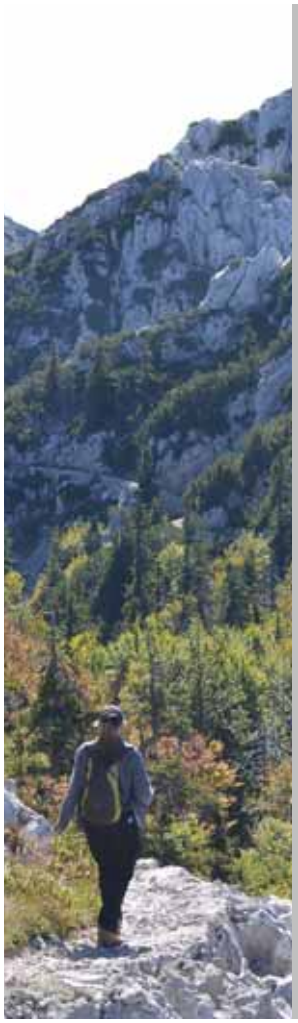

IMPACTS OF COVID-19 ON PROTECTED AND CONSERVED AREAS: A GLOBAL OVERVIEW AND REGIONAL PERSPECTIVES

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ABSTRACT

Protected and conserved areas (PCAs) throughout the world face huge challenges as a result of the COVID-19 pandemic. We give a global overview of impacts and responses. Protected area agencies, NGOs and research groups, together with the communities that support the management of PCAs, have conducted online studies to understand the overall impacts of COVID-19 containment measures on PCAs at regional and global levels. This paper summarises results from ten surveys, eight regional and two global, from 90 countries representing all continents except Antarctica. It draws lessons from different regions and contexts, and synthesises information on impacts and responses, particularly with regard to conservation and management activities, visitor services, revenue, stakeholder engagement, capacity, threats, illegal activities and neighbouring communities. Results vary; generally impacts have been most severe in Africa and Latin America, although many protected area agencies have evolved coping strategies and impacts are apparently not quite as severe as first thought. The paper also identifies future opportunities for PCAs in the post-COVID-19 era and proposes strategic decisions that may help cope with the current pandemic and prevent future ones.

Key words: Coronavirus, pandemic, protected areas, conserved areas, lessons learned

INTRODUCTION

The coronavirus disease (COVID-19) was first brought to global attention in December 2019 and declared a pandemic by the World Health Organization on 11 March 2020. The outbreak brought the world to a crisis posing unprecedented health, economic, environmental and social threats. Immediate action was required to minimise infections and control the spread of this zoonotic disease, suspected to be caused by human–wildlife contact (White & Razgour, 2020). As in most sectors, protected and conserved area (PCA) operations were scaled down or suspended, visitor facilities closed, workplaces shut, many staff withdrawn from duty stations and supply chains disrupted (Hockings et al., 2020). These measures were often instituted in the absence of emergency response guidelines and without

the necessary financial information, capacity, skills and technologies. While some PCAs may have benefitted from reduced visitation and pollution, others have seen increased illegal activity (Bennett et al., 2020). Impacts spread beyond PCA boundaries and concerns have been expressed about Indigenous people and local communities living inside and around PCAs (IUCN, 2020). Drawing inferences from recent outbreaks of zoonotic diseases such as Ebola, bird flu (H1N1), Middle East respiratory syndrome (MERS), Rift Valley fever, severe acute respiratory syndrome (SARS), West Nile virus and Zika virus – all of which have been linked to various forms of ecosystem degradation (Plowright et al., 2017) – it is clear that the underlying causes of these and other potential diseases need to be addressed to prevent future pandemics (Kavousi et al., 2020).

To understand how measures to control COVID-19 were impacting on PCAs, several online regional and global surveys were undertaken by a range of PCA practitioners, partners and stakeholders. The surveys were carried out within four months of the pandemic being declared, in Africa, Asia, Europe, Latin America and the Caribbean (LAC), Oceania and North America. They covered terrestrial and marine PCAs under various governance models (state, private, community/ Indigenous and collaborative).

This paper summarises the results. It draws lessons from different regions and contexts, synthesising information on the experience of dealing with the pandemic, the consequences for conservation and management of PCAs, lessons learned and emerging recovery strategies. It identifies opportunities for PCAs in the post-COVID-19 era and proposes strategies to reduce the risks of zoonotic pandemics and cope with any future outbreaks.

METHODS

Ten online surveys were independently prepared to help understand the impacts of the pandemic on PCAs at regional or global levels, the measures undertaken to address them, and to identify future opportunities for PCAs in the post-COVID-19 era (Table 1). The respondents included directors of PCA agencies, owners and managers of privately protected areas and community conserved areas, and other partners and stakeholders. Most questionnaires sought information on the impacts of COVID-19 on visitor services, revenue, PCA staff, conservation and management activities and neighbouring communities, with some also reporting changes in threats and illegal activities. Some questionnaires asked about innovations, strategies and actions taken to address the challenges posed by the pandemic, the success of such measures and lessons learned. One, which is reported separately because it adopted a rather different approach, looked explicitly at wildlife responses. Reports on the regional surveys are contained in supplementary online material. Ideally, identical surveys would have been used, but the spontaneous and rapid initiation of the surveys meant that this was not possible. Nonetheless, a rich array of material was collected quickly, during the first peak of the pandemic. While the surveys differed so much that direct statistical comparison was difficult, we have analysed each in turn and drawn overall conclusions and recommendations. Most surveys collected lessons learned, many in the form of recommendations.

The ten surveys comprised eight regional and two global assessments. Africa's survey was conducted by the IUCN -World Commission on Protected Areas (IUCN-WCPA) in collaboration with the African Wildlife Foundation and completed by the directors of protected area agencies in April 2020. IUCN carried out a similar survey for the Asia Protected Areas Partnership (APAP) targeting PCA agencies in the region in June 2020. A survey in Tiger range countries was conducted in May-June 2020. MedPAN, the network of marine protected area managers in the Mediterranean countries, launched a survey focusing on marine protected areas (MPAs) in the region in May. The rest of the surveys were carried out between June and August 2020. They include the Oceania survey that focused on public, private and Indigenous protected areas, along with community managed areas and locally managed marine areas. The North American questionnaire conducted by IUCN-WCPA was sent to all protected area agencies and related bodies in Canada and the USA, while the LAC survey, carried out by REDPARQUES and targeting its

Some protected areas in southern Europe reported heavier than usual visitation during the relaxation of lockdown in summer 2020. Velebit National Park, Croatia © Nigel Dudley

Table 1. Characteristics of the ten independent surveys on the impacts of COVID-19 on protected and conserved areas

Region	Countries	Organisational lead	Number of responses
Africa	Algeria, Benin, Cameroon, Chad, Ethiopia, Ghana, Guinea-Bissau, Madagascar, Malawi, Mozambique, Niger, Nigeria, Rwanda, Sao Tome and Principe, Seychelles, Somalia, Sudan, Swaziland, Uganda	IUCN and AWF	19
Asia	Bangladesh, Bhutan, Cambodia, Japan, Myanmar, Republic of Korea, Malaysia, Singapore and Sri Lanka	IUCN on behalf of the Asia Protected Areas Partnership	9
Tiger range states	Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Malaysia, Myanmar, Nepal, Russian Federation, Thailand and Viet Nam	Tigers Alive	77 responses from 40 PCAs
Oceania	Australia, New Zealand, Palau, Samoa, Tuvalu, Solomon Islands, Papua New Guinea, Kiribati and Fiji	IUCN	44
North America	Canada and the USA (Mexico was included in the Latin America survey)	IUCN	9
Latin America and the Caribbean	Argentina, Bolivia, Chile, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Mexico, Paraguay, Peru, Dominican Republic, Uruguay and Venezuela	REDPARQUES	14
Latin America species survey	Argentina, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, Mexico, Peru and Venezuela	Fundaciòn Tropos and Escuela latinoamericana de Areas Protegidas	40
Mediterranean marine protected areas	Albania, Algeria, Croatia, Cyprus, France, Greece, Israel, Lebanon, Monaco, Northern Cyprus, Slovenia, Spain, Tunisia and Turkey	MedPan	35
Privately protected areas (PPA)	Argentina, Australia, Brazil, Canada, Chile, Colombia, Costa Rica, Falklands (UK), Namibia, Nepal, Oman, Peru, Puerto Rico (USA), South Africa, Spain and the USA	WCPA PPA and Nature Stewardship Specialist Group	48
Frankfurt Zoological Society (FZS) supported protected areas	Germany, Ukraine, Belarus, Poland, Kazakhstan, Indonesia, Viet Nam, Ethiopia, Democratic Republic of Congo, Tanzania, Zambia, Zimbabwe, Brazil, Colombia, Guyana and Peru	FZS	29

members, was completed by the focal point for each country. A survey coordinated from Costa Rica looked at wildlife impacts in Latin America. Finally, we report on two surveys that sought global views. The first, conducted by the WCPA Privately Protected Areas and Nature Stewardship Specialist Group focused on privately protected areas (PPAs); the second carried out by the Frankfurt Zoological Society, targeted PCAs supported by that organisation. All surveys were completed by September 2020.

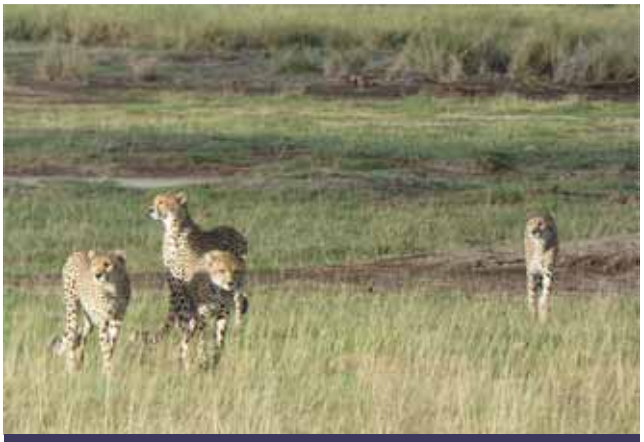
RESULTS

Given the diverse geographical, eco-climatic, economic, social, cultural, historical, religious, ethnic, racial, political and demographic environments within and between continents, the results of the surveys predictably differ in many ways. Some provided detailed information, including raw data, while others only released summarised highlights. This paper does not attempt to provide a detailed analysis of the surveys but rather regional and global overviews. Below we summarise each survey in turn before extracting key points, leading into the discussion section.

Africa

This regional survey assessed 23 basic activities normally carried out in PCAs, broadly focusing on biodiversity conservation, security operations, revenue generation and collaboration with stakeholders. Responses were received from directors of PCA agencies from 19 countries spread out across all African regions. The effect of COVID-19 on any PCA activity was rated 'high' if its impact on any of these activities was considered to be between 60 and 100 per cent, 'medium' (40-59 per cent), 'low' (20-39 per cent) and 'not important' (0-19 per cent). Ninety-four per cent of participating countries reported impacts of 20 per cent and above, although only high impacts (i.e., 60-100 per cent) are presented in this paper.

Most countries reported significant impacts on all operations. More than 70 per cent noted the effects on



Many protected areas provide sources of income for local communities through tourism that have proved irreplaceable in the short term. Cheetahs, Amboseli National Park, Kenya © Nigel Dudley

revenue generation from tourism and other sources, monitoring the illegal wildlife trade, and security intelligence. More than 60 per cent noted impacts on investigations of suspected illegal activities, training programmes, research and monitoring, the security of tourists and tourism-related facilities, and conservation work outside PCAs. Impacts on the protection of endangered species, conservation education and outreach, regular field patrols and anti-poaching operations were reported in more than 50 per cent of cases. Between 50 and 70 per cent of countries also reported high impacts on collaboration with stakeholders: these affected work with governmental bodies and local communities in more than 60 per cent of cases; whilst collaboration with private landowners, researchers and non-governmental organisations was affected in more than 50 per cent of cases.

Fewer than half the countries reported a high impact on the handling of emergency wildlife incidents. The maintenance of critical infrastructure was affected in fewer than a third of all cases and internal communications in a fifth.

Following heavy losses in revenue, just over a quarter of all countries reported that they expected to maintain basic PCA operations for up to one month; roughly the same number expected to keep going for several more months, but barely 20 per cent felt they would be able to operate beyond a basic minimum for 6-12 months. This level of impact was reported within one month of COVID-19 being declared a pandemic.

Over 80 per cent of countries attributed their reduced capacity to cope with the pandemic to insufficient funding, 67 per cent to COVID-related restrictions and 50 per cent to insufficient human resources due to chronic understaffing, and many of those available being sent home as a result of the pandemic. These were also identified as among the areas that needed urgent support to fight the impact of the pandemic. Eighty per cent of countries said diversification of income was a way to reduce overreliance on tourism and enhance the sustainability of PCAs. Other strategies included broadening partnerships, enhancing capacity and skills, reducing rural poverty and greater use of technology. All countries said that local communities and private landowners needed to be assisted economically in order to safeguard their livelihoods and reduce their reliance on PCAs.

Lessons learned

- The pandemic has the potential to reverse conservation gains already achieved, so urgent safeguarding measures should be put in place, such as emergency funding and support;
- Standardised emergency guidelines are needed on preventing, detecting, responding to and recovering from this and future pandemics;
- An emergency African Wildlife Crisis Fund should be established to support critical conservation activities and protect the livelihoods of the poor and vulnerable groups;
- There is a need to up-skill and resource the capacity of PCAs, and equip them with appropriate tools and technology to support research, monitoring, law enforcement, communications and partnerships;
- Diversification of revenue sources is needed to reduce overreliance on international visitors;
- A strong lobby is needed to encourage African governments to provide greater budgetary and policy support for PCAs;
- A strong partnership should be established between the conservation and health sectors at a national level to prevent or cope with future pandemics;
- Countries must invest in the restoration of degraded ecosystems to prevent future pandemics;
- Sustained support and economic empowerment is needed to help local communities and private landowners better conserve nature.

Asia

The Asia Protected Areas Partnership (APAP) survey was sent to protected areas agencies in 18 countries in June 2020. It was completed by 12 agencies in nine countries.

Three-quarters of respondents reported that PCAs had been fully or partially closed in response to the pandemic. The remainder reported that they remained open largely as usual, but with social distancing rules in place. New online activities, such as virtual tours, were introduced in some countries to compensate for reduced physical access to PCAs.

Three-quarters of respondents reported that conservation activities, such as patrols, anti-poaching, habitat enrichment, research and monitoring, had been largely unaffected, but one-quarter observed that some of these activities had been partially stopped. One respondent reported that their conservation budget had been reduced by half, affecting patrols, research and monitoring.

Fifty-eight per cent of respondents reported that engagement with local communities had been fully or partially stopped. Many events, including festivals and official meetings with local communities, had been cancelled, held under strict COVID-19 protocols or carried out virtually. Several respondents reported that special measures had been put into place to assist affected communities. These included donations of emergency supplies and the introduction of new and innovative mechanisms, such as 'drive-through' farmers' markets, where visitors could purchase locally grown produce from their cars (thus reducing the risk of exposure to Coronavirus).

Eighty-three per cent of respondents stated that staff numbers in their respective PCA agencies had remained unchanged, whilst 17 per cent reported staff reductions. However, there were concerns in some agencies about impacts on staff well-being, not only through direct exposure to Coronavirus, but also from the loss of opportunities for training and capacity building, as well as increased workloads. For example, some respondents observed that staff had been required to carry out extra duties, such as advising park visitors to abide by COVID -19 prevention measures, implementing pandemic prevention measures, carrying out additional patrolling and maintaining park facilities in areas with reduced visitation. Furthermore, lockdown and curfew had made reporting to duty a challenge for some officers. No staff recruitments, salary increments or additional budgets were reported.

Lessons learned

- Use of technology should be embraced more broadly, to address both conservation requirements (e.g. drones for surveillance) and visitor needs (e.g. virtual tours);
- Local communities should be more economically empowered to reduce their dependence on park resources;
- Rules and regulations related to social distancing (between people, and between people and wildlife) should be drawn up and disseminated;
- Procedures to prevent the spread of infectious diseases among visitors should be prepared and made available;
- Information and case studies should be shared among PCAs on all aspects of zoonotic diseases, their impacts on wildlife and their socio-economic consequences;
- Staff capacity in relation to safety and health issues should be enhanced;
- Sustainable funding sources for PCAs should be put in place.

Tiger range states

This survey was completed by protected area managers, rangers, and civil society supporting protected area management in government-managed protected areas. A total of 77 responses covering 40 PCAs were received from 12 out of the 13 Tiger range countries. Many reported that COVID-19 had impacted on funding and staff responsibilities and welfare, thereby compromising the ability of PCAs to achieve their conservation goals. It was reported that rangers were stretched and their jobs had become more difficult, with new duties allocated, including unfamiliar ones such as community health checks (see also Singh, in this issue). The provision of key supplies and equipment was disrupted in 60 per cent of PCAs, budget cuts were experienced in nearly half of them and community engagement activities stopped in 75 per cent. Nonetheless, the level of patrol coverage was reported to be stable and there was no

Ranthanbore National Park usually provides income for hoteliers, guides and restaurants, catering to an increasing domestic wildlife tourism market in India © Nigel Dudley

consistent evidence that threats had grown since the pandemic. Looking ahead, most respondents (76 per cent) were pessimistic about future budget allocations while 62 per cent were concerned about their ability to manage PCAs because of the pandemic.

Lessons learned

- Governments and donor agencies need to ensure funding levels remain or are increased in tiger PCAs across the region;
- Threats to PCAs, Tigers and Tiger prey are likely to decline if funding, effectiveness of legal systems and levels of community engagement are improved;
- Effectively managed PCAs will allow the protection of wildlife and wild places and help maintain an essential buffer between zoonotic disease pools and people.

Oceania

The results are based on feedback from 44 respondents, 26 from governments and 9 each from national and international NGOs. 31 responses were from Australia. The core operations most affected by COVID-19 were: maintaining relationships with stakeholders and volunteers; training; maintaining relationships with Indigenous landholders and managers; and carrying out research and monitoring. Core resource management activities, such as protecting species and fire management, were much less impacted. About one in five respondents said that at least 60 per cent of their visitor management work had been negatively impacted.

60 per cent of respondents reported that COVID-19 had only a minor impact on their law enforcement operations. Moreover, half of them reported that there had been at least a 60 per cent reduction in the delivery of environmental education. While a similarly large reduction took place in local employment from tourism, most respondents indicated that their ability to maintain or enhance visitor facilities had not been so heavily impacted.

Government funding was reported to be the most important source of revenue for most respondents and had not been significantly impacted. Other revenue sources included philanthropic support to communities and income from tourism. More than 60 per cent of respondents indicated that tourism-derived revenue was very or extremely important to local businesses, the local economy and the state/national economy. As expected, this revenue source had been significantly negatively affected.

The partnership activities most affected were conservation education, outreach and working with communities on issues such as invasive species management. Work with NGO partners, other government bodies and researchers was relatively little affected.

Nearly two-thirds of the non-government respondents indicated that they would not be able to maintain current operations for more than a year if current COVID-19 restrictions persisted. The rest of the respondents indicated that their ability to maintain normal operations was not at risk.

Lessons learned

- Agencies need to enhance their online presence and social media skills to maintain communication with the general public during closures, and to say when parks are reopened, especially for new park users;
- PCA visitor capacity should be assessed to avoid overload on some sites and enable better management of visitor flows; staff need training in online platforms;
- Cooperation between sectors of government must be enhanced to ensure good communication and cooperation, especially in emergency situations;
- Agencies can utilise the high use of protected areas in Oceania during the pandemic to increase the public and political understanding of the high value of natural areas to human health and well-being.

North America

Responses were received mainly from the federal agencies responsible for protected areas in Canada and the USA, with additional contributions from state, provincial and other jurisdictions in those countries. Initially, 44 per cent of visitor services were closed and 33 per cent partially closed; the rest remained open with social distancing. In the US, parks adjusted their visitation based on the local conditions of COVID-19 outbreaks. Some parks in areas with high outbreak rates closed completely while those in areas with low outbreak rates enforced social distancing, heightened hygiene measures and shut down visitor centres and other public facilities. In Canada, the national government closed all public spaces including protected areas, to visitors. A staged and gradual re-opening is being undertaken under public health direction and subject to social distancing rules.

The closures allowed some natural habitats to recover from the effects of historic use levels, whilst some park-

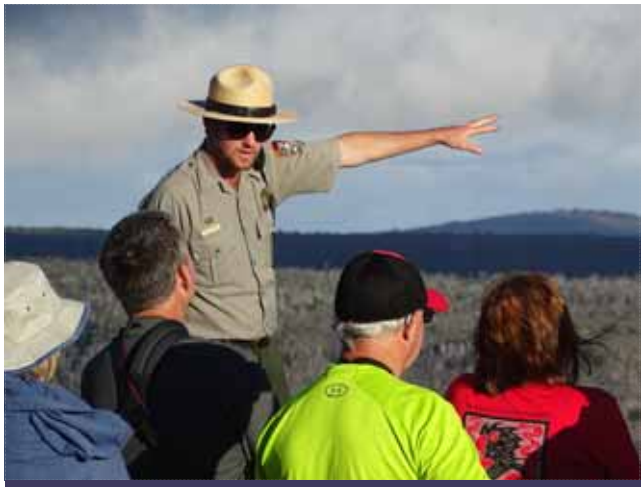
based wildlife moved into nearby developed areas causing human–wildlife conflict. Loss of revenue and shifting operational priorities presented management with significant financial and capacity challenges.

Some PCAs introduced new web-based and social media activities to compensate for reduced physical access. These include live programming, self-guided interpretive packs, virtual outreach programmes and tours, and podcasts.

During the initial lockdown, almost half the sites were fully or partially closed, with the rest remaining open with minor modifications. However, activities relating to visitor safety, monitoring, public compliance and animal welfare resumed shortly thereafter, in accordance with health and safety guidelines. Conservation activities have been resuming in a phased manner.

Nearly 80 per cent of public engagement, outreach and services to local communities ceased or were reduced. Nearly as many reported reduced staffing, mainly due to not hiring temporary summer staff, students and volunteers. This reduced visitor services, resource protection and restoration. Most staff had to work from home, while those few on site were required to adhere to disease-prevention protocols such as social distancing, repeated sanitising, face coverings and use of plexiglass barriers.

The large majority of PCAs had introduced steps to respond to COVID-19. These were mainly technological and included greater accessibility to digital media for meetings, public interaction and telework. Over half reported that their organisations were holding discussions in preparation for future outbreaks, covering topics such as codifying remote working arrangements, enhanced development of online resources, updating pandemic response and management plans, and adopting more remote data collection measures.



Protected areas have changed ways of interacting with visitors, radically reducing the kind of face-to-face contact which is valuable to build rapport with conservation aims. Volcanoes National Park, Hawaii, USA © Nigel Dudley

Lessons learned

- Appropriate systems should be put in place to enable quick communication;
- Establish emergency preparedness plans;
- There is a need to provide more support to local communities and privately protected areas;
- Conservation partners should provide guidance on how systems of PCAs can work together to manage this and future pandemics.

Latin America and the Caribbean

Responses from the LAC survey were received from the REDPARQUES focal points from 14 out of the 19 member countries, 12 from Latin America and two from the Caribbean. They reported that all visitor services were initially fully or partially closed, but gradual re-opening started subsequently, based on local conditions. Reduced visitation resulted in reduced income for PCAs and local communities and, in some cases, cuts in staff numbers and salaries; which (presumably) contributed to an increase in illegal activities such as logging, poaching, fires and settlements in some PCAs.

Conservation activities such as patrolling, anti-poaching, monitoring, research, control of invasive species and habitat restoration continued largely as usual in most PCAs. Remote surveillance and interventions against direct threats were prioritised to compensate for reductions in staffing and budgets. Drones, satellite images and other technologies were used to enable PCAs to do more with less.

In 57 per cent of reported cases, engagement, outreach and the provision of services to local communities in and around PCAs remained in place, but these were partially stopped in the rest. Reduced numbers of visitors greatly reduced income to local communities. Increase in community engagement through online platforms was reported. PCA authorities provided COVID-19-related support to local communities, including implementing government social assistance policies, food distribution, delivery of personal protective equipment and training in hygiene and safety measures.

Fifty per cent of all respondents reported that PCA staffing levels remained unchanged, the other 50 per cent reported a decrease that was attributed to safety measures and budget cuts, resulting in some of the remaining park staff being overworked. Greater use was made of phones, radio and internet communication. Most parks made more use of remote sensors, such as satellites and drones, and introduced virtual tours for 'visitors'. See also Box 1 for responses to a survey on wildlife behaviour change in Latin America.

Lessons learned

The survey identified that parks needed: sustainable financing; technology to allow remote surveillance and monitoring; strengthened capacities; increased education on the importance of PCAs for the well-being of society; and to disseminate the results of surveys to health-related organisations. The following steps were suggested:

- Cut out unnecessary face-to-face meetings in future and enhance use of technology;
- PCA visitor capacity should be assessed to avoid overload on some sites and enable better management of visitor flows;
- Emergency plans and safety protocols for staff and visitors should be developed;
- Managing present and future pandemics calls for development of adequate and appropriately trained and equipped human capital, including the use of technology to meet various needs;
- PCAs need improved waste management and sanitation, and enhanced access to basic services in order to cope with future emergencies and health protocols for the safety of the staff;
- PCAs will require adequate and sustainable funding;
- All citizens need to be educated on the importance of PCAs in supporting the well-being of society;
- PCAs of the various governance types are needed, and collaboration with local actors should be strengthened to compensate for the current budget deficits and staff cuts in publicly funded protected areas.

Mediterranean marine protected areas

Responses were received from 35 sites in 15 Mediterranean countries. Not all sites answered every question, making calculation of percentages difficult, but the survey revealed a rich variety of experience regarding marine protected areas, which had been poorly represented in several other surveys (see also Phua et al., 2021).

Most sites had closed at the time of the survey, although 11 remained open, some with restrictions. Twenty of the remainder had plans to re-open once the most severe restrictions had been lifted, while a few reported that future plans remained uncertain. The extent to which the public complied with restrictions sometimes changed over time, with increased illegal fishing. There were reports of fears of floods of visitors once restrictions were ended and differences between MPAs near cities and smaller communities, with people in the latter more likely to break the rules.

Only a few sites faced immediate reductions in funding, mainly due to reduced tourism but also sometimes from government cuts, with one MPA suffering a 60 per cent budget reduction. Nine sites had staff cuts but only two reported that they were currently unable to pay staff. Most MPAs had most people working from home, although some had partial or complete staff on site. Monitoring activities were affected in 25 sites.

Box 1: Wildlife behaviour changes in Latin America

A survey of 40 people in 32 PCAs in Latin America looked at observed changes in the prevalence and behaviour of wildlife (specifically mammals, land and water birds and reptiles). Those responding varied from field rangers to directors of PCA agencies. The survey focused on the impacts of COVID-19, particularly reduced numbers of visitors and vehicles. People from 23 PCAs reported changes in wildlife distribution, including species moving into new zones or returning to areas that had previously been abandoned, and new species moving into the area. A further 12 PCAs recorded more observations of key species, while in only one case did observations decline (the Giant River Otter, *Pteronura brasiliensis*, due to increased hunting and fishing). While many of the increases occurred among commoner species, positive changes were also observed in vulnerable species like the Spectacled Bear (*Tremarctos ornatus*) and some listed as endangered, including the Mountain Tapir (*Tapirus pinchaque*) and Grey-cheeked Parakeet (*Brotogeris pyrrhoptera*). One site reported changes in the pattern of daytime and night-time activity in the South American Tapir (*Tapirus terrestris*) and two reported behavioural changes in birds. This survey is the first continent-wide snapshot of behavioural changes in named species and confirms what had been suspected: that a decline in visitor numbers gave many PCA species valuable breathing space.

The survey sought information about whether the absence of staff and visitors had allowed rare species to colonise new areas, leaving them exposed once lockdown ended. While there were few reports of this happening, there were many concerns that a sudden boost in tourism at the end of lockdown might affect vulnerable species, including cetaceans, turtles, Monk Seals and the Kentish Plover.

Lessons learned

- There was great variation in the ability of sites to cope with the pandemic: some found productivity actually increased with people working from home, whilst others felt such systems failed to work. Training in remote working would be useful;
- Although some sites had contingency plans for sudden emergencies (such as earthquakes), these generally did not address pandemics;
- A temporary dramatic reduction in visitation had beneficial impacts, with reports of reduced pollution and a boost in fish numbers, but perhaps less dramatic than might have been expected;
- Governance and management bodies should facilitate the implementation of timely and adaptive management measures to allow MPAs to cope with the impact of a pandemic;
- MPAs relying heavily on tourism funding need to plan contingency sources of funding to cope with a pandemic;
- The network of MPAs provided a way to quickly share best practices among practitioners during the pandemic.

Privately Protected Areas

This summary of the impacts of COVID-19 on PPAs is drawn from 48 responses from 16 countries covering all continents. It provides a global snapshot of the situation faced by PPA owners and managers. Over 80 per cent of visitor services and facilities were fully or partially closed, causing significant reduction in revenues. Other funding sources dried up, including sponsorship contracts as many PPA supporters were also affected by the pandemic. As a result, some planned activities and investments were abandoned or postponed, with priority given to maintaining staff, paying salaries and supporting critical conservation activities. Fifty-seven per cent of the respondents reported reductions in staff numbers, mostly affecting temporary staff and volunteers. A few PPAs with endowment funds were somewhat cushioned from the worst impacts of the pandemic.

Due to financial hardship, 67 per cent of the respondents reported that conservation activities, including patrols, anti-poaching, monitoring, research, control of invasive species and habitat restoration, had ceased or been curtailed. Seventy-three per cent of the respondents reported that public engagements, outreach and the provision of services to local communities partially or fully ceased. To keep visitors engaged without physical access to PPAs, 33 per cent of respondents introduced new online services, including virtual tours, workshops, seminars and webinars, live Facebook activities and videos.

Forty-two per cent of respondents reported that they were engaged in discussions on how to prevent and/or cope with future pandemics. Among the measures discussed were: developing protocols for staff, visitors and researchers during pandemics; replacing face-to-face meetings with virtual meetings where possible; developing emergency management plans and guidelines; diversifying income to reduce overreliance on tourism; enhancing self-guided tours to reduce congestion on trails; developing high quality video clips to keep visitors engaged; and preparing guidelines to sensitise people on the role that natural areas play in human health and preventing pandemics.

Lessons learned

- The use of technology needs to be enhanced to enable improved remote monitoring;
- Best practice guidelines for developing virtual tools and educational materials for PPAs need to be established and made available;
- All people should be educated on the importance of PPAs and the connection between healthy nature, healthy people and sustainable living;
- The global community should be put on the alert and encouraged to prepare for the worst-case scenario in case of an even more deadly future pandemic;
- Guidelines on interactions between people and wildlife should be developed to prevent future Coronavirus-like zoonotic disease outbreaks;
- Visitor carrying capacities for PPAs should be established to ensure that economic pressures are not used to justify unsustainable visitor levels.

Frankfurt Zoological Society (FZS)

The survey targeted FZS project managers who forwarded the questions to PCA staff or discussed the survey with them. In total, the survey was completed for 29 individuals (9 in Europe, 8 in Africa, 10 in South America and 2 in South-East Asia) working in 16 countries.

PCA budgets remained, on average, unchanged in European and South-East Asian PCAs, but reductions of up to 60 per cent and 70 per cent were reported in African and South American PCAs, respectively. Half of the PCAs reported reductions in government funding, whilst planned reductions had been announced in Viet Nam. Income from entry fees and tourism operations were reported as falling across all regions, with a couple of exceptions in Eastern Europe. Some of the budget gaps left by these cuts and reductions were covered through emergency funds, reshuffling budgets, and from the core funds of the FZS. However, these were not enough for those PCAs that suffered massive budget losses and had to reduce operations or salaries. There were no major changes reported in funding by public donors, but there were concerns that reductions could occur due to the global economic crisis and a shift in donor priorities. Some private donors feared difficulties in maintaining financial support if their own finances were impacted.

About 65 per cent of PCAs reported negative impacts on staff: reduced salaries and allowances, being furloughed, working longer shifts, and fears of falling sick with COVID-19. Temporary staff were laid off, especially in South American and African PCAs. Staff in many PCAs struggled to complete their work remotely, which was particularly challenging in places with poor or no internet access and for staff without computers at home. Morale was adversely affected among at least 50 per cent of staff.

Respondents reported that PCAs were able to implement 80 per cent of their regular operations, but there were substantial regional differences. Whereas European PCAs were able to implement 90 per cent of their operations, South American ones could only undertake 40 per cent, mostly due to the strict containment measures implemented by governments. The most affected operations were: engagement with local communities (cuts affecting 79 per cent of PCAs); staff training (reduced/stopped in 76 per cent of cases) and biomonitoring (reduced in 52 per cent of cases). However, whereas regular community engagement was consistently reported as negatively impacted, some PCAs provided food and health support to local and Indigenous communities to prevent or minimise the impacts of COVID-19. Reductions in patrols occurred in 35 per cent of the PCAs, mostly in South America: all patrols ceased in Guyanese and Brazilian PCAs. However, a few African, European and Vietnamese PCAs (21 per cent in total) increased patrol efforts to counteract expected or observed increases in illegal activities.

An increase in bushmeat hunting was reported in 48 per cent of PCAs, an upsurge that was attributed to COVID-19 related unemployment, increased migration to rural areas and general economic hardship. Drug cultivation and trafficking, and gold mining increased in most South American PCAs already affected by these threats, caused by economic difficulties at national and local levels, and the absence of government and PCA staff. Threats associated with recreation were reported to decrease in 29 per cent of the cases but increased in some European PCAs.

A few PCAs in Peru and Tanzania reported changes in wildlife behaviour, with some species being observed in unusual places, presumably resulting from less visitation and human disturbance. Some of these reports were based on the analysis of camera trap data.

Lessons learned

- Capacity must be built to allow remote communication and implementation;
- Funding streams need to be diversified and resilience to shocks enhanced using contingency planning and reserves. Reliance on short-term funding agreements and single fragile sources like tourism is risky;
- Support to PCAs in times of crisis has been invaluable;
- Remote risks need to be identified and PCAs must plan accordingly, including developing guidelines and protocols for dealing with risks;
- Increased surveillance is needed in times of crisis, as threats may increase;
- Local communities are key PCA stakeholders and must be supported throughout this crisis, thereby strengthening relations with PCA and conservation staff.

DISCUSSION

The surveys reported above came from 152 reports, from 90 countries with every continent except Antarctica represented in the survey (although see Box 2). Some countries which did not respond to their own continent survey are at least partially covered by some of the specialist surveys, which covered 26 African countries, 21 from Asia, 17 from LAC, 13 from Europe, 9 from Oceania and 2 from North America.

Impacts: There were many commonalities in the impacts reported via the different surveys, but some regional differences emerged. It is encouraging that despite many difficulties, most PCAs are continuing to function; indeed, several reports are that the reduction

Box 2: Surveying impacts on protected areas in Antarctica

Forty members of the Scientific Committee on Antarctic Research's Standing Committee on the Humanities and Social Sciences are examining how the pandemic is impacting work on the continent. The study is organised into five thematic units: futures and governance, research and decision-making, tourism, perceptions of Antarctica, and wildlife–human interactions. It will involve horizon-scanning, interviews, surveys, social media analysis and desk-based surveys, and one key aim is to identify the most vulnerable research. Observed changes to date include cancellation of high-level meetings affecting governance and impacts on the Antarctic. Initial results are expected in the first half of 2021 (Lorenzo et al., 2020). Other impacts are projected, such as a downturn in research funding and activity, a long-term dip in cruise tourism and, if food security is impacted, increased pressure for fishing in the region at a time when it is more difficult for regulatory bodies to meet (Frame & Hemmings, 2020).

in visitation has provided a chance for some level of species and ecosystem recovery. Predictably, PCAs in the richer countries seem to be coping better than those in poorer countries. Least affected are countries in Europe, Oceania and North America. Medium impacts occurred across Asia; the most severe problems arose in Latin America, Africa and particularly in Eastern and Southern Africa. Many countries shut down their PCAs completely to visitors during the height of the first wave of the pandemic, particularly in LAC, although this was approached more regionally in North America (e.g. USA) depending on local prevalence of infection. Problems in Africa, in contrast, were due particularly to lack of finance. Some Asian countries listed rangers and wildlife protection as 'essential services' and thus these were permitted to continue.

The economic impacts of these closures, coupled with a collapse in international tourism and trade restrictions, have been significant for PCA agencies and individual PCAs in many countries. Reductions in government budgets and tourism revenues have had huge and immediate implications: PCA conservation and management functions have been disrupted, some staff cannot be paid, and some have lost their jobs and related benefits. As a result, several respondents felt the budgetary allocation for their PCAs would not last more than a few months under the conditions they found themselves in, with a risk of serious financial collapse. However, most countries have relaxed controls somewhat since then, so it will be interesting to see if these places have started to recover. The collapse of tourism and associated income had also hit people in local communities, who, in normal times, were able to generate an income from guiding, the hospitality trade, product sales, etc. – indeed in some cases they depend fully on tourism. Now many are left with little by way of support. This shows clearly the risks of relying so heavily on tourist income, particularly non-domestic tourism. The tourism sector is already vulnerable to political shocks and isolated terrorist attacks; now it has also been shown to be exposed to pandemics. Many respondents, particularly in countries of the Global South, where ecotourism finances much conservation and sustains many local communities, emphasised the need for alternative and diversified funding.

Government funding had been mostly unaffected at the time of reporting, although there are concerns about maintaining budgets in the face of a global recession, and there have been announcements of planned budget cuts for 2021. Some PCAs are reported to have lost their entire budgets already.

Despite the financial losses, there were efforts to maintain staff numbers and salaries. Not all surveys provided insights on the impacts of COVID-19 on the human resources of PCAs, but there were some reports of lay-offs, particularly of temporary staff. The payment of salaries had been secured, except in some cases where tourism revenue collapsed. Some PCAs and countries reported changes in staff duties and workload increases.

PCA operations have been affected as a result of COVID-19 containment measures and financial losses. Although most but not all PCAs seem to have maintained some level of management, there has been a widespread reduction and even total halt of community engagement and monitoring and evaluation work, as well as notable reductions in law enforcement and capacity building. Indeed, monitoring and evaluation has been one of the most widely reported victims of COVID-19 (e.g. Corlett et al., 2020), leading to a gap in monitoring data that probably affects conservation everywhere, potentially compromising trend analysis and reducing the ability to report on management outcomes. Virtually all government PCA systems and many others have switched many of their activities to remote, online engagement, with an inevitable impact on fieldwork, patrolling and enforcement in many but by no means all countries. However, most African and some Latin American countries lacked the resources, equipment,

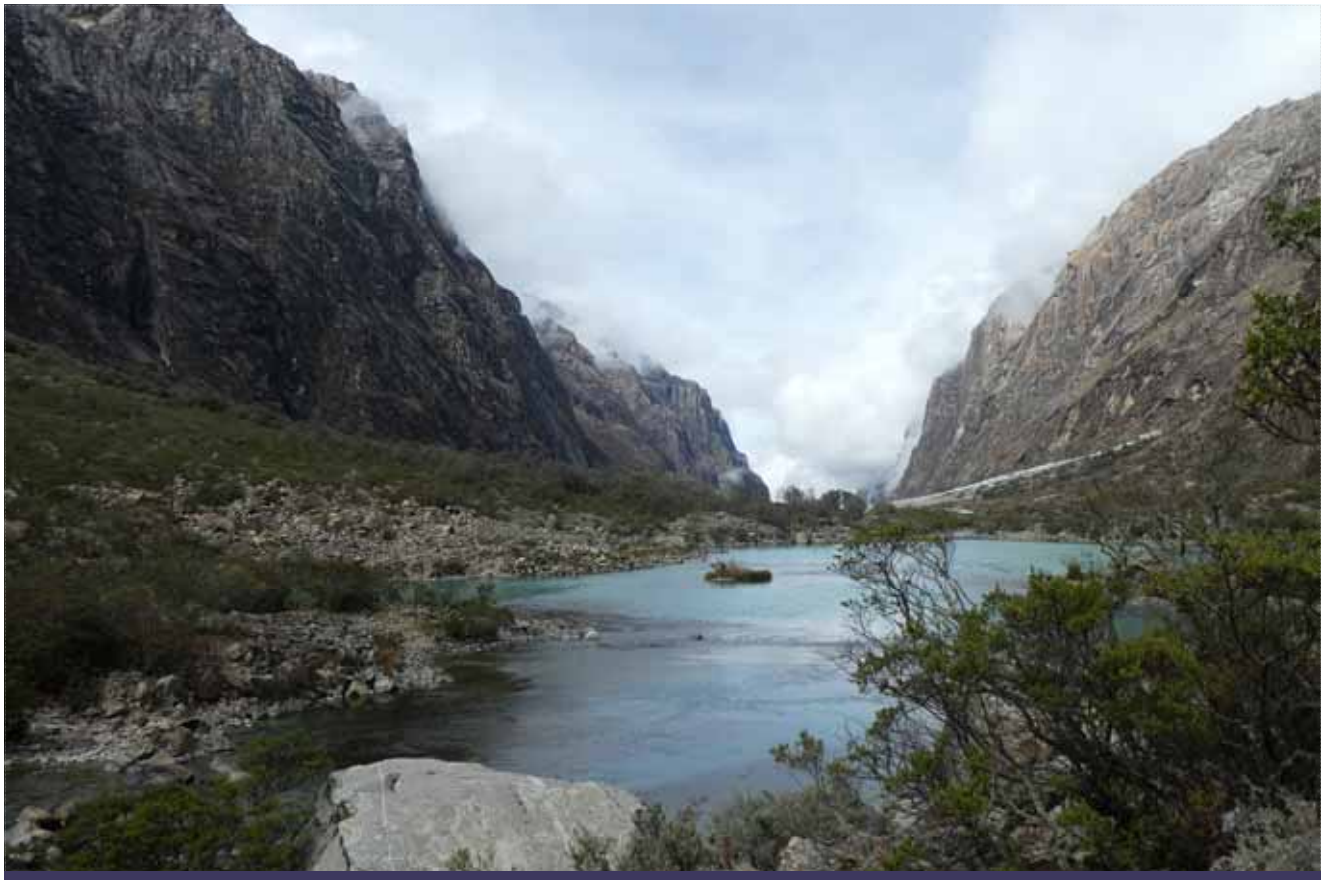
training, connectivity and appropriate technology to support online platforms in the office and the field.

Concerns about potential threats to PCAs were raised from the onset of the pandemic (e.g. Hockings et al., 2020; Lindsey et al., 2020). Encouragingly, there were relatively few reports of major increases in threats or illegal activities, although some incidents are reported. Denser populations in surrounding areas, particularly where people returned to their home villages from cities, is expected to result in an increase in pressure on natural resources inside PCA boundaries. In some countries, wildlife crime for commercial purposes may have been prevented by restrictions in domestic and international travel and trade (e.g. see Hockings et al., 2020).

Coping strategies: Given the restrictions on movement and the collapse of international tourism, some countries have put a great deal of effort into developing opportunities for experiencing PCAs remotely (e.g. through online materials, video blogs and static cameras) and developing interactive learning sessions. Some institutions have been examining the scope for self-guided exploration of PCAs to reduce risks to rangers from close contact with numerous visitors. Others are using emergency funds to keep going or are prioritising actions so that they can maintain core functions with reduced inputs.

The absence of emergency response guidelines, poor levels of preparedness and limited capacity to deal with a pandemic were recognised as key weaknesses. Many PCA agencies are now planning for the next pandemic, or other major, unexpected catastrophe.

Many changes instituted under COVID-19, or highlighted for development, were already either underway or recognised as necessary before the pandemic. The main long-term effect of the pandemic may have been to accelerate these changes. Principal among these is a switch to greater reliance on remote or home working, which many PCA agencies say will continue to some extent. There are clear limitations in terms of fieldwork and patrolling but opportunities in other areas, although even remote field working is becoming more practicable, with electronic monitoring and surveillance systems becoming cheaper and better all the time. A switch to online learning, including



Huascarán National Park, Peru © Nigel Dudley

MOOCs (Massive Open Online Courses), is providing opportunities for many rangers and other staff, who would previously have been unable to afford the fees and travel costs of face-to-face training. Though these changes are almost certainly here to stay, many PCA activities will still require boots on the ground.

Lessons learned: Despite the huge problems that the world continues to face as a result of the pandemic, there are cautious grounds for optimism. Many PCAs seem to be coping with the additional challenges, one way or another, although almost all have experienced serious challenges. There were more complaints about monitoring failure than major increases in wildlife crime; the former is something that can be responded to at least in part by increased use of technological solutions. But virtually no PCAs were fully prepared; there were no contingency plans for a major pandemic, including at national levels, even though something of this sort has been predicted by health experts for years.

If PCAs were poorly prepared for this pandemic, a more serious health emergency would have devastating effects unless present shortcomings are addressed. The pandemic has thus created an opportunity to argue that these critical needs must be urgently addressed. A post-COVID-19 strategy will need to invest in better planning, capacity development, appropriate technology to enable remote work, and sustainable and diversified financing. Local communities and private landowners must be meaningfully engaged and adequately supported.

These measures will not bear fruit unless efforts to protect healthy ecosystems and to re-establish an ecologically healthy relationship between people and nature are given priority as part of the One Health initiative. The Healthy Parks Healthy People initiative (Townsend et al., 2015) and other studies have already demonstrated the fundamental link between healthy ecosystems and human health and well-being, and more specifically, the role that PCAs can play in this respect. Undoubtedly, this will cost a lot, but it pales in comparison with the price humanity has paid, and continues to pay since the lockdown. Failure to act is not an option: “future pandemics are likely to happen more frequently, spread more rapidly, have greater economic impact and kill more people if we are not extremely careful about the possible impacts of the choices we make today” (Settele et al., 2020).

Recommendations: There are some actions that national governments, PCA agencies and institutions like the IUCN World Commission on Protected Areas, could take in response to the results of this survey. Our surveys tell us this is what is required:

Planning and research

- Strategic guidance, including use of scenarios, for PCAs and agencies to help prepare for future unforeseen events, including pandemics and other major disruptions;
- Clear guidelines on managing PCAs during a pandemic (drawing on experience during 2020);
- Technical and strategic guidance on minimising risks from the spread of zoonotic diseases;
- Collaboration between international organisations, governments, the private sector and others to develop new funding models for PCAs;
- Research and some practical advice on carrying capacities for PCAs, both in terms of visitor impacts and also from a health perspective in the medium term.

Funding

- Better and sustainable funding, including diversification of income sources;
- A global effort to help build diversified and sustainable funding pathways, including emergency allocations, for those PCAs which have been over-reliant on tourism;
- Emergency funds to support critical conservation activities and safeguard the livelihoods of the poor and vulnerable sectors of society.

Adequate capacity

- Capacity building for remote work and communications, particularly for poorer countries but also more generally (e.g. on teleworking, online training and use of more remote working technologies, such as drones for monitoring and surveillance);
- A global effort to recognise and improve the working conditions for rangers and staff while coping and adapting to new challenges.

Partnerships with the health sector and others

- Collaborations and joint initiatives between PCAs and other relevant sectors, including those responsible for land use planning and health, with the aim to develop inclusive strategies, policies and guidelines to reduce transmission and spread of zoonotic diseases;
- Establishment of a platform for sharing lessons on handling future pandemics and for reaching out to the broader global community to create awareness

of the link between healthy people and healthy nature.

Putting local people first

- Recognition of local communities and private landowners as critical allies for conservation of biodiversity who sometimes require economic and other kinds of support;
- Addressing rural poverty and safeguarding the livelihoods of local communities and private landowners. By creating space for conserving biodiversity, it is they who normally bear a disproportionate burden for the benefit of all humanity.

Finally, many respondents highlighted the importance of promoting the message that well-funded and effectively managed and governed PCA systems provide vital ecosystem services for human health and survival, and for tackling climate change, biodiversity loss and future pandemics. The OECD's recent policy brief rationalised why governments need to integrate biodiversity needs into their COVID-19 response and pandemic recovery plans (http://www.oecd.org/coronavirus/policy-responses/biodiversity-and-the-economic-response-to-covid-19-ensuring-a-green-and-resilient-recovery-d98b5a09/). It includes a call to scale up investments in biodiversity conservation, sustainable use and restoration.

SUPPLEMENTARY ONLINE MATERIAL

Reports on regional surveys

ACKNOWLEDGEMENTS

The authors would like to acknowledge all the busy managers, rangers and other conservationists who took the time to answer the questionnaires in these surveys.

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