included in the ROH as it was unclear if they occurred in the line of duty. In addition, 30 suicides were recorded but not included in the ROH. It is important to note here that suicide cases have been increasing year-on-year, reflecting a potential higher level of work-related stress as a possible contributing factor. We have recorded over 500 ranger deaths due to COVID-19 in the year 2020–2021, and whilst a proportion of these are likely to have been contracted in the work environment, it has not been possible to definitively link such deaths to working conditions or indeed to lack of follow-up medical treatment. However,

Table 1. Causes of death in the line of duty

Category	Explanation
Homicide	Any death at the hand of another person or persons with intent. This also includes cases in which the deceased was-off duty but killed because of their ranger work.
Deaths from occupational and work-related accidents	Any death recorded due to occupational hazards such as firefighting; drownings; falls; equipment failure and other such incidents.
Transport-related accidents	Any on-duty death due to vehicle accidents or other forms of transportation from bicycle to aircraft. Those obviously outside of the work situation, or on the way to and from work, or if alcohol was involved, are not included.
Wildlife attack	Any death of a ranger due to attack from wild animals.
Deaths-in-service due to occupational illnesses/diseases as a result of working conditions; exposure; stress, etc.	Any deaths arising because of illness or medical conditions arising due to the nature of work, e.g., dengue, malaria, rabies, hypothermia, pneumonia, heart attack in workplace/stress-related scenarios and other similar conditions. Conditions such as cancer and other 'natural causes' are excluded as these are not directly work-related.

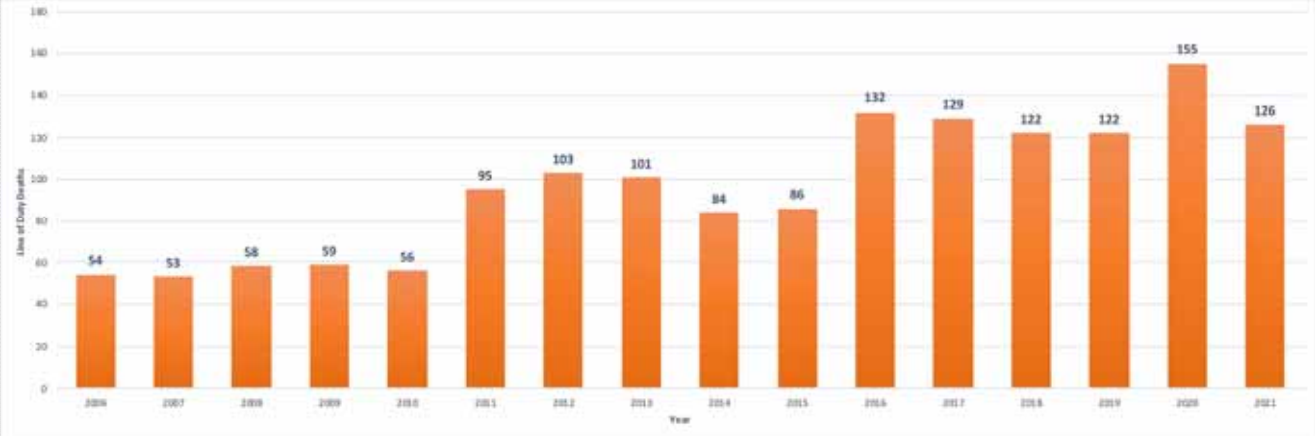

Figure 2. Trends in loss of ranger lives recorded in 2006–2021 from the Roll of Honour (ROH) database indicating an increase in ranger casualties over a temporal scale. Comparison between the early years vis-à-vis later years is indicative only, due to possibly non-recorded data in the early years.

both these factors may have negatively impacted the situation. The data was disaggregated based on region, country, year and cause of death. The causes of death were further categorised into five sub-categories (Table 1).

Data limitations: Gathering data on ranger deaths has been a challenging task, especially in the earlier years of the study when access to the internet and use of social media was much more limited. In 2006, membership of IRF, with 38 ranger associations as members, was not as widespread as it is now. The lack of direct communication with rangers in places like Asia, Africa and Latin America meant that many ranger deaths went unrecorded. The lack of clear definition of rangers perhaps also contributed to the missing cases. The possibility of some ranger casualties intentionally being unreported cannot be denied. Matters have improved in recent years with IRF membership of over 100, which includes ranger associations (sub-national, national, regional) and conservation organisations that support rangers, together with enhanced global communication systems. However, some parts of the world such as China, the Russian Federation and parts of Central Asia and the Caribbean are still difficult to communicate with and thus it is difficult to obtain reliable information from these regions. Therefore, these results should be seen as indicative only, as cases might have been missing during the early years of recording.

RESULTS

We analysed 1,535 ranger fatality records covering the period 2006–2021. A gender-level disaggregation of the records was not possible for this analysis (Figure 2). The average loss of rangers' lives for the period was 95.9 rangers per year. Recorded rangers' deaths peaked in 2020 with the total number of casualties recorded for

that year being 155; whereas 2007 had the lowest number of recorded casualties, 53. The lowest number may be due to data gathering limitations as highlighted in the Methodology. Felonious deaths including homicides contributed to 42.2 per cent (n=648) of the total ranger lives lost, whereas the remaining 57.8 per cent (n=887), accounting for the non-felonious deaths, include all other causes (vehicle accident, aircraft accident, firefighting, drowning, illness and others).

Regional comparisons in ranger loss of life

Based on the recorded data, Asia has witnessed the highest number of losses of rangers' lives during the past 15 years, with a total of 643 rangers losing their lives, comprising 41.9 per cent of the overall loss. Africa was second with 591 ranger losses during this period making up 38.5 per cent of the overall ranger death toll. North and South America were third and fourth with 121 and 82 ranger losses making up 7.9 per cent and 5.3 per cent respectively of the total losses. The remaining rangers were from Europe (n=57, 3.7 per cent), Central America (n=26, 1.7 per cent) and Oceania (n=15, 1 per cent) (Figure 3).

Homicides

Homicide is defined as the killing of a person by another person with intent to cause death or serious injury, by any means (WHO, 2015). With 84.8 per cent of rangers stating that being a ranger is a dangerous job due to encounter with poachers, homicide remains the most common cause of death among rangers. Homicides included the killing of rangers by poachers, militias, combatants, rebels and other belligerents (Figure 4). The majority (88.5 per cent) of the cases were reported from Asia and Africa which reflects the high level of threats rangers are facing in protection of wildlife and their habitats.

	HOMICIDES	ANIMAL ATTACKS	VEHICLE ACCIDENT	DROWNING / FIRE & OTHER RELATED ACCIDENTS	ON DUTY DEATH IN SERVICE	
AFRICA	352	55	67	64	53	591
ASIA	222	151	103	108	59	643
CENTRAL AMERICA	13	0	1	12	0	26
EUROPE	17	0	6	14	20	57
NORTH AMERICA	11	1	40	36	33	121
OCEANIA	1	1	7	6	0	15
SOUTH AMERICA	32	1	15	14	20	82
	648	209	239	254	185	

Figure 3. Regional breakdown of line of duty deaths

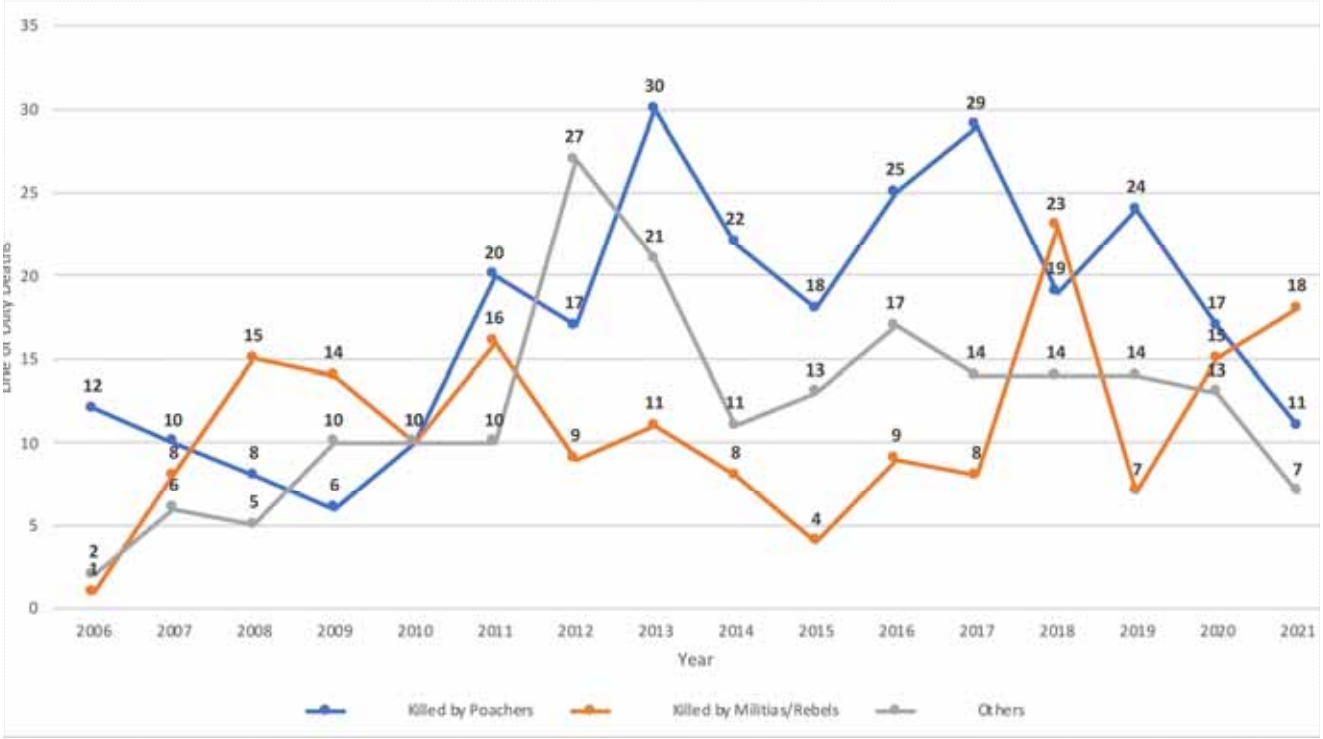

Figure 4. Ranger casualties linked to felonious deaths in 2006–2021

Wildlife rangers in the northern sector of the Selous Game Reserve carry out a boat patrol on the Rufiji river © Greg Armfield

Deaths from occupational and work-related accidents

Drowning and firefighting both accounted for approximately 10.2 per cent of rangers' lives lost respectively (n=83, 74) (Figure 5). Although comparatively more minor in the proportion of overall ranger casualties, the annual ratio of ranger casualties due to firefighting increased substantially from no deaths in 2006 to 15 in 2021. Lack of data availability in earlier years may be one of the reasons behind the low numbers in early years, but the impact of extreme weather events (IPCC, 2022) that have been occurring in the past few years cannot be discounted.

Other work-related accidents, such as falls; electrocution; falling trees/rocks; accidental weapon discharge/friendly fire; avalanche/landslide and others accounted for 97 deaths during the 16-year study period. The worrying incidents of several deaths from accidental weapon discharges and friendly fire suggests weapons training needs to be given more attention.

Transport-related accidents

Accidents on duty were the second major contributor to the loss of lives of rangers making up 15.5 per cent (n=239) of the total casualties. Most accidents were caused by vehicles such as cars, bikes and planes/ helicopters. The data indicates an increase in transport-related deaths with the highest number of cases reported in 2020 (31). Homicides and accidents, altogether, were responsible for 57.7 per cent of overall ranger deaths occurring in 2006–2021.

Wildlife attacks

Dangerous encounters with wildlife are an important aspect of the life-threatening situations that rangers face and contributed to the loss of 14 per cent of rangers' lives (n=209) in 2006–2021. Of these, elephants were responsible for the killing of 118 rangers, which continues to increase over time. Attacks from other wild animals including rhinos, big cats, hippo, snakes and crocodiles have not shown any clear increase or decrease (Figure 6). There might be several reasons for the increase in elephant attacks such as the increase in human–wildlife conflict (HWC) due to habitat fragmentation or a simple lack of data availability in early years from Asia and Africa. This would need further investigations.

Occupational illnesses/diseases and other work-related deaths-in-service

Illnesses contracted on duty, including heart attacks, work-related illness and other diseases were the fourth most common cause of death for rangers. When considered together, these three causes of death were responsible for 12 per cent (n= 185) of all rangers' deaths. The results also indicate a linear increase in ranger deaths linked to illnesses contracted on duty and heart attacks over a temporal scale from 2006 to 2021. However, these should be approached with caution as data availability is likely to also have increased over time. Though we do not have the exact numbers, malaria may have contributed to some of these casualties. According to the Life on the Frontline Survey conducted in 28 countries, 31.1 per cent of rangers had malaria in the past 12 months with Africa being the most impacted region (93.3 per cent). The relative risk shows that rangers in all regions are at much higher risk for malaria than the general population (Rerolle et al., 2022).

DISCUSSION

Results of our study show that at least 1,535 rangers died in the line of duty from 2006 to 2021 due to felonious homicides, accidents, wildlife attacks and occupational illness. Contrary to initial beliefs, the analysis demonstrates that death in the line of duty is not a rare event for rangers and, while there are considerable regional differences, such deaths occur across all regions. Asia and Africa experienced the highest number of ranger fatalities, with 80.3 per cent of the overall total. This finding is consistent with prior studies that have highlighted these regions as being amongst the most dangerous places for the ranger workforce (Belecky et al., 2019; Singh et al., 2020).

Wildlife poaching and the illegal wildlife trade (IWT) represent a serious extinction threat to wildlife globally. Results presented in our study also revealed that felonious homicides (poachers, militants/rebels, organised crime groups) are the most common cause of death for rangers. IWT continues to persist as the fourth largest transnational organised crime (UNODC, 2020). Poachers are often well armed and are willing to resort to violence if approached by rangers, due to the high incentives of poached wildlife for trade (Warchol & Kapla, 2012). The decades-long legacy of civil war in parts of Africa have contributed to an increased availability of firearms (Reyntjens, 2009; Rothmann, 2008). These are used not just by the militants, but also by poachers, which leads to a higher probability of the loss of life (Beyers et al., 2011). Africa's oldest nature reserve and a World Heritage Site, the Virunga National Park in the Democratic Republic of Congo, lost 12 rangers during 2020, killed by suspected members of rebel groups. This brought total ranger fatalities in

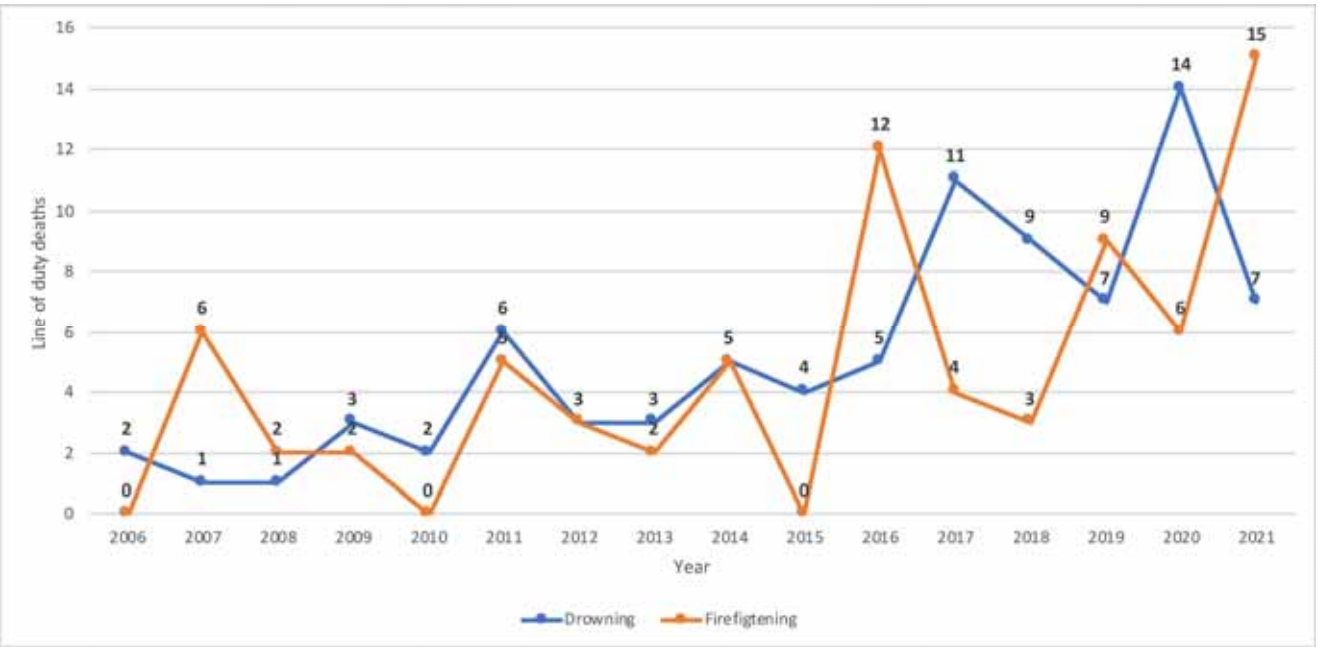

Figure 5. Line of duty deaths due to drowning and firefighting

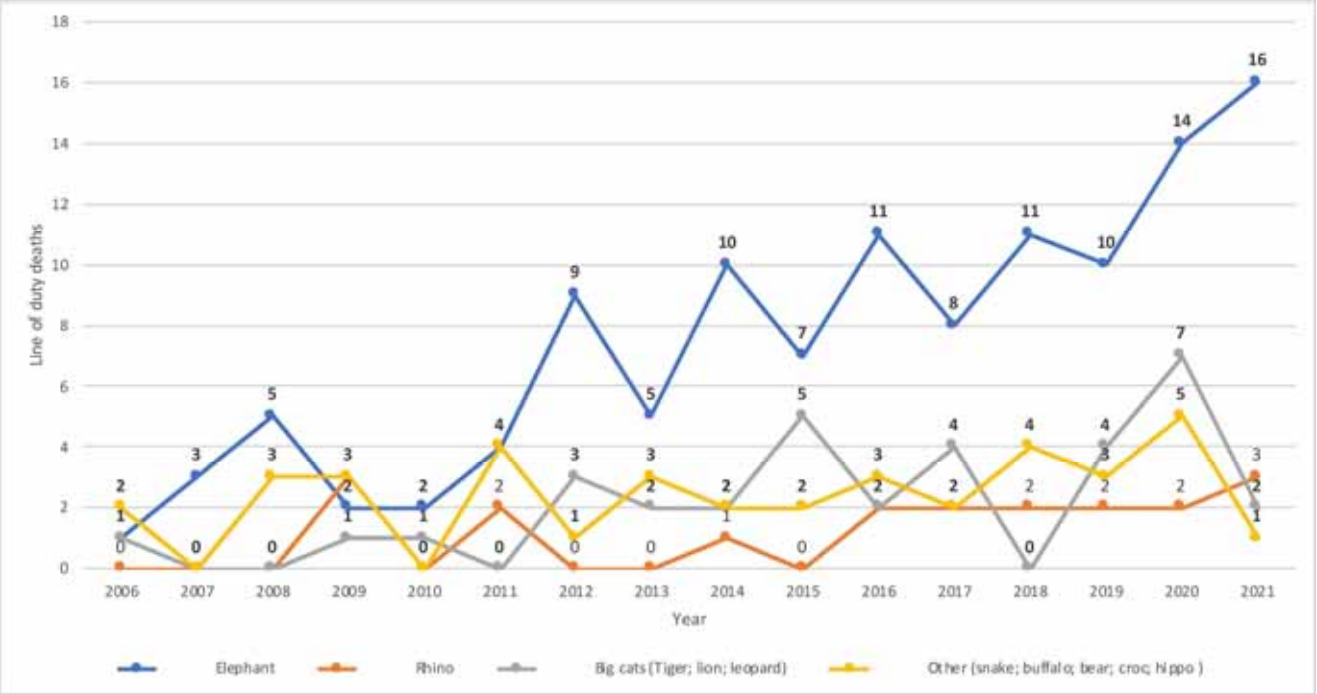

Figure 6. Categories of wildlife attacks related to ranger fatalities recorded in 2006–2021: a) Elephants, b) Rhinoceros, c) big cats and d) other animals

Virunga National Park alone to over 200 (Virunga, 2020).

There is a growing amount of data now available that sheds light on the significant role that rangers play as the first line of defence to protect wildlife, on the level of their job satisfaction and the challenges they face during the course of their duties (Belecky et al., 2019; Singh et al., 2020; Warchol & Kapla, 2012; Leaky & Morrell, 2001; DigunAweto et al., 2019). These studies show a consensus that inadequate capacity, equipment and resources, and limited salaries are the key contributors impacting on ranger duties. The landmark Global Ranger Perception Survey covered these aspects further

quantifying voices of rangers from the field and showing the scale of vulnerability and danger rangers face (Belecky et al., 2019). This further indicates that 85 per cent of rangers interviewed in Asia, Africa and South America feel that being a ranger is a dangerous job (Belecky et al., 2019; Singh et al., 2020; Rothmann, 2008). Wildlife crime and wildlife enforcement are therefore increasingly important areas of study in the fields of criminology and wildlife conservation (Moreto et al., 2017).

Deaths from occupational and work-related accidents was the second major reason for ranger casualties, claiming 254 lives in the study period. The data indicates that deaths related to drowning and firefighting are on the increase. Globally the impact of extreme weather, climate and water-related events has significant impact on the global population and economy. According to the World Meteorological Society 2019 report, there were more than 11,000 reported disasters attributed to these hazards globally, with just over 2 million deaths and US$ 3.64 trillion in losses (WMO, 2019). The increase in the number and extent of such extreme weather events may have contributed to the ranger casualties.

Accidents appear to be a common factor contributing to line of duty deaths in law enforcement agencies globally (White et al., 2019) and rangers are no different with 239 casualties reported since 2006. In the USA alone, motor vehicle-related incidents have been recognised as the leading cause of deaths for law enforcement officers (Bureau of Labor Statistics, 2020; White et al., 2019).

Dja River crossing in Nki National Park © Daniel Nelson / WWF

While the issue is pervasive, there is little attention given to addressing this adequately, and the vast majority of rangers also believe the existing medical treatments are inadequate. The data generated through the Global Ranger Perception Survey showed that less than 25 per cent of rangers are trained in basic first aid and emergency skills and nearly 52 per cent lack access to adequate medical treatment at the time of need (Belecky et al., 2019; Singh et al., 2020). With the high prevalence of accidents, often in remote locations, there is a need for first aid skills, first aid equipment and rapid medical response systems to be put in place.

Fatal encounters with wildlife were the fourth major reason that contributed to the loss of ranger lives in the workplace. Elephant attacks have been by far the most common and are increasing, which may indicate that Human–Elephant Conflict (HEC) is becoming a more serious wildlife management issue. Wildlife attacks have been listed as the key reason by most rangers (78.2 per cent) for the ranger profession being dangerous (Belecky et al., 2019).

The overall higher proportion of ranger casualties linked to non-felonious causes also highlights the need for specialised training, increased access to resources, and improvement of emergency response mechanisms (Eliason, 2011a; Belecky et al., 2019). Deaths from occupational and work-related accidents, especially drowning and firefighting, also stood out as prominent causes of loss of life. The vast majority of rangers receive only minimal job training or no training at all (Singh et al., 2020) which fails to meet the requirement of the modern ranger's responsibilities (Conservation Assured, 2018).

Illnesses contracted on duty due to working conditions were the fith most common cause of death for rangers. A noteworthy finding is that of an increased number of heart attacks and other illnesses contracted on duty. Eliason (2011a) found a similar trend in the increase of heart attacks of game wardens in the USA post-1960 and regarded this as an outcome of increased stress. Additionally, findings of the Global Ranger Perception Survey highlighted underlying factors such as lack of access to basic field equipment and amenities like drinking water and mosquito nets which might help avoid diseases contracted on the job (Belecky et al., 2019; Singh et al., 2020). Diseases such as yellow fever, hepatitis and COVID-19 can be addressed by providing adequate vaccinations and adequate personal protective equipment (PPE).

Our present work is among the most comprehensive assessments of dangers associated with loss of life in the ranger workforce to date. Findings from our study help to paint a clear picture of the dangers of the job of a ranger based on the analysis of line of duty deaths records and provides several areas for future research. The motivation and performance of rangers is severely affected by life-threatening situations and the loss of colleagues in addition to the aforementioned challenges.

Future work and research should include investigations of ranger casualties and the relationship with the working conditions of rangers including training, equipment, welfare, and the political and governance environment under which rangers operate. It is also pivotal to do further research on the wider role rangers play and how this is impacted by the changing intensity of extreme climate events, zoonotic diseases, etc. The need for a stable long-term funding mechanism to support rangers with adequate training and equipment remains critical. While acknowledging the difficulties associated with gathering data on the permanent and temporary injuries caused to rangers in the line of duty, we consider that it is crucial to begin gathering this type of information as well. Future studies might also expand to the economic, emotional and social impacts of a ranger's death on the deceased's family.

RECOMMENDATIONS

Recognition of the ranger profession: Rangers do not only play a crucial role in the protection of wildlife, habitats and ecosystems but also protect cultural heritage, act as first responders in case of natural hazards, and help to maintain ecosystems' carbon storage and sequestration. As 'managers' of the relationship between people and wildlife, they can even play a role in lowering the likelihood of future zoonotic disease events. Despite the pivotal role that rangers play, the recognition of the ranger profession is not at the same level as other similar first responder – or essential worker – professions, such as firefighters and police. As per the International Standard Classification of Occupations (ISCO), rangers are listed along with agriculture, forestry and fisheries workers (ISCO, 2012); a grouping that does not appropriately align with the unique responsibilities of rangers. Lack of recognition of the multifaceted and critical roles rangers play seriously impedes the ability to bring needed policy and regulative reforms, and limits the ability to establish a mechanism for sustainable and long-term funding to support the sector (see below). Enhancing awareness amongst the public, ranger employers and key government ministries (health, labour, etc.) is of critical importance in this regard, starting with a more appropriate ISCO classification of the ranger profession, but also including rangers as key stakeholders in relevant policy and decision-making processes at international and national level.

Improve working conditions and welfare of rangers: Many ranger on-the-job deaths especially from occupational illness can be minimised by improving their working conditions and welfare. Inadequate hygiene conditions such as lack of clean drinking water and limited access to toilets further threatens the life of rangers. 17.1 per cent of rangers in the Life on the Frontline report (Belecky et al., 2019) indicated that their existing health problems have worsened due to their working conditions over the prior 12 months. Providing an adequate supply of basic equipment and training on topics such as human–wildlife conflict, first aid, survival tactics and firefighting can help in saving the lives of rangers. Given the mental and physical stress rangers have to endure in order to perform their duties, it is pivotal to provide interventions aimed at improving the mental well-being of rangers along with their physical well-being. The employment and welfare standards that are currently under development by the Universal Ranger Support Alliance will set the framework to address these welfare needs (URSA, 2021). Governments and conservation organisations must come together to support the uptake and implementation of these standards, including integrating them into relevant policy frameworks, strategic plans and support schemes.

Access to adequate insurance scheme: On average, two rangers lose their lives in the line of duty every week, yet only 37.7 per cent have access to adequate life insurance and only 44.7 per cent have access to insurance schemes that cover serious on-the-job injuries (Belecky et al., 2019). According to the Life on the Frontline report, 94.5 per cent of rangers have no other source of income, being a ranger is their full-time profession with no support available to their families in the case of on-duty deaths. The situation in Africa and Asia is worse in comparison to other regions with regards to insurance access (Long et al., 2016), even though these two regions report the highest ranger casualties globally. This is a considerable demotivating factor for individuals working, or considering working, in the ranger profession. Ranger employers need to be lobbied to provide adequate health and life insurance coverage to all rangers. However, this may take time. Conservation NGOs can provide interim support to rangers. Good examples are the Thin Green Line Foundation's support to the families of deceased rangers

(Thin Green Line Foundation, 2021), the Ranger Foundation's (USA) support to Latin American rangers since 2017 (Ranger Foundation, 2021) and WWF-India's partnership with Apollo Hospitals for the free treatment of rangers (WWF-India, 2018).

Enhance mechanisms for systematic recording of ranger casualties: The IRF has been recording ranger casualties since 2006, and remains the only global data source for such incidents. Although the IRF has a wider reach through its member associations, there is a high possibility of cases being missed. Ranger associations that are not members of the IRF are unlikely to be aware of the existence of the Roll of Honour – and there are many countries that do not even have dedicated ranger organisations. We recommend that such data should be maintained at the national level by ranger employers, ministries or departments to understand the challenges faced by rangers and to draft adequate solutions to address these challenges. It is also recommended that such data should be shared with IRF through national and regional ranger associations to ensure that the database is robustly maintained and updated. The Last Line of Defence report by Global Witness (2021) recommends identifying rangers as land defenders and those who support the environment through their work. Alignment between the ROH and Global Witness database will further highlight the issue and clarify the frequency of such incidents.

Strengthening community relations: Rangers work in remote locations in low numbers without access to adequate medical treatment and basic equipment (Belecky et al., 2019). Local communities can play a pivotal role in supporting rangers in delivering their duties and managing emergency situations such as human–wildlife conflict, fire management, and in limiting the ability of wildlife criminals to operate in their territory. However, in some conservation areas there is a lack of trust between rangers and communities, which has been highlighted by various sources, including the URSA Action Plan (URSA, 2021). Establishing processes that can increase dialogue and build trust between rangers and Indigenous people and local community members will benefit all involved; and to this end, ranger employers should actively assess how they can provide tangible benefits and opportunities to local peoples as part of these engagements.

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RESUMEN

La profesión de guardaparque es diversa y desafiante, y requiere que las personas actúen en situaciones de riesgo y a menudo de peligro para la vida. El Cuadro de Honor de la Federación Internacional de Guardaparques ofrece la oportunidad de examinar los peligros que rodean a la profesión de guardaparques. Analizando el número y las causas de las muertes de guardaparques en actos de servicio durante un periodo de 16 años (2006-2021), se han registrado un total de 2.351 muertes. Las muertes por delitos, como el homicidio, representaron el 42,2 por ciento, mientras que las demás fueron a consecuencia de accidentes, enfermedades, ataques de la fauna silvestre u otros accidentes laborales. El número de las víctimas parecen estar aumentando en el tiempo y pueden ser el reflejo de fenómenos como el aumento de los conflictos entre el ser humano y la fauna silvestre, así como del cambio de las condiciones climáticas. Las recomendaciones para hacer frente a estos riesgos incluyen un mayor reconocimiento del papel de los guardasparques, mejorar las condiciones de trabajo, y dar acceso a un seguro adecuado para los guardaparques.

RÉSUMÉ

La profession de garde-forestier est diverse et stimulante, et exige des individus qu'ils opèrent dans des situations risquées et souvent mortelles. Le tableau d'honneur de la Fédération internationale des gardes-forestiers offre l'occasion de passer en revue les dangers qui entourent la profession de garde-forestier en analysant le nombre et les causes des décès de garde-forestiers en service. Sur une période de 16 ans (2006-2021), un total de 2,351 décès de garde-forestiers en service a été enregistré. Parmi les données analysées, les décès d'origine criminelle, tels que les homicides, représentent 42.2 %, les autres étant dus à des accidents, des maladies, des attaques d'animaux sauvages ou d'autres accidents non intentionnels liés au travail. Le nombre de victimes des gardes-forestiers semble augmenter au fil du temps et pourrait refléter des phénomènes tels que l'augmentation des conflits entre les êtres humains et la faune sauvage, ainsi que l'évolution des conditions climatiques. Les recommandations pour faire face à ces risques comprennent une meilleure reconnaissance du rôle des gardes-forestiers, l'amélioration des conditions de travail et l'accès à une assurance adéquate.

CONSULTATIVE COUNCILS IN CHILE: PARTICIPATORY OR PROTECTIONIST MANAGEMENT OF THE FRAY JORGE NATIONAL PARK?

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ABSTRACT

In 2001, the Chilean Government created Consultative Councils as part of their national park management strategy. Consultative Councils were designed with three objectives: 1) to generate opportunities for citizen participation with regards to the management, conservation and development of national parks and the surrounding communities; 2) to improve the abilities and opportunities for adjacent communities to protect their ways of living and be acknowledged and valued by society; and 3) to strengthen areas of development in communities and help promote strategic alliances between communities and private and public institutions. We set out to examine whether the Fray Jorge National Park – Consultative Council (FJNP-CC) has achieved these three objectives. Our findings indicated that the FJNP-CC has failed to facilitate community participation in park management (Objective 1) and has done little to improve the abilities and opportunities for adjacent communities to protect their ways of living (Objective 2). However, the FJNP-CC has proven effective at facilitating community access to private and public institutions (Objective 3). Despite achieving only one of its three objectives, the FJNP-CC is still considered by community members and park managers as the best opportunity to manage, if not reconcile, competing interests in the park.

Key words: CONAF, conservation, community, collaboration, conflict, management

INTRODUCTION

Since 1926, 42 national parks and 165 protected areas have been established in Chile. These areas now cover an estimated 151,465 km2, or 19.5 per cent of Chile's total land base (Petit et al., 2018). The government agency responsible for the management of Chile's national park system is the National Forestry Corporation (CONAF), which is housed in the Ministry of Agriculture. CONAF was established in 1970 (originally named the Reforestation Corporation) to administer the sustainable management of national forest resources. In 1972, CONAF's role was expanded to include the administration of national parks and protected areas. With a mandate to maximise the environmental, social and economic values of these unique areas, CONAF undertook a national planning strategy for its park system.

CONAF's initial planning process was very much informed by what some have characterised as 'fortress conservation' (Brosius et al., 2005), which prioritises the protection of biological resources over human uses. This approach was not out of step with other international planning approaches of the time that similarly emphasised authoritarian protection to safeguard critically threatened habitats (Stevens, 2014). Yet these biologically rich and intact areas were often home to communities who, following park designation, found themselves displaced, restricted from access, and unable to continue cultural and economic land-based traditions (Brosius et al., 2005). Considered to be threats to biological diversity, the presence of people in Chile's parks and protected areas was considered the most significant risk to achieving national conservation goals. For example, in Chile's Juan Fernandez National Park, uncontrolled human access is believed to be responsible for the over-exploitation of wildlife species, the introduction of invasive species, and the eradication of 75 per cent of the park's endemic flora (Cuevas & Van Leersum, 2001, p. 899). Similar impacts were reported in Rapa Nui National Park where the introduction of sheep, cattle and horses disrupted the ecology of the

park's environment (Lee, 1990). These types of threats proved influential to CONAF's 'fortress-like' approach to park management.

Since the late 1990s, there has been a global affirmation that reforms are necessary in the way parks and protected areas are managed, and that a reorientation of the protectionist approach to conservation is required (World Conservation Union, 2003). Stevens (2014) has characterised this affirmation as a new paradigm for park management where communities are actively engaged in park management and their livelihoods are enhanced rather than adversely affected. In Chile, this 'paradigm shift' was reflected in the creation of Consultative Councils.

In 2001, CONAF made it a priority to establish Consultative Councils for each of its national parks. Consultative Councils represent participatory institutions involving government and community representatives whose mandate involves three objectives: 1) to generate opportunities for citizen participation with regards to the management, conservation and development of national parks and the surrounding communities; 2) to improve the abilities and opportunities for adjacent communities to protect their ways of living and be acknowledged and valued by society; and 3) to strengthen areas of development in communities and help promote strategic alliances between communities and private and public institutions. In the 20 years that have passed since first being established, no external assessments have been conducted to determine if Consultative Councils have achieved these objectives.

We set out to examine the Fray Jorge National Park – Consultative Council (FJNP-CC). This research was conducted in collaboration with CONAF and together we sought to understand how effective the FJNP-CC has been in achieving the three objectives noted above. This includes assessing whether the administration of the FJNP reflects the 'new paradigm' of participatory park management or if it remains rooted in protectionism and the prioritisation of biological conservation over local livelihoods. The research presented here offers insight into how effective the FJNP-CC has been in engaging local communities in park management while protecting the park's unique and ecologically sensitive values.

PARK AND PROTECTED AREAS MANAGEMENT

In parks and protected areas throughout the world, a shift from 'fortress conservation' to participatory approaches in park management has long been occurring. This transition can be witnessed in countries throughout Central and South America, where government agencies have created participatory institutions to engage communities in parks and protected areas management (Ferreira & Freire, 2009). Some of the more common approaches include supervisory committees, co-management and consultative councils (Elberts, 2008). For example, in

Fray Jorge National Park, Chile © David Natcher

Brazil, Peru, Bolivia, Argentina and Ecuador, supervisory councils have been established to facilitate community participation in protected area management (Elberts, 2008). Supervisory councils are used as public forums that allow communities the opportunity to influence park policies and help ensure that the rights and interests of communities are reflected in management decisions. In Colombia, the co-management of parks and protected areas has been successful in reducing conflict between communities and park managers and has facilitated grassroots participation in the deliberation of park policies (De Pourcq et al., 2015). In Brazil and Mexico, consultative councils are commonly used to bring local politicians, non-governmental organisations and communities together in a more collaborative approach to park management (Ferreira & Freire, 2009; Trimble et al., 2014; Catalan, 2015; Bockstael et al., 2016).

While communities have become increasingly insistent about their rightful place in park management and are demanding a greater say in the decisions that affect them, it has often been government agencies that set the terms, conditions and mandates for collaboration. While providing financial and various forms of technical support to communities (Elberts, 2008; Ferreira & Freire, 2009; Catalan, 2015), this top-down approach has been criticised for coopting the 'participation' of communities without relinquishing any real control over park management (Bockstael et al., 2016). For example, Trimble and colleagues (2014) found the co-management of national parks in Brazil is often hampered by procedural inequalities caused by hierarchical governance structures that are used intentionally to preclude local participation. Bockstael et al. (2016) reported similar deficiencies in the Paraty region of Brazil, where government officials and park managers continue to enact inequitable influence while purporting the benefits of community engagement. Executed in this way, participatory management is used by governments to manipulate the very communities they purport to assist, either by co-opting possible dissent, disenfranchising local representation, or downloading responsibilities to communities without providing the necessary resources (Bockstael et al., 2016; Guyot, 2011; Thorkildsen, 2016).

In their defence, governments sometimes claim that communities lack the capacity to engage in management (Trimble et al., 2014). Lacking the necessary human and financial resources, communities must rely on the capacities of government, who by necessity must retain management responsibility. This view has been challenged on grounds that governments too often equate capacity with formal education, income and socio-economic status (Alonso-Yanez et al., 2016), and by these standards, the contributions of communities are rendered inconsequential to the challenges park managers face.

This is not to suggest that successful forms of collaborative park management do not exist. Rather, numerous examples have been reported that show the positive outcomes that have been achieved through participatory management (e.g. Guyot, 2011; Mason et al., 2012). In these cases, success has often been achieved through a shared commitment to ontological diversity, where social equity is prioritised alongside conservation objectives, and the empowerment of community members is viewed as a positive outcome of collaboration (Guyot, 2011; Catalan, 2015). In many of these cases, communities have gained an equitable space in park management and have used park resources to enhance their own livelihoods (Guyot, 2011) while contributing to the ecological sustainability of park resources (Andrade & Rhodes, 2012). Yet this same literature also acknowledges the fragility of collaborative management and the vulnerabilities that can occur when unforeseen and emergent demands (internal and external) are placed on the ecological values of parks. It is this variability that motivated our analysis of the FJNP-CC.

METHODOLOGY

Research site

Established in 1941, the Fray Jorge National Park (FJNP) is located 390 km north of Santiago in the semi-arid zone of Chile. Covering roughly 100 km2, FJNP has a Mediterranean climate and receives an average rainfall of 114 mm per year (Squeo et al., 2016). The FJNP has four distinct ecosystems – semi-arid, forest relics, wetland, coastal zone – which are relatively undisturbed. This assemblage of environments has resulted in FJNP having a high level of ecological diversity. Park managers have identified 440 plant species within the park, of which 226 are endemic to Chile, including 10 endangered and 84 vulnerable species (Squeo et al., 2016). The park is also home to 130 avian, 23 mammal, five reptile and two amphibian species (Kelt et al., 2015). The FJNP has received UNESCO designation as a World Biosphere Reserve (1977) and at the time of this research is seeking RAMSAR designation for the Limari River and associated wetlands that serve as the park's southern boundary.

Within the park there is an interpretive visitor centre, a small picnic site and a 3 km hiking trail, but overnight camping is prohibited. Despite its limited services, FJNP

receives approximately 18,000 visitors per year, 90 per cent of whom are Chileans who visit the park during the summer months of January and February. To manage visitor impacts, the park employs seven full-time and four part-time seasonal rangers who are responsible for supervising the park's single point of entry, staffing the interpretive centre and patrolling the park's 100 km² area.

There are six communities adjacent to the park boundary, four of which are agricultural and two that exploit near-shore fisheries (Figure 1). The collective population is approximately 650 residents, although this number can fluctuate as residents relocate for seasonal employment, most often to mining districts in the Coquimbo, Arica and Atacama regions, or to Ovalle for short-term employment or for young children to attend school (Table 1).

Due to variable access and their general remoteness, these communities have little infrastructure and limited public services (e.g. water, electricity, schools, public transportation). However, the agricultural communities have a moderate advantage. The agricultural communities typically have a community president, an agricultural president and some have a livestock community representative. In addition, they also have

Figure 1. Fray Jorge National Park and adjacent communities

Table 1. Attributes of communities adjacent to park

Community	Population (2016)	Primary livelihood	Area (ha.)
Valdivia de Punilla	153	Agriculture/ herding	1,896
Peral Ojo de Agua	47	Agriculture/ herding	1,459
Buenos Aires	148	Agriculture/ herding	2,112
Lorenzo Peralta	32	Agriculture/ herding	1,399
Caleta El Toro	200	Fishing/ seaweed collection	2.5
Caleta El Sauce	80	Fishing/ seaweed collection	2.5

other organisations that are actively involved in local affairs, such as: a potable water committee, livestock (goat keepers') association, neighbourhood association, subsidised housing association, seniors' association and parents' association. The two fishing communities have a President of the Neighbourhood Association who, along with members of the executive committee, serve as administrators for their respective village. They also have a Seaweed Collectors' Association, a Seaweed Cooperative and a Women's Association that is funded by the parent organisation in Santiago.

The FJNP-CC was established in 2001. The basis for community representation is determined by the community's relative proximity to the park and their historical use of the park area. Each community is responsible for appointing a single representative to the FJNP-CC. Government appointees include representatives from Agriculture and Livestock Services, the Technical Corporation Service, Agricultural Development Institute and Social Investment Fund (FOSIS). Internally, the FJNP-CC appoints a four-member Board of Directors, which includes three community representatives, two of whom serve as President and Vice-President, and a representative from CONAF who serves as Secretary. Board memberships are for two-year terms and are eligible for renewal. Membership of the FJNP-CC is non-salaried but incidental costs associated with participation are covered by CONAF. The FJNP-CC holds quarterly meetings that are open to the public, however only council members are permitted to cast votes. The authority of the Consultative Council is advisory, in that it serves only to "guide and/or advise the actions of CONAF in the planning and management of the

park" (CONAF, 2001). The Consultative Council, through its President, is therefore afforded the opportunity to make management recommendations, but actual decision-making authority rests with the Regional Directorate of CONAF (CONAF, 2001).

Methods

Data collection occurred primarily through semi-directed interviews (N=31) and focus groups (N=4). A purposeful sampling strategy was used to elicit known expertise (i.e. members of the FJNP-CC), followed by a snowball sampling strategy where recruitment was based on the recommendations of others. Interviews were conducted with CONAF regional and district employees (N=7), community members (N=16), and former (N=5) and current (N=3) members of the FJNP-CC. Interviews were conducted with 22 men and 9 women, who were between the ages of 24 and 68. Interviews typically lasted 1-2 hours and were conducted in the participants' homes or offices. Prior to the interviews, the right to free, prior and informed consent was explained to each participant, as well as assurances regarding confidentiality and anonymity. Signed or verbally recorded consent was obtained before proceeding. Interviews were conducted through a semi-directed format that explored the perceived effectiveness of the FJNP-CC in achieving its three objectives. Semi-directed interviews conferred a significant advantage over a more structured or formal interview style in that they allowed participants the freedom to defer comment, raise other associations or propose alternative topics not anticipated by members of the research team. Interviews were aided by a locally hired interpreter.

In addition to interviews, four focus groups were held. Three of these focus groups were comprised of community members, including one involving only men (N=4), one with only women (N=7), and one involving both men (N=3) and women (N=2). These focus groups were conducted at the Valdivia de Punilla community centre. Focus group participants were recommended by community FJNP-CC representatives and were selected based on their experience, knowledge and general willingness to share their opinions. Focus group discussions followed a similar format as interviews, where informal and semi-directed questions were used to elicit insights on the success and challenges of the FJNP-CC to achieve its objectives. The fourth focus group was conducted with five of the seven FJNP rangers (1 female, 4 male), the format of which was consistent with the others. The interviews and focus group discussions were audio recorded, with transcripts coded and analysed using Nvivo software to identify key themes and responses to probing questions. Outside of these structured formats, our research also benefited from numerous opportunistic conversations during the two years of research.

Results of this study were presented back to the FJNP-CC during an open-house community meeting that was held in Valdivia de Punilla. In addition to community members and FJNP-CC representatives, regional and national CONAF staff and directors were in attendance. This form of reporting proved beneficial for clarifying initial interpretations, identifying and exploring new insights that emerged, and perhaps most importantly, facilitating constructive dialogue among participants concerning the challenges and opportunities for the collaborative management of the FJNP.

RESULTS

Objective #1: Has the FJNP-CC generated opportunities for community participation with regards to the management, conservation and development of the FJNP?

FJNP-CC meetings are typically held in the community of Valdivia de Punilla. Scheduled quarterly, the meetings are used to keep community members informed about park activities and to be a conduit for information exchange. The FJNP-CC meetings are also used to hold park managers accountable to the communities. Prior to the establishment of the FJNP-CC, there was no mechanism or formal institution for keeping communities informed about park activities, but "now we know what they [park managers] are doing, what they are using money for, and how much money tourists leave here" (Valdivia de Punilla community member).

As valuable as these meetings may have been, they have become increasingly sporadic and are often only scheduled when park managers deem it necessary or when a conflict with one of the communities arises, for example following reports of illegal grazing within the park's boundary. This has left fewer opportunities for relationship building or for the meaningful engagement of communities in park management. Furthermore, although these meetings were originally intended to be a venue for the exchange of knowledge and a safe space for communities to provide feedback on park activities, these opportunities have become increasingly uncommon. When meetings do occur, communication tends to be unidirectional, where park managers provide updates on the park's activities and community members are simply the recipients of information or accusation. Community members noted that the opportunities to comment, let alone influence park decisions, are limited, and view the supposed openness

of park managers to community input to be disingenuous.

Park managers suggested that community members are reluctant to express opinions about the park and getting feedback on park initiatives has been challenging, with community members usually saying, "todo es bueno" (everything is good). Park managers attribute the limited input to apathy, coupled with a lack of organisational and technical capacity. To park staff, most community members are indifferent to the activities of the park, while community representatives on the council are believed to lack the background and wherewithal to participate in park management in a meaningful way.

However, the community members who serve on the FJNP-CC have considerable and diverse experience. Each has held numerous leadership positions, including elected presidents of their communities, serving as board members for community associations, and having been employed in the public and private sectors. Additionally, these leaders possess professional experience and backgrounds ranging from business owners, government employees and even a retired park ranger. Although residing in relatively small and isolated communities, community representatives bring a wealth of skills, experiences and qualifications to the FJNP-CC. For this reason, community representatives object to the suggestion that they lack the necessary skills or capacity to participate. To the contrary, community representatives accuse park managers of using such characterisations to justify their dismissiveness and exclusion of local input in decision-making.

Accusations of capacity deficit were also levied against park managers and staff. Although community members acknowledged the formidable task of trying to balance ecological protection with local and societal uses of the park, some community members were nonetheless critical that ecological protectionism and park enforcement have subordinated the equally important need for relationship building and conflict resolution. Community members said that most often they are made to feel peripheral to the management of the park, and in many instances treated as threats to the sustainability of park resources. Park managers and staff did not dispute this charge, but rather justified their prioritisation of ecological protection to the growing societal demands placed on the park's resources – whether in the form of tourism or local extraction – that by necessity require protection. The demands placed on park managers, compounded by limited human and financial resources, require the efficient allocation of time and resources. For this reason, park managers acknowledged that the protection of the park's most at risk ecological values has been prioritised over the important but less pressing need for relationship building with communities.

Fray Jorge National Park, Chile © David Natcher

Objective #2: Has the FJNP-CC improved the abilities and opportunities for communities to protect their ways of living and be acknowledged and valued by society?

Within the park's visitor centre, there is no representation of the culture or history of the local residents. Rather, only the 'natural' (non-human) features of the park are highlighted. Yet the land within FJNP had originally been used for cultivation and grazing. These uses include accessing water, pasture, wildlife and seaweed. The park also contains the northernmost remaining tract of Valdivia temperate forests; timber that was originally harvested by communities for housing, fence posts and fuelwood. When FJNP was gazetted, access to resources within the park was restricted and strictly enforced. Today, the communities adjacent to the FJNP continue to derive much of their livelihoods from either agriculture or fishing, but now must do so in more marginal areas outside the park boundary.

Park related employment is also limited. FJNP provides seasonal employment for four community members who work as rangers from January to March. The remaining seven full-time staff are employees of CONAF who typically rotate through the national park system. Service opportunities outside of the park are equally limiting. There are no overnight accommodation or camping facilities, and food service is limited to an occasional roadside kiosk that sells snacks and drinks. One of the community members who was interviewed did secure a permit to operate a small restaurant but found it difficult to attract customers outside the peak tourist season (January or February). She explained:

> "…those [tourists] who go to the park pass through the communities. But since there is nothing much to do, no swimming pool, they just go back home."

This same informant suggested that if CONAF was willing to assist community entrepreneurs there would be an opportunity to develop tourism-based businesses.

> "There are about 15,000 people going through the park and the communities are not doing anything to take advantage of that market."

At the urging of the FJNP-CC, CONAF did agree to re-route the park's access road from lands that passed through private ranches to an area in closer proximity to the communities. The FJNP-CC requested this change recognising the economic potential that could be gained from tourism and other spillover developments. While the economic benefits have been marginal to date, and tend to be seasonally derived, the park visitors that do pass through the communities do on occasion stop for local services when available. This economic potential has led some community members to consider future business investments:

> "…we have the chance to dream about businesses to make money, you know, because before there was no road, we did not even dream about having a kiosk or some small business."

Community members did, however, acknowledge that it will be difficult to attract tourists until more efficient services can be provided.

> "The problem is that if the people with money come here now, they find that we don't have potable water, or a place to stay. So if they came here, they don't have a place to stay."

With few employment opportunities in or outside the park, coupled with their exclusion from the park's natural resources, many community members expressed concern that their ways of life were at risk. Many community members fear that if conditions do not change, and income earning opportunities fail to be developed, an outmigration of youth will occur. In fact, some community members feel this is the actual intention of CONAF, in that if community members ultimately leave and relocate to more populated regional centres, there will be less pressure placed on the park's ecological resources. Others had a less cynical view of CONAF's motivations, believing they have in fact made sincere efforts to support the economic development of communities. However, their motivations for doing so were similarly exclusionary in that if economic opportunities can be created for communities outside the park boundaries, there will be less demand placed on the park's natural resources, for instance through grazing or the collection of plants, fuelwood or seaweed. In the end, community members voiced frustration that their historical uses of the park area have been criminalised while receiving little to no assistance in developing and maintaining alternative livelihoods. Having no direct or personal experience of accessing resources of the park, the youth of the communities do not necessarily share the same connection to 'place' as their parents and grandparents do. Many youth now experience the park as do tourists – short walks in a peaceful setting. Older community members seem to accept this as an inevitable change but recognise that if they hope to keep the younger generation from leaving, new economic opportunities will need to be found that do not involve the extraction of park resources.

Objective #3: Has the FJNP-CC strengthened the areas of development in communities and helped to promote strategic alliances between communities and private and public institutions?

In the context of making strategic alliances, nearly all interviewees said that participating in the FJNP-CC has benefitted their respective community. Prior to the formation of the FJNP-CC, the communities lacked the most basic of services, as one CONAF representative explained:

> "We found a very, very poor people. They didn't have electricity, they didn't have potable water, bathrooms, no basic services. Now that is starting to change."

The community leaders attributed the improvement in the provision of basic services to the FJNP-CC. For example, one community leader noted that:

> "CONAF was involved in the formation of the Potable Water Committee. CONAF suggested the idea at the Consultative Council. CONAF then connected the communities to the General Directorate of Water here [Ovalle] so that they could start the committee to get potable water."

The FJNP-CC was also given credit for facilitating community access to representatives in other

government departments that prior to the formation of the Council were inaccessible. As one community representative explained:

> "…it is a good opportunity because we meet with the people who have the power and people with authority. So they come here and we can present our problems to the authorities and get the response we need."

In this way, the FJNP-CC serves as an important bridging organisation that is used by communities to gain access to other institutions and funding opportunities. This includes gaining access to other government agencies responsible for non-park related activities, for instance access to potable water, connectivity to the electrical grid and road maintenance. In the absence of the FJNP-CC, community leaders would have to travel roughly 30 km to Ovalle in the hope of meeting with government officials. Given that only one of the four agricultural communities has regular public transport, which runs only three days per week, transport is problematic and requires time and financial resources that often need to be allocated elsewhere. For this reason, many community members viewed the FJNP-CC in a positive light. A CONAF employee similarly explained that "In the end the Consultative Council is like a bridge between the communities and the authorities."

Yet not all community members shared this positive outlook. Notwithstanding the bridging opportunities the FJNP-CC affords, some community leaders expressed frustration that in the absence of a genuine relationship with CONAF, most activities are superficial in terms of park management and are more often only supported when they can be used in promotional materials or during election campaigns. According to one community leader, FJNP-CC only supports activities that are visible to tourists and can be seen from the park entrance. They argue that the more remote communities that are not readily visible to the public are often neglected, and the needs of their residents are rarely considered.

> "There have been no benefits to the communities for the past two years. We don't have agreement or disagreement [with CONAF], because there is no relationship at all. We feel ignored because we are hidden off the [park] road. And that's why I want to go to this meeting to increase the participation of my community in the Consultative Council."

DISCUSSION

Many of the FJNP-CC representatives spoken to during this research offered positive examples of the changes that have occurred in park management over the past 20 years. Some described the relationships that have evolved, which has been made possible from a shared commitment to the conservation of the FJNP. Others noted a shared responsibility for the park and a sense of ownership in the collaborative process that would not have occurred in the absence of the FJNP-CC. However, personal experiences are subjective in that people recall events from their own cultural and political vantage points. Examples of the past that depict cooperation were not necessarily shared by all, but they do suggest a vision of what they would like to achieve and what they would like others to see.

During our interviews the issue of capacity, and the lack thereof, was often raised. For many government representatives the capacity of community representatives was considered lacking, with limited technical, financial or organisational skills available. Government representatives suggested that community members' lack of capacity was demonstrated by their perceived apathy towards park management and a disinterest in engaging in decision making. For this reason, communication was admittedly unidirectional, flowing from park managers to community members with little in return. Aware of these perceptions, community members explained that park managers use 'capacity' as a way to justify the exclusion of community members from management decisions. By advancing the notion that communities lack capacity and are ill-equipped to assume meaningful roles in park management, park managers are unencumbered to set park policies in the absence of local input or influence. Some community members acknowledged that apathy does exist among some but note that it results from 20 years of having their concerns dismissed and their recommendations rejected. This is particularly the case when discussions arise over access to park resources (e.g. fodder, fuelwood, algae).

Whereas CONAF and park managers have proven reluctant to engage in any discussions about community access to the park, they have been supportive of economic development opportunities outside the park boundaries. This support is reflected in the rerouting of the park's access road that has made local businesses visible to tourists and has inspired entrepreneurial interest. CONAF has also helped facilitate community access to other government agencies where communities can leverage other financial and capital development resources. As welcome as this support is, many community members see this type of aid as strategic and believe it is used to lessen the human impacts on the park, regardless of the risk posed to community livelihoods. That is, by creating more economic opportunities outside the park, communities will be less dependent on, and therefore disinclined to

exploit, park resources. For these reasons, community members accuse park managers of clinging to practices emblematic of fortress conservation where the protection of ecological values takes precedence over the needs and historical ties of park-adjacent communities. Yet this criticism is readily accepted by park managers who unapologetically feel their principal responsibility is to protect the integrity of the park's ecological values, even if that protection comes at the expense of community interests. For this reason, the transition from fortress to participatory management of the FJNP has yet to be achieved, with park managers clinging to the notion that ecological values are best protected by the exclusion of people.

When CONAF set out to establish Consultative Councils for national parks and protected areas, they undoubtedly knew the challenges that would be involved, particularly in settings where historical interactions between communities and government institutions are marred by distrust. In our study of the FJNP-CC, all participants acknowledged the challenges in collaborative management. Community members recognised the importance of protecting the critical species and unique habitats found within the park. Park managers also acknowledged the historical connection that communities have with the park area and the need for community members to generate an adequate livelihood from the park and its resources. Yet finding a balance between these needs is challenging and all conceded that probable tensions have and will continue to arise. However, community members and park managers sincerely believe that despite its fragility, the FJNP-CC represents the best opportunity to manage, if not reconcile, these competing interests in an area that is valued by all.

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Compliance with ethics standards

This research (Ethics Number: 17–253) was reviewed by the University of Saskatchewan Behavioural Research Ethics Board (Beh-REB) and is in full compliance with the Tri-Council Policy Statement (TCPS): Ethical Conduct for Research Involving Humans (TCPS, 2018). Ethical requirements for informed consent in research are consistent with Article 9.1 of the TCPS for protecting the welfare of communities. This research was guided by a Research Memorandum of Understanding signed between CONAF and the University of Saskatchewan, which defined the terms and conditions for the ethical conduct of research and the dissemination of results.

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RESUMEN

En 2001, el Gobierno chileno creó los Consejos Consultivos como parte de su estrategia de gestión de los parques nacionales. Los Consejos Consultivos se diseñaron con tres objetivos: 1) generar espacios de participación ciudadana en torno a la gestión, conservación y desarrollo tanto de los parques nacionales como de las comunidades aledañas; 2) mejorar las capacidades y oportunidades de las comunidades aledañas para proteger sus formas de vida y que sean reconocidas y valoradas por la sociedad; y 3) fortalecer áreas de desarrollo de las comunidades y promover alianzas estratégicas entre éstas y las instituciones públicas y privadas. Nos propusimos examinar si el Consejo Consultivo-Parque Nacional Fray Jorge (CC-PNFJ) ha logrado estos tres objetivos. Nuestros resultados indicaron que el CC-PNFJ no ha facilitado la participación de la comunidad en la gestión del parque (objetivo 1) y ha hecho poco por mejorar las capacidades y oportunidades de las comunidades adyacentes para proteger sus formas de vida (objetivo 2). Sin embargo, el CC-PNFJ ha demostrado ser eficaz a la hora de facilitar el acceso de la comunidad a las instituciones públicas y privadas (objetivo 3). A pesar de haber alcanzado sólo uno de sus tres objetivos, los miembros de la comunidad y los gestores del parque aun consideran que el CC-PNFJ es la mejor forma de gestionar, si no reconciliar, los intereses contrapuestos en el parque.

RÉSUMÉ

En 2001, le gouvernement chilien a mis en place des conseils consultatifs dans le cadre de sa stratégie de gestion des parcs nationaux. Ces conseils consultatifs ont été conçus avec trois objectifs : 1) créer des opportunités de participation citoyenne en ce qui concerne la gestion, la conservation et le développement des parcs nationaux et des communautés environnantes ; 2) améliorer les capacités et les opportunités des communautés adjacentes à protéger leurs modes de vie et à être reconnues et appréciées par la société et ; 3) renforcer les domaines de développement dans les communautés et aider à promouvoir des alliances stratégiques entre les communautés et les institutions privées et publiques. Nous avons cherché à déterminer si le Conseil consultatif du Parc national de Fray Jorge (PCFJ -CC) a atteint ces trois objectifs. Nos résultats indiquent que le PCFJ-CC n'a pas réussi à faciliter la participation des communautés à la gestion du parc (objectif 1) et qu'il n'a pas réussi à améliorer les capacités et les possibilités des communautés adjacentes à protéger leurs modes de vie (objectif 2). Cependant, le PCPNF-CC s'est avéré efficace pour faciliter l'accès des communautés aux institutions privées et publiques (objectif 3). Bien qu'il n'ait atteint qu'un seul des trois objectifs, le PCFJ-CC est toujours considéré par les membres de la communauté et les gestionnaires du parc comme la meilleure occasion de gérer, voire de concilier, les intérêts concurrents dans le parc.

HUMAN–WILDLIFE CONFLICTS AND THE IMPACT ON LOCAL COMMUNITIES' SUPPORT FOR KHAO YAI NATIONAL PARK, THAILAND

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ABSTRACT

Human–wildlife conflict is one of the biggest challenges facing conservation in Thailand and throughout the world. This study investigates human–wildlife conflicts in Khao Yai National Park, Thailand, and their impact on local support for park conservation. Semi-structured interviews were employed, and data was analysed using narrative analysis. Economic losses due to wildlife crop depredation were identified as the main cause of human–wildlife conflict, leading to less support from local people for conservation activities. However, it was also found that human activities are the root cause for wildlife disturbance. The respondents underlined that humans first trespassed on the lands of wildlife, negatively affecting their needs. Therefore, the potential for severe human–wildlife conflict greatly depends on human activities. This study suggests that planting vegetation at the park boundary to provide more sustenance to wild animals and to prevent them from coming out of the forest is critical for long-term success regarding wildlife conservation and human livelihoods.

Key words: human-wildlife conflict, National Park, conservation, Khao Yai, Thailand

INTRODUCTION

While wildlife and other natural resources are important for human society's ongoing economic and social development, biodiversity is also under increasing pressure worldwide from factors such as increasing human populations, global economic activities, social changes and climate change (Carter et al., 2014). Environmental degradation, species loss and threats to species have resulted in the promotion of national parks as an international conservation strategy. Early conservation efforts that excluded humans from nature emphasise the values of natural resources where people are seen as an adverse impact on these valuable resources and as a destructive element to the natural integrity of ecosystems (Jeanrenaud, 2002; Adams, 2005).

The establishment of national parks could be regarded as a Europe-centric conceptual division between nature and human society (Adams & Hutton, 2007). According to Neumann (1998), national parks are "quintessential landscapes of consumption", in which human beings and any evidence of their activities do not belong. Neumann also argues that these early approaches to conservation were initially a desire to "escape" to "pristine" nature. They were founded on a fundamental conception of nature as something pristine that could be distinguished and physically separated from human-transformed lands (Champbell, 2005; Adams & Hutton, 2007).

Despite the growing establishment of national parks under this approach of displacing local people from natural resources, there has been a global reduction in biodiversity. It has also resulted in conflicts between park management and surrounding communities. This is largely because local communities who traditionally depend on the park resources for their livelihoods, have been either denied or restricted access. Bhusal (2012) argues that park authorities have always failed to adopt appropriate management policies to protect parks from traditional exploitation of natural resources.

In Thailand, for example, the government often severely restricts livelihood activities in conservation areas or resettles residents elsewhere, with consequent conflict over the land. One example of such a conflict concerns land rights in a national forest reserve in the Buriram province of Thailand, Dong Yai. Here the government decided to allocate land and release the deteriorating forest to the private sector for tree planting. About 300 out of 1,297 families had to move out of the forest area without any compensation. Two thousand villagers protested against the authority and burnt down 20 rai

(3.2 ha) of the forest and one tree nursery. A Buddhist monk and three village leaders were arrested and imprisoned under the National Forest Reserve Act 1964 (Yamauchi, 2005) for encroaching and destroying the forest reserve. Unclear rights to forest resources and lands have also been reported in Kanchanaburi province, in the west of Thailand. Interviews were conducted here with 50 participants regarding conflicts between national park authorities and local communities. The results showed that the underlying cause of the conflict is the unclear and contested tenure (Phromlah, 2014).

Thapa (2014) also identified national parks in these jurisdictions as breeding grounds for conflict. Even established national parks are not free from conflict with local people who inhabit the area either inside the parks or in the buffer zones. In many countries, park–people conflicts are centred around restricted access to traditionally used forest resources (Nana & Tchamadeu, 2014; Thondhlana & Cundill, 2017), loss of crops and livestock due to wildlife damage (Karanth & Nepal, 2012; Lamsal, 2012; Timsina, 2014; Thapa, 2016), land-use conflicts (Kideghesho et al., 2013; Isdori, 2016), lack of benefits from national parks and limits to community participation in reserve management issues (Thondhlana & Cundill, 2017). Among these threats, human–wildlife conflicts such as crop raiding, livestock depredation, predation on managed wildlife, or human mortality from wildlife are critical and significant pressures facing park management. Specifically, crop damage and livestock depredation are the most prevalent forms of human–wildlife conflict and these contribute to the problems of food insecurity and poverty in the majority world (Dickman, 2010; Gemeda & Meles, 2018).

Human–wildlife conflict refers to the negative interactions between human and wild animals, with undesirable consequences for both people and their resources and wildlife and their habitats. It occurs when animals pose a direct and recurring threat to the livelihood or safety of people, leading to the persecution of that species (IUCN, 2020). This conflict has been in existence as long as wild animals and people have inhabited the same landscape and shared the same resources. The expansion of human populations into or near areas inhabited by wildlife and the modification of natural environments for agricultural activities escalate human–wildlife conflict (Gemeda & Meles, 2018; Lamichhane et al., 2019). Wildlife species, which meet a number of human needs, decline or disappear as human populations clear wildlife habitats for anthropogenic activities (Masanja, 2014).

Elephant, Khao Yai National Park © Rangsiwut Keawsang

This study examines the human–wildlife conflicts in communities around the Khao Yai National Park in Thailand. The study findings are discussed in terms of wildlife conservation activities' impacts, both intentional and unintentional, on local livelihoods and incomes. This paper seeks to improve understanding of these conflicts that can affect local communities' support for park management.

METHODOLOGY

Study site

As Thailand's first national park established in 1962, Khao Yai National Park is a national symbol of nature conservation. It is a major international, regional and local tourist attraction in Thailand because of its beautiful scenery, rich forest, waterfalls, abundant wildlife and location close to Bangkok (Suwanwaree & Aroon, 2014). It is located in north-eastern Thailand and covers parts of four provinces: Nakhon Nayok, Prachin Buri, Nakhon Ratchasima and Saraburi. In 2005, together with three other parks in the same Dong Phayayen mountain range, Khao Yai National Park was proclaimed as a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site under the name 'Dong Phayayen – Khao Yai Forest Complex' (UNESCO, 2013).

The park encompasses a mountainous area of 2,168 square kilometres and is the third largest national park in the country. The area comprises dry deciduous and evergreen forest, tropical moist evergreen forest, hill evergreen forests and grassland. The forest provides a wide range of ecosystems and habitats for at least 2,000 species of plants, over 300 bird species, 70 species of mammals, and 74 reptiles and amphibians (Myers, 2016).

Figure 1. Map of Khao Yai National Park showing villages included in the study

Due to its rich biodiversity, Khao Yai National Park is a magnet for illegal collecting, logging and poaching, such as the illegal harvesting of high-value timber species such as the vulnerable Siamese Rosewood (*Dalbergia cochinchinensis*). Khao Yai has villages within the national park and heavy settlement pressure from 104 villages along its borders (Figure 1). The majority of local villagers are involved in agricultural activities such as the production of maize, orchard fruits, flowers, mushrooms and poultry.

Data collection

This study was conducted using a qualitative approach to enable the study of subtle nuances in attitudes and behaviours, and investigation of social processes over time (Rubin & Babbie, 2011). Semi-structured interviews were employed to collect qualitative data in this study, with the aim of obtaining insights into the human–wildlife conflicts in communities surrounding the national park, and the impacts of such conflicts on local support for national park management.

Before data collection, a selection procedure identified the target villages to be studied around the Khao Yai National Park. A total of nine Moo (village in the Thai language) were selected as the research population for this study: Moo 3, Moo 4, Moo 5, Moo 6, Moo 10, Moo 11, Moo 13, Moo 17 and Moo 18. With the help of the village chiefs, purposive sampling was then applied to sample 15 interview respondents across the nine selected villages. The respondents were selected from different occupational backgrounds. The sample includes employment or identity categories such as elder, village chief, teacher, farmer, National Park officer and park ranger. Interviewees from different backgrounds and responsibilities were chosen to provide valuable and rich data to reveal different perspectives and understanding towards conservation attempts, as well as the challenges faced in handling human–wildlife conflicts.

Data analysis

The interviews were made up of semi-structured questions adapted from Labov's (1982) evaluation model of narrative. The importance of the narrative model is to lead respondents to share their views and experiences through a story-line. The interview transcripts were then analysed using narrative analysis. This analysis method has demonstrated its effectiveness in examining participants' points-of-view in order to understand their culture and experience in real life through their story-telling (Richmond, 2002).

Qualitative data collected from the interviews were analysed to generate themes based on Labov's (1982) structural analysis of narratives to investigate the interviewees' experiences of human–wildlife conflicts. The researchers explored and arranged the stories into a basic narrative structure including: abstract, orientation, complicating action, evaluation, results and coda. First, the story was summarised in an abstract to provide an overview. In the orientation step, the action

of the participants was introduced and identified according to place, time, characters and situation to answer the questions, "Who? When? Where? What were they doing?". Under complicating actions, the sequence, crisis or turning point of the events were recorded to tell "What happened next?". The overall meaning of the story was evaluated and the ending or outcome of the story was described in a result. Finally, the researchers ended the story by recording a coda to tell "What does it all mean?".

RESULTS AND DISCUSSION

Interviews with the participants who were elders, village chiefs, farm or plantation owners, and a primary school teacher narratively revealed their local livelihoods and incomes, now and in the past. The local people's original ways of living were linked to the forest before the existence of the national park. After park establishment, they engaged in agricultural farming before tourism became a significant activity. The respondents shared their viewpoints on wildlife damage to crops which impacted local incomes, and their support for park management. In addition, interviews with the park officers discussed the park efforts for conflict resolution in addressing agricultural crops depredation and park boundary demarcation problems. Overall, emerging themes extracted from the findings through the narrative analysis included 'human encroachment and degradation of resources', 'the impact of human–wildlife conflicts on local livelihoods and incomes' and 'park management of conflict situations'.

Human encroachment and degradation of resources

Human encroachment into forests has induced many severe changes to the natural environment even during ancient times. Many forest areas and wildlife species have been affected through hunting, logging and agricultural expansion. People pursued lands and resources in order to meet their legitimate material aspirations (Wahab, 2016). Before Khao Yai National Park was established in 1962, the local people were considered a forest-dependent community. They lived within nature and depended on forest resources for their livelihoods. According to the interview respondents, the ways of living of their ancestors involved hunting and harvesting forest resources.

An elderly respondent mentioned that he was one of the first groups of people who came to live in Khao Yai during the early 1950s. In the past, the woodland was regarded as very fertile and lush. He described it as 'awesome forest', as nobody was around when he first stepped onto the land.

> "I have lived here since the 1950s, before it was declared a national park in 1962. I moved here together with my family members and few of my relatives…there wasn't anybody around this place, only wildlife such as tigers and elephants…which I would call it the coolest forest areas."

An elderly respondent explaining that he was among one of the first groups of people who came to settle in Khao Yai in the 1950s © Teh Kate Yng

The old man identified himself as the invader in this forest in the beginning. Fishing, hunting and collecting forest resources were among his main activities during the time he settled on this land. Apart from the contribution of the forest for food and nutrition, the respondent further explained how he made an income by selling products from hunted animals including furs, skins, claws, horns, heads, meats and other items. The quotation above demonstrates the economic contribution of the forest to local villagers, when they started trading animal products over 60 years ago.

After initially depending on forest resources for daily survival, the local communities in Khao Yai started to engage in agriculture. Crops included rice, potatoes, corns, bananas and other vegetables. They were able to easily access and clear lands for growing their crops. Every family was actively farming for their own consumption and as an income source. One of the respondents interviewed said that large areas of forest were cleared by heavy machinery such as tractors for commercial cultivation. Once the land had been cultivated for several years, the soil would become infertile, and the farmers would move and clear new lands. This led to soil degradation and erosion and the loss of fertile land. A primary school teacher commented:

> "Forests were slowly decaying because a lot of people opened the lands for growing corn and rice. They also used tractors to clear the lands… The biggest problem was when the soil had lost all its quality after the crops had been grown for several years."

In order to make a profit, the conversion of forest to agricultural fields involved chopping down the trees and disturbing the natural habitats of animal species (Chakravarty et al., 2012). Consistent with Kideghesho et al. (2013), our findings suggest that poverty at a household level forced the local people in Khao Yai to adopt coping strategies that were unsustainable and ecologically destructive.

Impact of human–wildlife conflicts on local livelihoods and incomes

The contentious relationship between park management and the neighbouring communities can be seen as a conflict between two opposing objectives: natural resources protection on the one hand; and safeguarding local livelihoods on the other. Previous studies have identified that policies related to national parks in Thailand are having an impact on people's livelihoods and incomes at the local level (Suwanmanee, 2009; Thaworn et al., 2010). This is because human–wildlife conflict is closely associated with the social and economic well-being of the local people (Upadhyay, 2014).

This study found that a serious threat impacting local communities' perspectives on wildlife conservation is conflict with wild animals from the park. Local villagers close to the national park regarded wildlife crossing the park boundary, rampaging through villages and eating farm crops as a common situation in Khao Yai. This problematic issue confirms Timsina's study (2014) that wildlife damage is a great concern among farmers as the losses can result in serious reductions in their annual income. The interview respondents stated that many wildlife species damaged their crops. Amongst them, the owner of a corn farm highlighted his loss of income saying:

> "A lot of animals have been coming down and eating the vegetation and fruits. My corn plantation has disappeared by 50 per cent. For one-acre plantation, I need to spend four to five thousand Baht. When the animals destroyed the crops, I need more money and time to re-harvest. Can you imagine how much I have lost?"

As compared to previous years, the number of animals leaving the forest and the potential for crop damage caused by the wildlife species was not as high. However, the overall wildlife damage to crops has increased considerably over the past decade and it has caused great economic losses for farmers. One interviewee reported that wildlife has learned to distinguish between forest vegetation and crops, particularly corn. They are clever enough to detect the difference in taste and know what is in season.

> In those days, the wild animals used to only rely on forest vegetation. But once they discovered the fine foods and novelties here, they decided to come more often since it's all so yummy! They are too smart now.

Another respondent who is also a farmer reported that crop damage was mainly from elephants. Elephants were often mentioned by the villagers as the most damaging species affecting coconuts and corn, and the most difficult to defend against (Timsina, 2014; Eustace et al., 2018). In the words of the respondent, the elephants are clever. This is because they choose only the tastier crops like corn, sugarcane and coconuts, but they never touch potatoes.

> Actually, we also plant potatoes as well, but the elephants wouldn't go for it, they only go for the corn. This is because the corn is very sweet. You see, in fact, they are clever enough, they know what to choose and what is tastier.

However, in the words of a senior respondent mentioned earlier, the farmers could not assign all the blame to the wild animals because humans are the ones

destroying the animals' homes in the first place. He was angry, noting that the natural habitats of many wild species have been destroyed due to agricultural activities by humans causing a corresponding loss of biodiversity. Therefore, when wild animals graze on cultivated crops, the farmers should accept the behaviour.

Park management of conflict situations

Local villagers who suffered from loss of income complained and expressed their dissatisfaction with the park management in failing to resolve wildlife crop depredation. In many conflict scenarios, the situation is compounded by the challenges of obtaining compensation and a lack of concrete solutions by the park administration to address wildlife damage. As a result, the threats to local livelihoods are consistently associated with low local support for park management in Khao Yai.

The interview respondents highlighted that the compensation problem has still not been resolved and that farmers' complaints were ignored. The farmer whose corn plantation had been eaten by elephants blamed the ineffectiveness of the national park management for taking too long to propose a solution.

> The park management said that they are going to pay us for the losses, but they haven't paid us so far. They have taken too long and delayed the issue. We have been dealing with it for more than a year already!

Nevertheless, interviews with national park officers depicted different perspectives in solving the human–wildlife conflicts. The Deputy Superintendent of the park defended their quick response in resolving wildlife disturbance problems in order to prevent local people's negative attitudes and attacks towards wild animals. He argued that in most cases, the delay in the claim was usually caused by incomplete paperwork or when the applicants were not the legal landowners. The officer replied:

> We would provide cooperation to solve the complaints as soon as possible because we worry the people would harm the wildlife by putting up the baits and traps…but before we pay the compensation, we have to do the correct assessment and follow procedures religiously… The procedures would take longer time and become very complicated if the lands do not belong to the farmers. They only rent the places for doing the farming while the owners are probably someone from Bangkok. Due to this situation, they could not provide sufficient documents to apply for the compensation.

On the one hand, the local people blamed the inefficiency of park management in providing solutions.

National Park Deputy Superintendent discussing the effectiveness of the park management in addressing wildlife damage © Teh Kate Yng

Wildlife watching tower, Khao Yai National Park © Rangsiwut Keawsang

On the other hand, another government officer who is a park ranger argued that the wildlife damage happened mainly because of the increase in human population and the expansion of human activities. This is supported by the findings of Lambin and Meyfroidt (2011) that show that the expansion of human land use at the expense of natural ecosystems has caused wildlife habitats to become increasingly fragmented and degraded. A member of the park staff was cited as saying:

> It is true that wildlife has caused substantial damage to the farmers' crops, because we [human] are the ones who first invaded their habitats... Nowadays, forests are rapidly being cut down especially for the construction of buildings such as hotels and resorts. Many people moved to stay in Khao Yai and the park is becoming an island where the communities gathered. As a result, the wild animals have started to come out of the forest after the loss of their real habitats.

In the very beginning, the fertility of the forest provided habitat and enough food for the wildlife. Later the forest was destroyed due to land clearance for agriculture, development, accommodation and infrastructure construction. As a result, the wild animals have lost their original habitats. They started to roam outside park boundaries and onto land owned by the local communities. The national park was regarded by respondents as an 'island' surrounded and crowded by an increase in the human population over the years. The decrease of forest lands has forced wild species to come out from their natural habitats.

In order to find a compromise for the benefit of both wild animals and local livelihoods, a cooperative project which involved the national park and local villagers was then implemented to plant vegetation and fruits inside the park boundary such as corn, coconuts and bananas. Hence, the animals could enjoy the crops inside the protected areas and they would not come out to cause problems. A village headman noted that he was confident that the outcomes of their attempts would be positive and lead to success.

> Concerning the problems of wildlife, especially the elephants coming to graze on our cultivation fields, we support and actively participated in the project of growing crops inside the national park... We just started planting these crops, and we do not know the results yet. But we predict more than 70 per cent of them will survive.

CONCLUSION

Overall, the results of this study confirm human–wildlife conflicts as problematic for local communities living close to Khao Yai National Park. The farmers expressed their concern about wildlife damage, which has increased significantly in recent years causing a serious reduction in agricultural crops. As a result, the interviewees blamed park conservation strategies for threatening their livelihoods. Moreover, those that suffered from a loss of annual income were discouraged from claiming compensation because of the time involved in the process. These individuals developed a poor park–people relationship and had low local support for wildlife conservation.

However, interviews with two respondents identified different perceptions about wildlife disruption to peaceful existence amongst the local communities. They agreed that humans are actually the biggest threat to wildlife. Consistent with Masanja (2014), ongoing human activities are a major cause of wildlife loss worldwide. The growing human populations overlap with wildlife needs and move further into previously uninhabited areas (Dickman, 2010).

In other words, when wildlife and humans are sharing the same landscape in close proximity, it is almost impossible to entirely avoid wildlife damage (Lamichhane et al., 2019). Therefore, managing the human–wildlife relationship requires a number of interventions which respect the lives of both the local people and wildlife in the park (Timsina, 2014). This study suggests that the park authorities and local villagers should work together to cultivate native vegetation inside the park boundary for wildlife consumption in order to benefit both wild animals and local livelihoods. These findings support the notion of a symbiotic relationship between humans and their environment, resulting in a lasting and fundamental relationship that is both close and complex (Liu, 2008).

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RESUMEN

Los conflictos entre los seres humanos y la fauna silvestre son uno de los mayores retos a los que se enfrenta la conservación en Tailandia y en todo el mundo. En este estudio, investigamos los conflictos entre los seres humanos y la fauna silvestre en el Parque Nacional de Khao Yai (Tailandia) y como impactan sobre el apoyo local a la acciones de conservación del parque. Para ello empleamos entrevistas semiestructuradas y realizamos un análisis narrativo de los datos. Pudimos determinar que el principal conflicto era el ataque de la fauna silvestre a los cultivos, provocando el bajo apoyo de la población a las actividades de conservación. Sin embargo, también descubrimos que son las actividades humanas que originan el ataque de los animales a los cultivos. Los encuestados subrayaron que, en principio, los humanos invadieron el territorio de la fauna silvestre y afectaron negativamente las necesidades de estos. Por lo tanto, el potencial para que se generen conflictos graves entre el ser humano y la fauna depende en gran medida de la acción del ser humano. Sugerimos que sembrar vegetación que pueda proporcionar sustento a los animales silvestres en los límites del parque puede evitar que estos salgan del bosque, lo que sería crítico para conservar a largo plazo la vida silvestre y los medios de subsistencia humana

RÉSUMÉ

Les conflits entre les humains et la faune sont l'un des plus grands défis auxquels est confrontée la conservation en Thaïlande et dans le monde. Cette étude examine les conflits humains-faune dans le parc national de Khao Yai, en Thaïlande, et leur impact sur le soutien local à la conservation du parc. Des entretiens semi-structurés ont été utilisés, et les données ont été analysées à l'aide d'une analyse narrative. Les pertes économiques dues à la déprédation des cultures par les animaux sauvages ont été identifiées comme la principale cause des conflits entre les humains et la faune, entraînant une diminution du soutien de la population locale aux activités de conservation. Cependant, il a également été constaté que les activités humaines sont la cause première des perturbations de la faune. Les personnes interrogées ont souligné que les humains ont d'abord empiété sur les terres des animaux sauvages, affectant négativement leurs besoins. Par conséquent, le risque de conflit grave entre les humains et la faune dépend largement des activités humaines. Cette étude suggère que la plantation de végétation à la limite du parc pour fournir plus de nourriture aux animaux sauvages et les empêcher de sortir de la forêt est essentielle pour le succès à long terme de la conservation de la faune et des moyens de subsistance des humains.

SHORT COMMUNICATION: GOVERNANCE TYPE BIAS IN GLOBAL RANGER SURVEY: IMPLICATIONS FOR RELEVANCE AND ANALOGOUS FUTURE WORK

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ABSTRACT

A growing body of literature explores rangers' perceptions and experiences of implementing conservation activities. In particular, the Global Ranger Perception Survey, carried out by the WWF, is the largest global assessment of ranger perceptions and experiences of working conditions in protected and conserved areas, providing insights into various aspects of the profession of rangers. Nevertheless, when the ranger perception survey data was associated with site governance type, we found that the survey is dominated by protected and conserved areas governed by government agencies (81 per cent) while sites with Indigenous and community governance were poorly represented (10 per cent) despite the vast area under this form of governance globally. These biases in governance mean that the survey data will be less relevant to protected and conserved areas with less government involvement, such as privately protected areas and those governed by Indigenous peoples and local communities. Our study therefore indicates that future large-scale surveys of ranger perceptions and experiences would benefit from including a more diverse set of sites with regards to governance types. Further, there could be value in carrying out a new survey akin to the Global Ranger Perception Survey with a focus on protected and conserved areas governed by Indigenous peoples and local communities.

Key words: rangers, governance, conservation areas, global survey, bias

FACTORS THAT SHAPE RANGER PERCEPTIONS AND EXPERIENCES

Rangers are central to conservation, operating on the frontlines to safeguard nature, cultural and historical heritage, as well as the rights and well-being of present and future generations (IRF, 2021). Modern rangers have multifaceted roles that include tasks such as research and monitoring, environmental risk mitigation, education and community and visitor engagement (IRF, 2021a; Moreto & Matusiak, 2017; Singh et al., 2021). Moreover, whilst rangers across the world operate under an incredibly diverse set of conditions, a pervasive characteristic of the work is its challenging nature (Oliver & Meier, 2006; Moreto, 2015; Moreto et al., 2016; Spira et al., 2019). Given the value of rangers to conservation and that the work is often demanding, an increasing body of literature seeks to explore ranger perceptions and experiences (Seager, 2021; Singh et al., 2021a; Singh et al., 2021b; Belecky et al., 2021).

Multiple factors can shape ranger perceptions and experiences. Female rangers, for instance, are disproportionately impacted by specific barriers such as pervasive and high levels of violence and harassment, but obstacles like low pay and poor equipment also have gender-differentiated effects resulting in female rangers purchasing more equipment at personal expense than male rangers (Seager, 2021). Ranger job satisfaction can also be related to other demographic factors, such as age and income (Spira et al., 2019; Ogunjinmi et al., 2008). An array of occupational factors can also shape ranger

Members of the indigenous monitoring team in Uru-Eu-Wau-Wau indigenous land in Brazil © Marizilda Cruppe / WWF-UK

perceptions and experiences; for instance, operating over large areas and for long periods of time, especially in the face of uncertainty and danger, can reduce morale and job satisfaction (Eliason, 2006; Moreto, 2015; Belecky et al., 2021). Inadequate provision of training and resources (Eliason, 2011; Etemesi et al., 2018; Meduna et al., 2009) and poor relations with local communities (Moreto et al., 2017; Moreto, 2015; Allendorf et al., 2007; Karanth & Nepal, 2012; Anthony, 2007) can also negatively affect rangers' ability to effectively deliver their tasks. In a similar vein, the types and mechanisms of governance associated with a particular conservation area might affect ranger perceptions and experiences.

Considering ranger perceptions and experiences in the context of conservation governance

Governance systems for area-based conservation differ broadly in a number of aspects, such as roles, rights, responsibilities, management systems and decision-making powers and processes. They can also be conceptualised on a spectrum from rules imposed from above that are devised and enforced externally (e.g. by states) to rules that are crafted by local users and internally self-enforced, such as by Indigenous peoples or local communities in Indigenous and community conserved areas (ICCAs). A rich variety of mixed forms of governance exists within this spectrum. The World Database on Protected Areas (WDPA) offers a typology of conservation area governance that aligns with this spectrum and conforms to the IUCN governance types as described in the IUCN governance of protected areas guidelines (Borrini-Feyerabend et al., 2013; IUCN & UNEP-WCMC, 2016). This WDPA typology is comprised of the following major governance types: Governance by government; Shared governance; Private governance; and Governance by Indigenous peoples and local communities. Many of these governance types are further divided into sub-categories.

Different forms of conservation governance might differentially affect ranger perceptions and experiences of their employment conditions. For instance, top-down governance of conservation areas, where local groups or bodies are partially or entirely excluded from decision

Figure 1. Countries included in the study. (1) Mexico, (2) Colombia, (3) Peru, (4) Paraguay, (5) Guyana, (6) Brazil, (7) Cameroon, (8) Democratic Republic of the Congo, (9) Central African Republic, (10) Tanzania, (11) Uganda, (12) Kenya, (13) Pakistan, (14) India, (15) Sri Lanka, (16) Nepal, (17) Bhutan, (18) Bangladesh, (19) Myanmar, (20) Viet Nam, (21) Thailand, (22) Cambodia, (23) Malaysia, (24) Indonesia, (25) Mongolia.

making, can often impose high costs on local livelihoods and exacerbate social conflicts, particularly in areas with high levels of poverty and resource dependence (Kothari, 2008; Adams & Hutton, 2007). A commonly perceived strength of Indigenous and community governance is that the local development of rules can translate to greater legitimacy and compliance on the ground (Ostrom, 1990; Baral & Stern, 2010). This suggests that sites with greater involvement of Indigenous peoples and local communities in governance tend towards being associated with more amicable ranger–community relations. In state-run PCAs where individual rangers have a variety of connections to a PCA (Woodside et al., 2021), which could, in turn, impact ranger perceptions and experiences related to ranger–community relations. Other hypotheses could, of course, be posited for why different types of area-based conservation governance could differentially affect rangers' perceptions and experiences of their roles as professional rangers.

Assigning governance types to the data of the largest survey of rangers

As an initial step towards considering ranger perceptions and experiences in the context of conservation area governance, we reviewed the results of a Global Ranger Perception Survey (GRPS) carried out from 2016–2019 across 25 countries in Asia, Africa and Latin America (Belecky et al., 2019), and assigned governance types (following the WDPA nomenclature) to each of the conservation areas. This RPS data was selected as it represents the largest global survey of ranger perceptions and experiences ever conducted to-date and because it contains information on various aspects of ranger work (including resource and training provision; relationships with colleagues and local communities). The process of assigning governance types began by identifying the RPS conservation areas that had direct matching counterparts in the World Database on Protected Areas (WDPA) and then assigning the governance types recorded on the WDPA to the GRPS conservation areas accordingly. For the remaining unmatched GRPS conservation areas, we asked country- and regional-level experts to assign a governance type, following the WDPA scheme, where possible. Through this process we assigned governance types to 425 GRPS conservation areas (out of 588) from 25 countries (Figure 1). We were unable to assign governance types to 163 of the 588 GRPS conservation areas for various reasons (the most common being that an GRPS conservation area would contain multiple sites with different governance types).

Implications of bias in the governance type covered by the survey

This process of assigning WDPA governance types to the GRPS conservation areas enabled us to highlight and quantify the extent of governance type representation in the GRPS (Table 1). Our results show that the GRPS mostly covers conservation areas that fall under the governance type category of Governance by government (81 per cent) – a predictable bias given that public-sector rangers were an intentional focus of the GRPS (Belecky et al., 2019). This Governance by government category contains three of the most abundant governance types: Federal or national ministry or agency (57 per cent of all classified sites), Sub-national ministry or agency (14 per cent) and Government-delegated management (10 per cent). The next most abundant governance type category is Indigenous people and local communities (11 per cent of all classified sites), which is dominated by the governance type: Governance by Indigenous peoples and local communities (98 per cent of sites with the Indigenous people and local communities governance type category). The governance type categories of Shared governance and Private governance both have scarce representation in the GRPS data, as do the governance types of Collaborative governance (6 per cent of all classified sites), Non-profit organisations (2 per cent), Individual landowners (0 per cent) and Indigenous peoples (0 per cent).

The GRPS is the largest global survey of ranger perceptions and experiences, and has yielded useful, broad insights into various aspects of their professional lives, albeit mostly restricted to state-governed protected and conserved areas. The GRPS data emphasises that working as a ranger remains immensely arduous, often as a result of long hours in challenging conditions, inadequate resource and training provision, and strained relationships with local communities (Belecky et al., 2019). These insights helped spark a groundswell of new collaboration and support for rangers (e.g. URSA, 2021), which might be particularly timely given the traction towards the target of 30x30 to expand the protected and conserved area coverage of the Earth's surface to 30 per cent by 2030 (Woodley et al., 2021) through effectively and equitably managed, ecologically representative, and well connected systems of protected and conserved areas. The fact that IPLCs manage or have tenure rights over a quarter of the world's land surface, intersecting 40 per cent of all terrestrial PCAs (Garnett et al., 2018), lends further urgency to understanding this governance structure and the individuals working within it, in order to achieve the global 30x30 target. These sites require sufficient support and recognition, including for their rangers.

Nevertheless, our brief study reveals deep biases in the degree to which the perceptions of rangers from different governance types are represented in the RPS data. The bias in GRPS sites towards Governance by government means that whilst findings from the analysis of GRPS data may well be relevant to many public-sector rangers, they will be less applicable to rangers and equivalent personnel in conservation areas with less government involvement in management and governance (e.g. areas with Shared governance, Private governance or Governance by Indigenous peoples and local communities).

Therefore, analogous future studies should endeavour to include an equal representation of sites covering all

Table 1. Summary of governance categories and types for conservation areas in the Global Ranger Perception Survey, as per the conservation area governance typology from the World Database on Protected Areas (IUCN & UNEP-WCMC, 2016)

Governance type category			Governance type sub-category		
Category	**Count**	**Percentage**	**Sub-Category**	**Count**	**Percentage**
Governance by government	346	81%	Federal or national ministry or agency	243	57%
			Government-delegated management	44	10%
			Sub-national ministry or agency	59	14%
Shared governance	24	6%	Collaborative governance	24	6%
Private governance	10	2%	Individual landowners	1	0%
			Non-profit organisations	9	2%
Governance by Indigenous peoples and local communities	45	11%	Indigenous peoples	1	0%
			Local communities	44	10%
Total	**425**	**100%**	**Total**	**425**	**100%**

governance types. Alternatively, there could well be value in carrying out another large-scale survey – akin to the GRPS – but with a focus on sites with little government involvement, like privately protected areas and sites governed by Indigenous peoples and local communities. Such research would complement the useful insights from the GRPS and therefore contribute to the development of a more comprehensive understanding of ranger perceptions and experiences across governance types in the world.

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RESUMEN

Cada vez son más las publicaciones que analizan las percepciones y experiencias de los guardaparques al implementar actividades de conservación. En particular, la Encuesta Mundial de Percepción de los Guardaparques, realizada por WWF, es la mayor evaluación mundial sobre las percepciones y experiencias de los guardaparques en relación a las condiciones de trabajo dentro de las áreas protegidas. Proporciona información sobre diversos aspectos de la profesión. A pesar de que el área protegida bajo manejo indígena y comunitario es vasta a nivel mundial, cuando se combinan los datos de la encuesta de percepción con el tipo de gobernanza de los sitios, encontramos que la encuesta está dominada por las áreas manejadas por organismos gubernamentales (81%), mientras que los sitios con gobernanza indígena y comunitaria están escasamente representados (10%). Dado este sesgo, los resultados de la encuesta son poco relevantes para las áreas que tengan menor participación gubernamental en el manejo, como son las áreas protegidas privadas y las gobernadas por pueblos indígenas y comunidades locales. Nuestro estudio, por lo tanto, concluye que las futuras encuestas a gran escala sobre las percepciones y experiencias de los guardaparques se beneficiarían de la inclusión de un conjunto más diverso de sitios en relación al tipo de gobernanza. Por otra parte, podría ser útil llevar a cabo una encuesta similar a la Encuesta de Percepción de los Guardaparques, pero esta vez centrada en las áreas protegidas gobernadas por pueblos indígenas y comunidades locales.

RÉSUMÉ

De plus en plus de publications explorent les perceptions et les expériences des garde-forestiers dans la mise en œuvre des activités de conservation. En particulier, l'enquête mondiale sur la perception des gardes forestiers (Global Ranger Perception Survey), menée par le WWF, est la plus grande évaluation mondiale des perceptions et des expériences des gardes forestiers en matière de conditions de travail dans les zones protégées et conservées. Néanmoins, lorsque les données de l'enquête sur la perception des gardes-forestiers ont été associées au type de gouvernance du site, nous avons constaté que l'enquête est dominée par les aires protégées et conservées gouvernées par des agences gouvernementales (81 %), tandis que les sites avec une gouvernance indigène et communautaire étaient peu représentés (10 %), malgré la vaste zone sous cette forme de gouvernance dans le monde. Ces biais dans la gouvernance signifient que les données de l'enquête seront moins pertinentes pour les aires protégées et conservées avec moins d'implication gouvernementale, telles que les aires protégées privées et celles gouvernées par les peuples indigènes et les communautés locales. Notre étude indique donc que les futures enquêtes à grande échelle sur les perceptions et les expériences des gardes forestiers gagneraient à inclure un ensemble de sites plus diversifié en termes de types de gouvernance. En outre, il pourrait être utile de mener une nouvelle enquête semblable à l'enquête sur la perception des gardes-forestiers s, en se concentrant sur les zones protégées et conservées gouvernées par des autochtones et des communautés locales.