



A Key Sector Forgotten in the Stimulus Debate: the Nature-Based Economy



Campaign
for Nature

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EXECUTIVE SUMMARY

In addition to the initial rescue packages already implemented to address the devastating economic impact of the coronavirus pandemic, countries around the world will need to develop stimulus plans to restart economic activity and re-employ the many people out of work. As they do so, stimulus would ideally target fast-growing, regionally or nationally important sectors that also promote health, address environmental challenges like climate change and biodiversity loss, and bring in foreign exchange export earnings. If those sectors are collapsing due to the lockdown and have not received adequate support so far, then the need for stimulus help is even more urgent and compelling.

In this report, we have collated evidence on how protected areas (e.g. national parks, marine protected areas) are in many cases central to local and national economies, and present a strong case for stimulus aid. They need emergency assistance to prevent laying off staff and breaking longstanding covenants with local communities, which also need support because the near shut-down of protected areas has left them without many basic services. Tourism to protected areas is often the main driver of jobs and income in rural and coastal communities, and protected area tourism revenues fund local community clinics, job training, and social safety nets.

Despite this concerning evidence, the nature-based economy has been overlooked in stimulus discussions so far.

The impacts to protected areas and local communities have already been stark. With the international lock-down response to the pandemic, tourism-based economies have collapsed, along with the social benefits and support that many of them provide. Local enterprises that depend on park visitors have lost almost all income. At the national level, nature-tourism-dependent economies such as those in Tanzania, Kenya, the Seychelles, Costa Rica, Ecuador, Nepal and Rwanda, are seeing or anticipating large GDP contractions. Facing shortages of food and income, some communities have turned to increased hunting in protected areas, while others no longer have the resources to guard against threats from organized crime. Rhinos have been killed in Africa, jaguars in South America, and ibises in Asia. Illegal miners have invaded protected areas in Peru. Kruger National Park in South Africa has even had to cull its own animals to feed the local population.

The resulting crisis is the equivalent of a factory not only being locked down, but also leaving the doors open so its main assets can be stripped out. If unaided by urgent financial support, the impacts could be severe and may lead to prolonged poverty, unemployment and depression in rural and coastal regions, especially in developing countries.

Furthermore, investing in protected areas presents a stimulus opportunity in its own right, creating jobs and incomes in the same way that traditional public infrastructure improvement projects have done in previous recessions. Studies show that protected area expansion and restoration would generate twice as many jobs as stimulus on more traditional industries such as oil and gas, or airlines; would boost tourism and economic revenue; and could generate high returns on investment, at least a 5:1 return:investment ratio, and in some cases as much as 100:1.

As an additional benefit, investing in and expanding protected areas would significantly reduce future economic risks from climate change and biodiversity loss, which the World Economic Forum suggests could be of even greater magnitude than the current pandemic. At the same time, investing in nature would help safeguard critical ecosystem services like clean water, flood and other risk mitigation, crop pollination, pest control, improved soil nutrients and rangeland quality, and would support other sectors, like fisheries, where overexploitation of nature threatens the long-term economic benefits delivered by the sector. The sectors more traditionally targeted by stimulus, however, including construction, manufacturing and fossil fuel based energy, are major drivers of climate change and biodiversity loss.

An enhanced system of effectively managed protected areas would also help reduce the risk of future pandemics. There is clear evidence showing that declines in the integrity of ecosystems increase the global risk of zoonotic disease spillovers and crises like the current coronavirus pandemic. Now is the right time for strategies that put halting ecosystem degradation at the center of efforts to achieve positive health, climate, biodiversity and sustainable development goals.

The IPBES Global Assessment on Biodiversity and Ecosystem Services identified the need for transformative economic and societal changes in order to mitigate the growing risks that stem from the destruction of nature. Investing in protected areas now has the potential to lay the groundwork for these transformative changes and deliver vast economic benefits and savings relative to investments in other industries more commonly targeted in economic stimulus packages.

CRITERIA FOR AN ECONOMICALLY EFFECTIVE STIMULUS

In order to avoid a significantly worse economic crisis related to the coronavirus pandemic, continued financial stimulus help is essential. Although governments and banks have attempted to support businesses and workers in rescue packages, further downturn still seems inevitable, with extensive job losses and company failures expected. Additional stimulus will therefore be needed to speed and ensure rapid economic recovery.

An economically effective stimulus has specific characteristics, identified in the wake of the 2008/9 global economic crisis. In particular, stimulus help should target¹²:

1. sectors that are badly affected, yet economically important;
2. sectors that received inadequate help in the current stimulus round;
3. regions that risk economic collapse without help;
4. sectors that expect future growth and bring in foreign exchange; and
5. sectors that are important for other political priorities including health, climate change, and preventing another economic crisis.

The first three points reflect short-term “rescue triage” – preventing the collapse of sectors that are important for jobs and GDP, either nationally or regionally. Importantly, this applies internationally as well as domestically. There is considerable concern that if developing regions do not receive more support, 49 million people will be pushed into extreme poverty and a quarter of a billion will suffer acute hunger by the end of this year (as predicted by the World Bank and the World Food Programme). Points 4 and 5 reflect longer-term economic planning. The global economy after the shock will see severe pressure on many currencies and a high burden of debt repayment – which can make debt owed in stable foreign currencies more expensive to repay. Rapid growth is needed both to restart the economy as vigorously as possible, and to build a tax base and wealth base that increases faster than debt interest. Foreign exchange export earnings are also critical to stabilize developing economies and prevent debt from ballooning.

One of the greatest political and attitudinal shifts under the pandemic is greater risk awareness. The widespread feeling is that no short-term recovery is acceptable if it could lead to an even worse situation. We cannot restart the economy in a way that escapes one economic risk, simply to throw us into the jaws of another. The main risks we are likely to face were summarized by the World Economic Forum in the Global Risk Report for 2020. At least 50% of those risks are related to the environment: climate change, extreme weather, and biodiversity loss (which itself contributes heavily to climate change, through land clearance and deforestation). The others are related to data and IT, asset bubbles, and the failure of governance.

THE NATURE-BASED ECONOMY: A BADLY-HIT SECTOR

One sector that meets all the requisites cited above is tourism and in particular, sustainable, nature-based tourism that benefits rural and coastal communities, where the wellbeing of an entire population is strongly linked to a visitor economy. Rural and coastal tourism is typically based around natural values in areas like National Parks and Marine Reserves. Prior to the pandemic shock, nature-based tourism was one of the fastest-growing subsectors³ of the tourism industry that contributed 10.3% of global GDP, 10% of all jobs in the economy, and was growing 40% faster than the overall global economy in 2019. In turn, the majority of nature-based tourism occurs in or around protected areas⁴, representing approximately eight billion annual visits in total⁵.

It is easy to forget this nature-based economic sector because for many, the phrase “the economy” generates an image of factories and offices, rather than natural spaces and protected areas. However, a number of rural areas have developed strong revenue-generating economies based on the protected area(s) with major income and employment effects in the surrounding region. Most directly, nature preserves attract tourist spending into rural and remote areas, providing hospitality sector opportunities (e.g. overnight stays), employment and livelihoods in all the supply chain services involved. Examples range from US and European National Parks, to African safari destinations, to coral-reef islands and Amazon destinations^{4, 5}. In the developing world the economic and social importance of protected areas often goes much deeper. Multiple parks make direct cash transfers to the local community, or support them by providing health clinics, education, infrastructure, and livelihood opportunities⁶. For example, revenues from gorilla tourism in Rwanda are shared with local communities⁷; Kibale National Park provides health clinics for the local population⁸; the community conservancy model around Kenyan parks similarly provides schools, clinics and grants for local communities; and Pench Tiger Reserve in India runs cooperatives and training for local people to work in five-star hospitality industries.

With the international lockdown in response to the coronavirus pandemic, these rural and coastal tourism-based economies have collapsed, along with the social benefits and support that many of them provide. For example, a survey circulated globally shows that in the vast majority of cases in Africa (72%), visitor cancellations were running at between 75% and 100% and consequently, 84% of tourism operators in protected areas expect over half of their staff to be made redundant or put on reduced wages. Similar reports have been received from Asia and from Latin America, where the virus outbreak is now dramatically increasing in its intensity. The reports are manifold, and some of them are collated in Table 1. Local enterprises that depend on park visitors have lost almost all income. At the national level, nature-tourism-dependent economies such as in Tanzania, Kenya, the Seychelles, Costa Rica, Ecuador, Nepal and Rwanda, are seeing or anticipating large GDP contractions.

And yet, many protected area enterprises have received little government assistance so far. For example, the economy of Tanzania is heavily dependent on Serengeti tourism, but because there is no official lockdown, ecotourism operators there are not eligible for financial assistance from the government. The lockdown has also affected the Indigenous Peoples and local communities who live in the protected areas, many of whom are unable to access basic supplies or supplement their incomes (Hauke Hoops, pers. comm.). Even in developed countries such as the USA, economies around parks like Acadia and Glacier National Park have all faced the loss of almost 100% of visitor revenues (David Mac-Donald, pers. comm.).

Spotlight on South Africa

Government operated reserves and conservancies have more resources to combat poaching. Private reserves are more at risk due to the loss in tourism and game sale revenues.

Local crafters and hospitality staff at local lodges living around the Kgalagadi Transfrontier Park in SW Botswana and NE South Africa have lost their source of income.

Even closed lodges must maintain pumps and generators and other infrastructure. Without these, lodges cannot reopen.

At least nine rhinos have been killed in South Africa.



Photograph by Chris Johns, National Geographic

A second stream of funding that supports protected areas and their local communities is based on investments, either by conservation bodies themselves or by philanthropic foundations that rely on their own investment incomes. SARS-CoV-2 (the virus that is responsible for the coronavirus pandemic) has caused the value of investments to fall heavily as stock markets crashed and dividend payments were suspended. Consequently, we have received many reports that philanthropic donors have reduced their support they can offer, and parks depending directly on endowment-based Conservation Trust Funds have seen a dramatic drop in income (where much of that income is again distributed to support the local economy).

Overseas Development Assistance (ODA) is the third major stream of financial support for protected areas. In many cases, ODA provides vital resources for management and socio-economic activities in surrounding areas. Currently it is unclear what the exact impacts of the current pandemic on ODA budgets in 2020 and beyond will be, predictions by the International Monetary Fund this April show that economic recessions in donor countries may sharply reduce ODA levels, especially if donors reduce the share of national income spent on aid. This could further exacerbate the financial situation of protected areas and associated beneficiaries.

In addition to having some of the largest income-flow losses, the protected area sector has an especially high risk of capital loss, which could lead to prolonged poverty, unemployment and depression in rural and coastal regions, especially in developing countries. Local economies based around protected areas depend on maintaining natural visitor attractions such as tigers or forest experiences. Declining in enforcement capacity and economic desperation generated by the pandemic have led to natural capital losses, as animals are poached and forests are illegally felled (Table 2).

Rhinos have been killed in Africa, jaguars in South America, and ibises in Asia. Encouraged by the shortages of locked-down enforcement staff, illegal miners have invaded protected areas in Peru, potentially poisoning watercourses (Hauke Hoops, pers. comm.). Poaching of wild meat (bushmeat) species such as antelopes and deer is already occurring in communities desperate for food or income, and Kruger National Park has even had to cull its own animals to feed the local population (T. Tear, pers. comm.). Although not exclusively caused by the current pandemic, deforestation of the Brazilian Amazon was 55% higher in the first four months of 2020 than in the same period last year.

This is the equivalent of a factory not only being closed for business, but also leaving the doors open so its main assets can be stripped out. Tourists often come to see charismatic animals such as rhinos and tigers, and if those species are poached and decline, paying visitors choose different destinations instead (or just stay away)⁹. Only one third of tourists to India's most visited protected areas, Ranthambore and Kanha, would still visit if there were no tigers to see¹⁰. Additionally, coral degradation can severely impact tourist arrival numbers^{11,12}. Carbon or ecosystem service payments will also be reduced if illegal forest clearance occurs.

Spotlight on Madagascar

Newer protected areas rely on the Madagascar Biodiversity Fund (Fondation pour les Aires Protégées et la Biodiversité de Madagascar, or FAPBM) which is jointly funded by the Malagasy government, Conservation International, and WWF. The FAPBM capital is placed on financial market where income is generated, a global recession will hit this fund and the newer protected areas particularly hard.

There are concerns about the loss of future funding due to the suspension of the next cycle of grant applications for NGOs.

There are growing concerns over the illegal collection and transport of timber from primary forests.

The loss of tourism revenues is reducing family household incomes. Loss of income could lead to an increase in illegal activities such as land occupation, exploitation, hunting, trafficking, clearing land for crops, overfishing, charcoal manufacturing and/or mining. Urban out-migration from coronavirus may exacerbate this.



Photograph by Luis Marden, National Geographic

The association between protected areas and local and regional economies depends on slowly-built relationship capital. Community conservancies, such as those created around the Masai Mara, strongly illustrate the time it takes to delicately build a social contract between local agriculturalists and conservationists, so that both the community and biodiversity can reach a state of mutually shared benefits – income, education and healthcare for the community, conservation of biodiversity, and a major contribution to national tourism and GDP flows. All of this is now under threat as revenues disappear and economic relationships become strained. The sharp drop in visitors leaves conservation areas unable to finance their obligations to the local communities, threatening to undo the entire mutually beneficial economic system.

Marine protected areas (MPAs) have been similarly affected as terrestrial ones. The tourism economy that provides much-needed revenue for recurrent marine protected areas budgets has collapsed. In the Galápagos Islands National Park, for example, 60% of the annual budget comes from tourist access fees. In addition, the plummeting demand for fish and the selling prices along the supply chain has reduced fishermen's incomes and purchasing power. In overfished areas around some MPAs (many of which now lack monitoring and surveillance due to budget cuts), this has prompted some local fisher-men to fish illegally inside marine protected areas. For instance, local witnesses report that some fishermen have taken advantage of reduced surveillance to use illegal fishing gear within the Galapagos Marine Reserve to catch fish to be sold locally.

Spotlight on the Seychelles

The local economy has lost revenue from the drop in access fees and Corporate Social Responsibility (CSR) Tax. The government has guaranteed to pay salaries for all direct protected area employees for 3 months, but no other support for protected areas. Large tourism companies have unpaid invoices from February and March which has disrupted cash flow into the economy.

Nature Seychelles had to stop its Conservation Boot Camp, a program that contributed to funding.

The lack of tourists may be contributing to the poor reproductive success of White Terns and White-tailed Tropic birds, possibly due to increase in predator density on trails now diurnal predators are not deterred by tourists.

The Seychelles has also noted more illegal fishing in the EEZ since January 2020 than in previous years.



Photograph by Manu San Felix, National Geographic

Spotlight on the Galapagos National Park and Marine Reserve



Unemployment and loss of revenue for local people involved in conservation.

The Galapagos National Park and Marine Reserve has lost an estimated 60% of revenue due to the shortfall in tourism access fee revenue since the halt of tourism. It has lost additional revenue from scientific studies that have ceased in the area.

In the absence of a tourist-driven economy, the local community has suffered from a lack of income for service providers. There has also been an increase in the use of illegal longlines that cause significant bycatch of sharks, sea turtles, and other marine megafauna.



Photograph by Pristine Seas, National Geographic

The longer-term economic impacts of these changes are obviously still unknown for SAR-CoV-2, but are well observed for very similar past crises. In Cameroon in the mid-1990s, a major economic crisis caused a migration back to the villages and a large spike in poaching, hunting and raffia collection in local forests, as the community's relationship with nature changed. This unsustainable harvest caused inevitable declines in biodiversity and natural resources, and by removing the last source of income and food, created poverty worse than the impacts of the crisis itself¹³. During the 1997 Asian crisis, increased pressure on forests caused water shortages in Thailand and Laos and the notorious region-wide "haze" of air pollution from forest clearing. At the same time, government environmental spending was cut reducing control and monitoring of forests and exacerbating the problem¹⁴.

In summary, crises in the developing world tend to cause migration and unsustainable exploitation of natural resources, while also disrupting the ability of governments to control environmental misuse or giving governments opposed to conservation opportunities to rescind environmental protections. The result is often greater poverty and destruction (overharvesting) of the last remaining sources of free food and income. This vicious cycle can be avoided by targeting short-term financial help to rural economies that have developed sustainable relationships with protected areas.

SUPPORTING FUTURE GROWTH AND BRINGING IN FOREIGN EXCHANGE EARNINGS

Economic regions based around protected area visits fulfill the conditions cited above for recovery stimulus assistance. The existing system of protected areas and tourism facilities often supports less well-off populations in rural and coastal areas, and so financial help is essential to buffer them from the current collapse in visitor mobility, and any money received would be put to work immediately. Failing to support the system of protected areas would cause extensive unemployment and poverty in areas with few other economic opportunities and little ability to cope with such a downturn. This could occur even in communities built around protected areas in wealthy countries, but across the developing world where social safety nets are weaker, the human and economic impact is expected to be particularly severe. Much of the poverty and hunger predicted by the World Bank and World Food Program would strike these communities, if they do not receive help.

Any collapse of the system would also cut off one of the major sources of foreign exchange export earnings just when they are needed most. Tourism is a leading source of export earnings in 20 of the 48 Least Developed Countries and has been generating a steady growth in at least 10 other countries¹⁵. An analysis of World Bank data shows that the rate of growth of tourism export earnings in lower-income countries and Sub-Saharan Africa was 5-6% per year, twice the global average for 2011-2018. At the same time, exchange rate depreciation against the dollar has already reached over 15% in Brazil, Colombia, South Africa and Uruguay and over 20% in Russia and Mexico. Such large spreads are likely to have severe inflationary consequences, enhancing the need for growth in both revenues and foreign exchange. Stimulus can therefore be international as well as national, with governments in countries like Kenya, India and the Seychelles providing some level of assistance and stimulus, necessarily supplemented by aid or philanthropic funding.

The first visitors are likely to be nationals who have been confined in their homes for many weeks, as illustrated by the floods of visitors to natural outdoor areas at the first lifting of lockdown restrictions. It may take longer for international tourist visits to begin to drive income in foreign wildlife parks. Some operators are reporting an imminent release of pent-up demand for such holidays, while others are expecting a continued nervousness for the rest of the year, and bookings returning more in 2021. However, none of that can occur if local businesses close or staff migrate away from the area in desperation. The whole point of stimulus is to prevent economic contraction while promoting economic regrowth. With few other alternatives, the protected area-associated economy could suffer one of the worst economic contractions without help, but also enjoy some of the most impressive return of economic activity if supported.

The need to restore and expand the protected area system presents a stimulus opportunity in its own right, creating jobs and incomes in the same way that classic public infrastructure improvement projects have done in previous recessions¹⁶⁻¹⁸. Staffing of protected areas is often inadequate and infrastructure is often crumbling^{19,20}. Even in the existing protected area/visitor system, infrastructure has also become degraded due to long periods of underinvestment, with visitor facilities becoming unusable. Many protected areas would also benefit from ecological restoration²¹, adding to the restoration sector's current economic value of \$25 billion per year in output and 221,000 jobs. Studies have shown how protected area expansion and restoration would boost tourism and economic revenue, would generate twice as many jobs as stimulus on more traditional industries such as oil and gas, or airlines, and could generate high returns on investment (at least a 5:1 return:investment ratio, and in some cases as much as 100:1)²²⁻²⁴. The additional benefit is that future economic risks from climate change and biodiversity loss are greatly reduced, whereas the sectors more traditionally targeted by stimulus (including construction, manufacturing and energy) are major drivers of climate change^{25,26}. Box 1 describes restoration opportunities in greater detail.

REDUCING RISKS RELATED TO HEALTH, CLIMATE CHANGE AND BIODIVERSITY LOSS

Above and beyond the fact that including protected areas in fiscal stimulus packages makes financial sense, public concerns today are centered on health and the importance of pre-empting major economic risks. The World Economic Forum's Global Risks Report 2020 suggests that climate change and biodiversity loss could cause economic losses of even greater magnitude than the current pandemic. However, that report was released before the pandemic gripped the public imagination, and so reducing the risk of future epidemics should be added to the list of priorities.

An enhanced system of protected areas would be a "triple win" contributing strongly to all three goals of health, climate change and biodiversity conservation. The positive health impacts of nature are broad. Child health and survival are increased by living adjacent to a protected area, potentially due to cleaner water and enhanced economic opportunities^{27, 28}. Protected areas often form part of the local health infrastructure in developing countries, including by directly funding and constructing clinics²⁹. Access to forests and nature is associated with better outcomes for immune health, cardiovascular outcomes, hypertension and cortisol levels (a stress hormone)³⁰⁻³⁴. Well-maintained natural areas are also critical for mental health, a fact that has come to prominence in populations emerging from lock-down³⁵. Pandemics themselves, such as SARS-CoV-2, often arise when natural areas are degraded and broken up, causing heightened contact between wildlife and people, each one of which increases the chance of another virus jumping the species barrier into humans³⁶⁻³⁸. Increased human take-over of unprotected natural spaces, and even illegal incursions into protected natural spaces for bushmeat and hunting, have both been linked to the current global health crisis. Box 3 describes the scientific evidence on this topic in more detail.

The potential carbon mitigation opportunities and long-term avoided economic damages from investing in nature are vast, as discussed in more detail in Box 2. For example, tropical deforestation accounts for 8% CO₂ emissions, and expanding the currently inadequate protected area system could greatly slow unregulated logging and clearing, as part of nature-based climate solutions³⁸. Protecting and encouraging the regrowth of secondary forests could also be a powerful mechanism for promoting carbon sequestration. Coastal ecosystems such as mangroves, tidal marshes and sea grass meadows sequester and store more carbon per unit area than terrestrial forests and are now being recognized for their role in mitigating climate change.

Protected areas are also fundamental to the preservation of biodiversity⁴⁰ and the delivery of ecosystem services (such as clean water and flood mitigation). Scientists are clear that the current protected area system is too small to achieve international biodiversity and climate targets. Current international policy goals for the Convention on Biological Diversity suggest that protected areas on land need to be doubled in extent, and marine reserves need to be quadrupled due to the inadequate extent of areas currently conserved.

BUILDING TOWARDS A MORE SUSTAINABLE FUTURE

Over a longer horizon, the Global Assessment from the government-appointed Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has emphasized that the global economy will only be able to sustain itself over the coming decades by moving away from an old model based on continuous growth and high consumption, and towards an approach that values sustainability.

Currently, the global economy is extracting natural resources at a rate greater than they can be replenished, threatening long-run economic benefits⁴¹. Many of the values reflected in the IPBES assessment emphasize the non-monetary aspects of human life, including health and happiness. There is a widespread sense that such a shift in values has occurred in households across the world, as the importance of life and wellbeing has trumped the previously dominant importance given to wealth and consumption. In the final analysis, a stimulus package that could unite short-term economic recovery with progress towards this long-term transition would be the ultimate win-win, as Box 2 explores in more detail. In many ways, stimulus directed at the typically vibrant economic activity around protected areas would help achieve that goal.

A protected-area stimulus package also helps resolve the debate between those who call for the current status-quo economy to be rescued and those who argue that the crisis presents a longer-term opportunity to build a more sustainable future (a "green" stimulus⁴²) that acts as the first step towards a vision for the future and reduces major risks. As described above, protected areas are central to one of the fastest-growing sectors of the status quo economy, but the sector differs from other status-quo options in its ability to reduce the key mid-term economic risks of climate change, biodiversity loss, and poor health outcomes. Expansion and restoration of protected areas could function as the equivalent of the post-Depression New Deal, using public funds to generate employment and economic regrowth, but spent on actions that fulfill the need to reduce climate change and biodiversity risk, moving towards a more sustainable economy that operates within planetary boundaries⁴³.

SYNTHESIS

Prior to the current pandemic, economies linked to protected areas were some of the most vibrant growth sectors of the global economy, with particular importance in areas such as Sub-Saharan Africa or small island nations. As visitor numbers and donor endowments collapse with the current pandemic, those local economies are some of the worst affected, and their human populations are often some of the least resilient. And yet so far, they have been often overlooked in stimulus discussions. To prevent the breakdown of all these systems, it is urgent that rescue stimulus funding provide a stopgap, maintaining both incomes and confidence in the systems.

Stimulus can be both direct and indirect. Protected areas, many of which have lost over half their income, need emergency assistance to prevent them from laying off staff and breaking longstanding covenants with local communities. A second target of assistance are the communities themselves, who need support because the near shutdown of parks or park incomes has wiped out their livelihoods and services. Community assistance is critical to hold together the entire model of a protected area/community cooperative 'business ecosystem.' Governments and international financial institutions should be investing in protected areas now to save these job-creating industries, often the cornerstone of local economies, from collapse. Stimulus for larger industries can be made conditional on causing no further harm to the public goals of climate or biodiversity by mitigating their negative impacts using the mitigation hierarchy.

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Table 1. Case studies of collapses in local economies dependent on protected areas

Unemployment and loss of revenue for local people involved in conservation	<p>Madhya Pradesh, India: nature tourism industry in four major parks employed 2,526 people, 82% from bordering park communities. Those bordering park communities have been found to be up to seven times better off than neighbouring villages without economic benefits from national parks, and had better health and education.</p> <p>Africa, survey of protected area tourism under coronavirus: in the vast majority of cases (440/571), visitor cancellations were running at between 75% and 100%. Consequently, 84% of parks expect over half of their staff to be made redundant or put on reduced wages Tanzania: No 'lockdown' in Tanzania so local ecotourism operators aren't eligible for government assistance. Consequent loss of tourism for safari operators has knock-on effect for car mechanics, hotels and local aviation companies.</p> <p>Enduimet Wildlife Management Area, Tanzania : 10/35 anti-poaching personnel in nearby Enduimet Wildlife Management Area, Tanzania lost their jobs due to budget shortfalls.</p> <p>South Africa and Kenya: Issue lies with funding – reserves and conservancies operated by government have more resources to keep anti-poaching activities (i.e. poachers) going. Private reserves much more at risk to loss in tourism and game sale revenues.</p> <p>Seychelles: Loss of access fees and Corporate Social Responsibility (CSR) Tax to local economy. Seychelles government has guaranteed payment of salaries for all direct PA employees in Seychelles for 3 months, but no other support for PAs. Large tourism companies that bring in tourists have not paid invoices for February and March so cash flow disrupted.</p> <p>Kgalagadi Transfrontier Park, SW Botswana and NE South Africa: Xaus Lodge supports local Khomani San and Mier communities. 32 hospitality staff, guides and resident crafters out of jobs. Calling for funds – 50% to local crafters and their families who now have no income (do not receive any unemployment benefits). 30% go to lodge staff and families who are supported by unemployment benefits (but will have very little income once they receive no further unemployment benefits). 20% will go to lodge infrastructure as without maintenance on pumps and generators the lodge won't be able to reopen.</p> <p>Benguerra Island, Mozambique – Africa Parks manages Bazaruto Archipelago where many islanders depend on earnings each day to purchase food and water.</p> <p>Living Irrawaddy, Myanmar: social business supports local communities to operate community-based ecotourism (1, 2 or 3 day tours) and manage dolphin conservation zones - drastic reduction in visitor numbers reduced their income.</p> <p>Bwindi Impenetrable National Park, Uganda: Change A Life Bwindi charity trains former poachers in beekeeping, mothers in basket weaving and teenage girls (who are unable to afford schooling) in tailoring. Offer 'community experiences' where guests visit local villages and experience daily life in the community. Take advantage of being near to protected areas where western tourists are likely to also pay them a visit. Rangers in park warned that loss of income from protected area will negatively impact this charity and its community project.</p> <p>Costa Rica: Park had, on average, positive and significant effect on wages (but magnitude varied considerably). Wages close to parks higher for locals living near tourist entrances. No robust evidence of positive impacts on locals living close to parks but away from tourist entrances. Demonstrates loss of tourists at these entrances could have major impact on local community.</p> <p>Fernando de Noronha Marine National Park, Brazil: An archipelago of 21 islands in the Atlantic Ocean, 354 km offshore from the Brazilian coast promoted for tourism and recreational diving. Generated ~\$22,802,000 a year to the local economy. Now has the highest incidence rate of coronavirus cases in Brazil (55 cases/3,000 inhabitants) and a lack of tourists has effectively shut down the local economy.</p> <p>Zanzibar: 100% loss of income in Chumbe Island Coral Park the economic shocks and increasing poverty in nearby communities (where livelihoods are often also part of the supply chain for tourism, from farmers and fishers to handicraft makers) is already resulting in increased levels of poaching for bushmeat and unsustainable resource use</p> <p>USA and Canada: Many US National Parks closed to some extent. All Canadian National Park sites closed.</p> <p>Galapagos National Park and Marine Reserve: 60% of revenue lost because of the lack of access fees due to halt of tourism. No tourism income for service providers.</p>
Loss of revenue directly from researcher/scientist visits	<p>Ranomafana National Park, Madagascar: Scientific research Centre ValBio had 6 study abroad programs in 2019, but only one in 2020 after rest were cancelled.</p> <p>Seychelles: Nature Seychelles had to stop Conservation Boot Camp program. Paid programme contributed to funding conservation work and paying locals.</p> <p>Uganda: foreign researchers, volunteers and interns are no longer coming and paying fees to access Uganda Wildlife Conservation Education Center.</p> <p>Galapagos National Park and Marine Reserve: total loss of revenue from scientific studies.</p>
Loss in PA revenue from capital on financial markets	<p>Madagascar: newer PAs rely on Madagascar Biodiversity Fund (Fondation pour les Aires Protégées et la Biodiversité de Madagascar, or FAPBM) of Malagasy government plus Conservation International and WWF. The FAPBM capital is placed on financial market where income is generated so a global recession will hit this fund and the newer PAs particularly hard.</p>

Loss in PA revenue from foreign funding	<p>Madagascar: Concerns about loss of future funding due to suspension in next cycles of grant applications that this NGO applies for (no details given).</p> <p>Loss of income from Zoos in western countries could hit PAs abroad that rely on their funding - Daniel M. Ashe, U.S.-based Association of Zoos and Aquariums (AZA), said ~\$250 million raised from AZA zoo visitors to support conservation efforts across the world.</p>
Unemployment and loss of revenue for local people involved in wider tourism industry	<p>Fiji: drops in tourist visitors (many of which are visiting protected areas) in 1987, 2000 and 2006 – drop of ~26% in visitors and ~21% in earnings after 1987 and similar for following coups. Forgone earnings ('opportunity costs') estimated between F\$ 373-986 million from these 3 coups.</p> <p>Maldives: damage to tourism industry and jobs (much of which is related to protected areas) during political unrest in February 2018.</p> <p>Ras Mohamed National Park, Egypt: loss in revenue from decreased visitor numbers after terrorist attacks on Sharm El Sheik in 2005 which continued until 2007. Local Bedouin populations (often employed as skippers of ships or garbage collectors in area), hundreds of hotels and tens of diving centres and tourism companies depend on natural resources inside the park. Fishing is major occupation of local people . Ras Mohamed National Park Business plan January 2008 Egyptian Environmental Affairs Agency Nature Conservation Sector</p> <p>Philippines: Loss of financial support that the community used to receive from the marine conservation NGO; this has strained the community</p>
Unemployment and loss of revenue for local people involved in tourism sector (scuba diving)	<p>Malaysia: Gazetted as a marine protected area in 2009, Sipadan Island is world-renowned for its diving sites. However, the coronavirus pandemic has affected the international inbound and local tourism market in Malaysia. In particular the scuba diving sector has been seriously damaged with a near total loss of revenue. This has resulted in the loss of casual jobs throughout the scuba industry.</p>
Unemployment and loss of revenue for local people involved in conservation	<p>Malaysia: Licensed tourist guides at Taman Negara, Malaysia's National Park, are experiencing a severe loss of income after the park was closed due to coronavirus. Tour guides earned a sole living by taking up jobs as tour guides, tour agents, resort operators.</p>
Inability to pay for compensation (e.g. livestock compensation)	<p>Rajasthan, India: loss of park gate fees (US\$3.3million) means they are struggling to pay for livestock kill compensation (e.g. for local dairy farmers), village works, park protection.</p>

Table 2. Examples of capital asset loss suffered by protected areas under lockdown

Killing of animals	<p>At least nine rhinos killed in South Africa and six in Botswana; poaching of jaguars, pumas and ocelots in Colombia; giant ibises in Cambodia; tigers and their prey in India; often related to the absence of deterrence from a tourist presence</p> <p>UK: Illegal killing of raptors enabled by lack of people in countryside</p> <p>Caribbean marine protected areas: increase in poaching</p> <p>Galapagos Marine Reserve: use of illegal longlines that cause significant bycatch of sharks, sea turtles, and other marine megafauna</p>
Illegal mining	<p>Peru: Artisanal gold miners entering and degrading Tambopata reserve due to lack of staff and tourists</p>
Deforestation	<p>Brazil: deforestation in first four months of 2020 was 55% higher than same period in 2019, partly linked to the reduced governance control caused by the coronavirus outbreak</p> <p>Madagascar: Repetitive cases in Boeny region in NW Madagascar, Atsimo Andrefana, Menabe and Eastern Madagascar in illegal collection & transport of timber from primary forests, charcoal fireplaces in PAs.</p>
Urban to rural migration putting pressure on protected areas	<p>India: millions of migrant workers forced to return unemployed from cities. Reports of increased local poaching in Kodagu and Shivamogga, Western Ghats where there have been sudden increases in rural unemployment.</p> <p>Madagascar: loss of tourism revenues reducing family income and households. These people will be tempted to undertake illegal activities such as land occupation, exploitation, hunting, trafficking, clearing land for crops, overfishing, charcoal manufacturing and mining. Urban out-migration from coronavirus may exacerbate this.</p>
Direct biological effects of loss in tourism	<p>Seychelles: Reproductive success of White Terns and White-tailed Tropic birds is lower with no tourists than in previous years – possibly due to increase in density of predators on trails now diurnal predators are not deterred by tourists.</p>
Indirect biological effects of loss in tourism	<p>Seychelles: More illegal fishing in EEZ since January 2020 than in previous years. Government has even urged artisanal fishers to fish more to bolster local food security during the coronavirus crisis.</p>

Box 1. Infrastructure stimulus spending, jobs and ecological restoration

Securing the future of globally threatened ecosystems will depend on the continued financing of conservation efforts within networks of protected areas, combined with large-scale coordinated investment in the restoration of degraded habitats. Traditionally, ecological restoration has taken a prescriptive approach, aiming to re-establish target species or habitats within degraded or damaged sites, returning ecosystems to a chosen historic state¹. Alternatively, projects may aim to restore broader ecological functions or choose to enhance beneficial ecosystem services that mitigate risks such as flooding, air pollution or climate change. These open-ended approaches embrace the dynamic nature of global ecosystems, transforming landscapes through the restoration of natural processes. One such approach that minimizes human intervention is rewilding².

Restoration approaches can:

1. promote biodiversity and resilience within threatened ecosystems;
2. enhance connectivity and ecosystem functioning across highly degraded anthropogenic landscapes such as agricultural land and urban areas;
3. provide ecosystem services through nature-based solutions, and;
4. advance human needs by connecting to nature and providing new economic opportunities through nature-based economies.

The past decade has seen a global increase in restoration projects and an expansion in associated job opportunities. In 2014, ecological restoration projects contributed an estimated \$9.47 billion to the US economy, creating 126,111 jobs³. These employment benefits spanned a range of local industry partners, from those involved in the planning process (e.g. environmental consultants and legal teams) to construction (e.g. landscaping or planting) and suppliers (e.g. plant growers or nurseries), as well as those directly involved in long-term site management.

National investment in restoration projects post-coronavirus could provide new and valuable employment opportunities that strengthen engagement between a diverse range of industry partners and help rebuild struggling local economies. Initial start-up costs are often seen (incorrectly) as inhibitory, but a systematic review of over 200 global restoration projects showed that the economic benefits associated with enhanced ecosystem service provision consistently outweigh input costs within a 20-year period⁴. Benefit to cost-ratios differ between biomes, reflecting the value and scarcity of their ecosystems, but can reach levels as high as 35:1 so should be considered as profitable and high yielding investments.

Restoration projects have a high success rate in enhancing biodiversity and associated ecosystem services⁵, though certain ecosystems, such as tropical forest, can take longer time periods to re-establish⁶. This creates a sense of urgency and suggests that immediate restorative action is

necessary to minimize imminent biodiversity declines. Once established these restoration projects can begin replenishing suites of critical ecosystem services that underpin human societies.

Increasingly, nature-based solutions are being sought to tackle urgent ecosystem challenges such as mitigating and adapting to climate change⁷. For example, landscape-scale restoration projects that combine afforestation, re-creation of wetlands and reintroduction of ecosystem engineers such as beavers, can offer a range of complimentary ecosystem services such as carbon sequestration, water regulation and flood reduction. These integrated approaches can offer strategic societal benefits (climate change, water quality, food security and human health) whilst supporting diverse and functioning ecosystems⁸.

Ecosystem restoration must also play a central role in securing the long-term productivity of global agricultural systems. This may involve a combination of approaches including the conversion of agricultural land into alternative habitat types and efforts to enhance the biodiversity value of agricultural systems themselves. Drawing on insights gained from traditional farming practices and shifting from intensive systems towards organic and diverse cropping systems (such as agroforestry or permaculture) can lead to enhancement of beneficial ecosystem services such as soil and water regulation, pest control and pollination, thus securing long-term productivity and security of our food supply systems⁹.

Lastly, the social isolation measures imposed by the coronavirus pandemic have served to highlight the importance of providing equitable access to high quality green spaces within highly populated urban areas. Expansion and enhancement of existing urban green spaces will not only benefit biodiversity but will also improve the physical and mental well-being of local residents^{10, 11} ensuring that more people have the opportunity to regularly engage with and enjoy nature.

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Box 2. Considering the long term consequences of short term stimulus: the need for sustainability and economic reform

The post-coronavirus recovery provides a unique opportunity to move from our current economic development model, characterized by an intimate connection between economic activity, carbon emissions¹, and material consumption², to an economic model suited to dealing with the global challenges of the 21st century. Many of these challenges are environmental in nature. Climate change threatens to generate systemic failures of food supplies³, raise sea levels high enough to threaten hundreds of millions of people in coastal areas⁴, and exacerbate inequality⁵, amongst other threats. Biodiversity is declining rapidly, with monitored wildlife populations declining by over 50% in the last 50 years⁶; a challenge recognized as one of the top threats to business globally⁷. The IPBES assessment identified the need for transformative economic and societal changes in order to mitigate these risks and stem declines in the quality of our environment, which included 'conserving and restoring nature on land while contributing positively to human quality of life'⁸.

Investing in nature now has the potential to lay the groundwork for these transformative changes, and deliver both vast economic benefits and savings relative to the status-quo rate of decline, and relative to other investments. In a classic study, Balmford et al.⁹ demonstrated that the economic value of maintaining and protecting natural ecosystems is nearly always higher than the economic value of converting that natural habitat into alternative land uses. However, land-use change frequently prevails as the benefits of converting nature often yield direct, commercial benefits to the converter in the form of market goods and services, whereas the benefits of maintaining nature (which include contributing to the stabilization of the global climate) mainly come in the form of 'public goods' – benefits that are provided for society as a whole. In order to deliver the transformative changes that the post-coronavirus recovery demands, there is a need to have a renewed emphasis on investing in public goods. Additionally, investing in nature today also yields a suite of long-run market-based benefits that promise to make future economies more resilient, and deliver wealth and stable employment opportunities for people long into the future.

THE LONG-TERM ECONOMIC VALUES OF INVESTING IN NATURAL CLIMATE MITIGATION

Investing in nature is widely recognized as one of the key mechanisms for tackling climate change¹⁰, with immediate investments yielding considerable economic benefits now and in the long-term. Putting an exact dollar value on the economic savings from avoiding future climate damages to our economy generated by investing in nature today is fraught with methodological challenges, and ultimately many of the methodological choices that have to be made (e.g. discount rates, treatment of uncertainty, non-linearities in the Earth system) to get some kind of final number are subjective and philosophical in nature¹¹. Therefore, below we refrain from specific estimates of the total avoided economic climate damages from investing in nature-based carbon drawdown today. However, for a rough rule of thumb to grasp the magnitude of economic savings, the 'central estimate' of the social cost of carbon (the cost that carbon imposes on society in the form of damage to our economies) used by the UK Treasury spans from £13.84/tCO₂e in 2020 to £80.83/tCO₂e in 2030¹², although it should be noted that recent studies that better capture the economic damages of tipping into alternative, unstable climate states derive estimates that are an order of magnitude higher¹³.

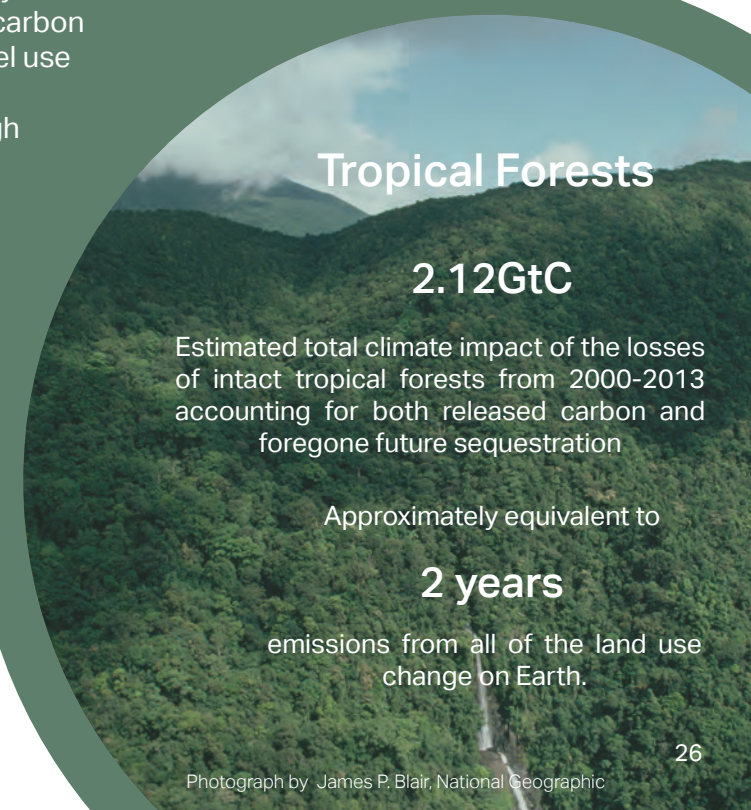
The potential carbon mitigation opportunities and long-term avoided economic damages from investing in nature are vast. Tropical forests are a major global store of carbon, and so preventing the release of the stored carbon is a major climate mitigation strategy. Additionally, when tropical

forest is cleared, its role in sequestering carbon emissions into the future is lost (i.e. protecting tropical forests yields a climate 'double dividend'). For example, the total climate impact of losses of intact tropical forests from 2000-2013 accounting for both released carbon and foregone future sequestration is estimated at up to 2.12GtC, or approximately equivalent to two years' worth of emissions from all of the land use change on Earth¹⁴. Temperate forests also have a vital role to play. In the western US, forests identified as being high productivity and with low drought risk have the potential to sequester 5.5GtCO₂e by 2099; equivalent to 6 years worth of fossil fuel emissions from the region, as well as delivering major benefits for biodiversity¹⁵. Another particularly important set of ecosystems are those which, once cleared, change state and therefore the carbon losses cannot easily therefore be reversed¹⁶. The amount of carbon stored in these ecosystems globally (such as mangroves and tropical peatlands) is 260GtC¹⁷, a large fraction of the overall carbon budget for 1.5 degrees of warming¹⁸.

Whilst protecting the carbon stored by the world's ecosystems is fundamental to preventing future economic damages from climate change, many of the world's wilderness areas and great stores of carbon and biodiversity remain shockingly underprotected¹⁹, which leaves a major long-term investment opportunity. Investing in new protected areas is demonstrated to be an effective strategy for reducing deforestation and preventing carbon from entering the atmosphere²⁰, provided investment is sufficient and accompanied by investments in adequate governance²¹. For example, in the Brazil Amazon, protected areas created since 1999 explained 37% of the reduction in deforestation from 2004-2006, delivering highly cost-effective emissions reductions²². The long-term economic benefits of investing in new protected areas can be enhanced through the use of systematic approaches to site selection, which can help optimize between multiple objectives so that protected areas deliver the maximum carbon and biodiversity benefits at the lowest cost²³.

Restoration of degraded or lost ecosystems presents another major investment opportunity. Protecting and encouraging the regrowth of secondary forests can be a powerful mechanism for promoting carbon sequestration. For example, a study modeled the potential carbon accumulated by secondary tropical forests in Latin America over 40 years, and found that they had the potential to sequester and store enough carbon to cancel out all of the carbon emissions from fossil fuel use in Latin America and the Caribbean from 1993-2014²⁴. Opportunities for investing in climate mitigation through reforestation exist all over the world: a recent study identified that planting trees in non-agricultural areas which are currently treeless but where trees would naturally occur could store 205GtC globally, a large proportion of the global carbon budget²⁵. However, failing to invest now would significantly reduce this mitigation potential, as predicted climate change will reduce the global area suitable for tree regrowth.

Nature-based climate investments offer some of the best long-term value for money of any climate mitigation investments found on the market today. Highly cost-efficient emissions reductions can



be found through both ecosystem restoration and protection²⁶. Analysis of the carbon abatement per dollar associated with a range of emissions reduction investments finds that investments in reforestation and restoration of natural ecosystems outperform many 'conventional' climate investments, such as electric vehicle subsidies, renewable fuel subsidies, and methane flaring regulation²⁷.

THE VALUE OF INVESTING IN NATURE NOTE TO DELIVER LONG-RUN MARKETABLE GOODS AND SERVICES

Whilst investing in nature promises vast long-term benefits in the form of reducing the future economic damages associated with climate change, nature conservation is itself a major economic sector which makes a highly valuable economic contribution to national economies. The World Economic Forum's Nature Risks Rising Report indicates that half of the world's GDP is moderately or highly dependent on nature and its services. In some sectors (e.g. fisheries), investments in conservation can help prevent the overexploitation of nature which threatens the long-term economic benefits delivered by the sector, so that it can provide stable or growing rather than declining economic benefits over time. Secondly, stimulus can help the long-term growth of valuable sections of the economy which provide considerable economic value and employment.

The global economy is extracting natural resources at a rate greater than they can be replenished, undermining long-term economic sustainability²⁸. At the micro scale, overexploitation is pervasive²⁹, and threatens the long-run economic benefits they can provide. Investments in the sustainable management and replenishment of natural capital today promises to yield economic benefits now and into the future, as the 'flow' of goods and services that come from nature ('ecosystem services') are often linked to the magnitude of the underlying 'stock' of natural capital. For example, pervasive declines of coastal habitats around the world have undermined the degree to which fish stocks can regenerate, as structured coastal habitats are essential nursery grounds for many vital commercial and recreational fish species³⁰. As a result, investments in the restoration of coastal habitats have the potential to drive long-term economic benefits by restoring nursery habitats³¹. Additionally, fully protected marine protected areas - alongside smarter fisheries management - have been shown to enhance fisheries yields by establishing reservoirs of larger, highly fecund fish.³² Such investments in marine conservation can therefore generate long-term economic benefits for commercial and recreational fisheries and coastal communities. For example, investments in restoring sea grasses in southern Australia yield an estimated $\$A31,650ha^{-1}y^{-1}$ of additional fish production, demonstrating a payback period of approximately 3 years to initial restoration investments of $\$A10,000ha^{-1}$,³³ with other coastal habitats such as mangroves and tidal marshes also providing high levels of enhancement³⁴.

Nature conservation would also generate significant returns from investment. The beauty and experience of natural areas and wildlife generate multiple economic benefits, most notably in the form of nature-based tourism. Nature-based tourism is a sector presenting significant growth opportunities³⁵, and in some countries can help address most if not all of the United Nations Sustainable Development Goals³⁶. However, an underinvestment in nature now has the potential to significantly limit future ecotourism growth opportunities. Protected areas around the world are estimated to receive approximately eight billion visits per year, generating an estimated \$600 billion each year in direct expenditure into regional economies³⁷ - benefits an order of magnitude higher than estimates of current investment in conservation globally³⁸. However, protected areas'

long-term economic contribution may be undermined by underinvestment, as wildlife declines and ecosystem degradation have the potential to negatively impact the sector. For example, one study estimated that the economic costs to African countries caused by the poaching of elephants amount to US\$25 million per year, significantly in excess of the investment required to prevent poaching³⁹. Additionally, it found that the economic returns to investments in protecting elephants in protected areas were comparable to other more conventional investments, such as education and infrastructure.

Another demonstration that today's underinvestment has the potential to undermine long-term economic prosperity comes from coral reefs. Reefs are estimated to generate US\$36 billion of economic value per year in coastal regions, representing approximately 9% of the value of all coastal tourism in countries with reefs⁴⁰. However, underinvestment in climate mitigation and reef protection today threatens the future of the entire sector, with 99% of coral reefs projected to disappear by the end of the century under 2 degrees of warming⁴¹. Along with tourism, investments in nature have positive economic impacts on a range of interrelated sectors: for example, an estimate of the economic contribution of the nature restoration economy in the USA found that, whilst the sector was associated with US\$9.5 billion in direct sales, indirect business-to-business services and increased household spending generated nearly double that benefit⁴².

LONG-TERM BENEFITS OF PROTECTION FROM FUTURE DAMAGES

An additional set of long-run benefits from investing in nature today revolve around reducing the long-term economic damages from pollution and natural disasters, many of which are expected to increase in severity over the coming decades with climate change. Natural ecosystems can play an essential role in buffering some of the predicted negative economic impacts of climate change. For example, climate change-induced sea level rise is predicted to threaten hundreds of millions of people in low-lying coastal areas with flooding by the end of the century⁴³. Investing in structured coastal habitats such as coral reefs can help mitigate the impacts of natural hazards by dissipating wave energy and reducing wave heights, delivering long-term coastal protection comparable to hard infrastructural solutions, but at lower cost on average⁴⁴. Climate change is predicted to alter regional precipitation patterns, exacerbating risks of flooding in places⁴⁵. Strategic investments in nature can help mitigate flood risks⁴⁶, but many of the flood mitigation benefits of natural flood management approaches such as afforestation develop with a lag of over a decade. As a result, investment is needed today in order to deliver significant flood mitigation benefits by mid-century. Despite the lag, investment in proactive natural flood management approaches can still deliver net economic benefits relative to land management approaches that simply react to changes in ecological conditions when they occur⁴⁷.

Coral Reefs

Reefs are estimated to generate

\$36 billion USD

of economic values per year in coastal regions

9%

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99%

of coral reefs projected to disappear by the end of the century under 2 degrees of warming.

Photograph by Enric Sala, National Geographic

In addition to reducing economic damages from climate change, investments in nature can also yield cost-effective long-term health outcomes. Urban nature can be a particularly powerful investment, especially in the context of accelerating urbanization rates around the world. For example, the UK government estimates that urban nature saved £162.6 million in healthcare costs in 2017 through the removal of particulates and other forms of air pollution⁴⁸.

LONG-TERM NON-ECONOMIC BENEFITS OF INVESTMENT IN NATURE

In addition to the benefits outlined above, investing in nature conservation delivers a multitude of long-term benefits which are not easily captured through the conventional metrics used in economic analysis. These benefits include the intrinsic value of non-human life (biodiversity); intangible contributions to people's wellbeing and identities; and the shared, social, and cultural values that communities associate with nature. Research looking at communities' willingness to trade ecosystem services for financial payments indicates just how significant these non-economic values can be⁴⁹. Given that a large proportion of the world's remaining biodiversity, protected areas, and wilderness areas, intersect with land which is managed by Indigenous Peoples and local communities⁵⁰, it is crucial that local values are given prominence, even when they do not support strictly monetary benefits⁵¹, and that we better understand and promote the existing and potential contributions that Indigenous Peoples and local communities can make to sustainability. For example, the IPBES Global Assessment found that recognizing the rights and traditional knowledge of Indigenous Peoples and local communities could enhance nature conservation and restoration as well as improve their quality of life.

One of the benefits of government spending is the ability to invest in those public goods that have long-term, non-monetary benefits, where traditional finance would not. Hence, investing in nature conservation to support these benefits should be an important focus of stimulus. Further, the localized benefits outlined above from investing in protecting and restoring nature would not be gained by investing in a brown stimulus package, and would even be undermined in the long-run, as ecosystem and climate degradation continue to be driven by fossil-fuel-based economic activities.

Investing in nature can also provide a just way forward in an era of rising inequality⁵². Stimulus that simply bails out extractive industries and underfunds nature conservation delivers both benefits and costs that are deeply unequally distributed⁵³. In particular, the impacts of climate change have the potential to widen global income inequality 'because hot, poor countries will probably suffer the largest reduction in [economic] growth'⁵⁴.

In sum, focusing solely on the economic benefits of these stimulus packages may lead to decisions that are short-termist and counterproductive from the perspective of other societal goals, such as wellbeing and sustainability⁵⁵. Stimulus investments in protected areas, restoration and nature-based climate change solutions are likely to be more effective at delivering the non-economic long-term benefits above if underpinned by transformative changes. This involves reorienting our economies and societies towards 'embracing diverse visions of a good life'⁵⁶, and measuring progress through metrics that more effectively capture the true costs and benefits of economic activities⁵⁷.

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Box 3. Protecting nature to protect human health

Recent estimates show that mankind has altered as much as 80% of Earth, varying in extent across particular ecosystems^{1,2}. The IPBES Global Assessment on Biodiversity and Ecosystem Services shows that humanity's impact has included significantly altering global patterns of species composition and abundance, decreasing primary productivity, and fundamentally changing the biogeochemical cycles of carbon, nitrogen, and phosphorus. The degree of anthropogenic degradation of ecosystems has ushered the Earth into a human-dominated geological era termed the Anthropocene³ and we are increasingly transgressing catastrophic environmental boundaries⁴.

Humanity needs a functioning biosphere to persist and this, by itself, should be enough for an enormous change in how we view nature and how much we spend trying to conserve it. The current coronavirus pandemic, transferred from animals to humans at a yet unknown point in time⁵, must sharpen this view. While we are still trying to better understand how these diseases emerge, all evidence shows that the erosion of nature places humans at greater risk to these types of pandemics.

UNDERSTANDING ZOOONOTIC DISEASES

SARS-CoV-2 is not unusual. It is the seventh known coronavirus having been transmitted to humans. Earlier cases include the SARS pandemic in 2002/03 (also in China and from bats via civets) and MERS in 2012 (in the Middle East, from camels)⁶. Given that they are infectious diseases, naturally transmitted from vertebrate animals to humans and vice versa, these coronavirus cases are part of a wider group of zoonotic diseases, and like others such as Ebola, they can cause large-scale human mortality and morbidity, disrupt trade and travel networks, and undermine progress toward the Sustainable Development Goals (SDGs).

The moment where an infectious pathogen jumps between a reservoir species and a new host species (in this case, humans) is known as a 'spillover'. Spillovers are not a new, or unknown, phenomenon, with more than 335 emerging infectious disease outbreaks (involving 183 distinct pathogens) reported worldwide during 1940-2004 (more than 50 per decade) and the rate of outbreaks is increasing⁷⁻⁹. These zoonoses have had significant implications in terms of both public health and economic stability, with the costs of many individual recent major outbreaks, such as SARS, MERS and Ebola estimated in the tens of billions of US dollars and exceeding 1-2% of GDP in less wealthy countries¹⁰. Particularly well studied cases highlight effects on regional economies, with the impact of the 2002-2004 SARS epidemic (774 deaths) on tourism, food and travel in mainland China alone costing an estimated US\$8.5bn¹¹ and the 2013 Ebola outbreak in West Africa costing an estimated US\$2.2bn in GDP and wiping out many of the recent development gains in Guinea, Liberia, and Sierra Leone, which had been among the fastest growing economies in the world^{12,13}. Some estimates suggest that the cost of the current coronavirus pandemic to the world economy may be up to US\$82 trillion in an economic depression scenario, with huge additional costs to human life and wellbeing.

From 1950 to 1980 vector-borne disease incidences were declining, however this trend has shifted in the past 40 years¹⁴ and there is now evidence indicating that the risk of disease transmission – not only for viruses – has increased among humans¹⁵. Some reviews show that 52% of all emerging infectious disease outbreaks have originated in wildlife and among emerging zoonotic diseases specifically, 71% of outbreaks have originated in wildlife (with the rest from domestic animals)¹⁶. There is also no doubt that the global connectivity of human society greatly increases the long-

distance transport of disease vectors¹⁷ and of animals infected with infectious pathogens¹⁸, increasing the number of human-wildlife interfaces where pathogens can spill over into humans. Connectivity also facilitates subsequent human-human transmission. But focusing on wildlife trade and human connectivity alone misses a crucial important link to the role ecological degradation plays in increasing risk. There is clear evidence that ecological degradation fundamentally increases risk of human-wildlife contacts and subsequently creates more exposure to diseases that lead to pandemics.

WHAT IS THE ROLE OF ECOLOGICAL DEGRADATION WHEN IT COMES TO INCREASING EMERGING ZOOONOTIC DISEASE RISK?

There are now multiple interacting lines of evidence showing that land-use changes such as deforestation, forest degradation (e.g. through logging), fragmentation, expansion of infrastructure (e.g. roads, railways, powerlines, dams), changes in drainage, and hunting for trade have led to an increase in the risk of zoonotic diseases^{19,20}. The human-caused ecological degradation has likely elevated disease risk for people, and these risks are further multiplied by large movements of human populations, agricultural intensification near to natural areas, and climate change, among other factors^{21,22}.

When people undertake land-use change activities, they fragment ecosystems and create more ecosystem edges. For example, fragmentation has placed over 70% of the world's forests within 1 km of an edge²³ and this is worsening across the tropics²⁴. It is now known that there is increased contact among people, livestock and pathogens along these newly created ecosystem edges^{25,26}. These edges represent areas where newly arrived human and livestock populations without immunity mix with unfamiliar pathogens, with contacts sometimes further increased by the movement of host species in response to the disrupted ecology of their habitat. In addition, much wildlife trade originates from recently opened frontier areas where populations have not yet been decimated by overharvest²⁷. There is increasing evidence that large trade volumes and poor hygiene practices expose people all along these trade chains to increased risk of infection^{28,29}. In addition, changes in the biodiversity within ecosystems (e.g. extinctions or depletion of some species) can alter the likelihood of diseases being transmitted among the remaining species ('dilution' and 'amplification' effects), although there is insufficient evidence to confirm how common this pattern is^{30,31}. It is well known for Lyme disease, for example, where eradication of wolves in the eastern United States caused a series of changes that cascaded through the food web and led to an increase in intermediate hosts for ticks that can infect humans with the disease³². However, this hypothesis has been tested on other disease systems (Hanta virus and West Nile virus) with mixed results³³⁻³⁶.

Degradation can cause increases in the local populations of host or vector species, raising the chance of transmission. Habitat damage can also place individuals of species under increased

Emerging Infectious Disease

52%

Of all emerging infectious disease outbreaks are estimated to originate in wildlife and among emerging zoonotic diseases specifically

71%

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Some estimates suggest the the cost of the coronavirus pandemic to the world economy to be up to

\$82 trillion USD

Image by Alissa Eckert, MS; Dan Higgins, MAMS, CDC

stress, making them more susceptible to infections.

Evolutionary aspects may play a role as well in the co-evolution between viruses and their (mammalian) hosts, in particular as the evolutionary adaptation of species, including pathogens, accelerates in response to anthropogenic drivers³⁷. Anthropogenic management has been found to cause a decline of natural pest enemies and competent hosts of vector-borne and zoonotic diseases in all regions, with larger declines in the tropics and sub-tropics³⁸. One important change resulting from human disturbance is the changing nature of species abundance. Johnson et al. found that the number of zoonotic viruses detected in mammalian species scales positively with global species abundance³⁹, suggesting that virus transmission risk has been highest from animal species that have increased in abundance and even expanded their range by adapting to human-dominated landscapes.

Ecosystem degradation also leads to unintended infectious disease impacts beyond zoonotic disease. There are several studies of the prevalence of vector-borne disease in relation to ecosystem change, in particular for malaria. For example, in the Amazon deforestation altered mosquito ecology, resulting in more larval breeding habitat and higher biting rates of humans by *Anopheles darlingi*, which is a highly competent vector for the deadly form of falciparum malaria^{40–42}. In Malaysian Borneo high historical forest loss is also correlated with higher incidence of malarial infections^{43,44}. *Plasmodium knowlesi* is a zoonotic malaria parasite normally residing in long-tailed and pig-tailed macaques (*Macaca fascicularis* and *Macaca nemestrina*, respectively) found throughout Southeast Asia. By 2019, *knowlesi* malaria had been reported to become the predominant malaria affecting humans in Malaysian Borneo, and was the causal agent responsible for approximately 70% of reported cases. Vectors which transmit the parasite, along with macaque hosts, are both now frequently found in disturbed forest habitats, or at the forest fringes, largely due to anthropogenic land use changes, and thus provide more frequent contacts with humans. Such access to humans as alternate hosts provides invaluable opportunities for the parasite to adapt to the human immune system⁴⁵.

There are examples of water-borne bacterial disease increases associated with ecosystem degradation. For example, there is a significant association between tree cover in upstream watersheds and probability of diarrheal disease among rural children under age 5, as measured from a dataset from 35 developing countries. The effect of a 30% increase in upstream tree cover is similar to the effect of improved sanitation⁴⁶. Fragmentation of riparian forests and density of roads crossing creeks within a watershed is significantly related to incidence of typhoid in Fiji^{47,48}.

BEYOND THE LAND: PATHOGENS ARISING FROM DEGRADED OCEAN ECOSYSTEMS

Incidence of disease because of our degradation of ecosystems not only happens in forests – or the land – which are the main focus of discussion currently. Degradation of ocean ecosystems also increases the risk of diseases for humans.

A review and analysis of the literature obtained data from 12 coastal and estuarine regions in Europe, North America, and Australia, along a gradient of human impact, including areas where biodiversity had been depleted, had collapsed, or had gone extinct, and places where biodiversity had recovered⁴⁹. Comparing places along that gradient showed that coastal and estuarine regions with more biodiversity means that invertebrates such as mussels, oysters, and sponges are able to

filter much more water and improve the health of these ecosystems. In contrast, places that had lost much of their biodiversity suffered several times more harmful algal blooms and fish kills, with the resulting beach and shellfish closures—some as long as 35 years. Combined with ocean warming and acidification, such harmful algal blooms and related shellfish toxicity are likely to increase in duration⁵⁰. The consequences for human health include food poisoning⁵¹ and exacerbation of respiratory diseases such as asthma⁵².

In coral reefs, unfished, uninhabited areas have ten times less bacteria than inhabited coral islands⁵³. Even small human populations (hundreds to several thousand people) exhibit such increases, which are not due to nutrient eutrophication, but to the degradation of the food web, starting with overfishing, which creates trophic cascades ending up in a shift from coral- to seaweed-dominated reefs. Pristine reefs tend to have crystal clear waters, where half the microbes are photosynthetic nanobacteria like *Prochlorococcus*, whereas at degraded reefs, about a third of the bacteria are pathogens, including several types of *Staphylococcus*, *Vibrio*, and *Escherichia*. Especially worrying is *Vibrio*, which can cause diseases in corals, contributing to the shift from coral-dominated to seaweed-dominated reefs⁵⁴, which in turn enhance microbial blooms. *Vibrio* can also cause fatal diseases in humans such as cholera⁵⁵, gastroenteritis, wound infections, and septicemia. This ecosystem shift—from mature, stable, and full of large animals to immature and dominated by small creatures—has been called the “microbialization” of coral reefs⁵⁶. Experiments show that abundant giant clams can filter pathogens out of seawater; however, people have depleted giant clam populations for meat and shells from most Pacific reefs, thus fostering the proliferation of human pathogens.

A step change needed in health response policy to place ecosystem management in the center. There is clear evidence that the decline in ecosystem integrity increases the global risk of zoonotic disease spillovers, and thus increases the chances of a pandemic like the one currently unfolding around the world. While an established pandemic attracts attention to medical infrastructure and front-line health workers, the critical venue to focus on for avoiding emerging zoonosis is the interface of human interactions with natural environments, most acutely in locations of rapid land-use change. Without an integrated approach to mitigating the risk of zoonotic diseases from environmental change, countries’ abilities to achieve SDGs and climate and biodiversity targets will be severely compromised.

The time is ripe to embrace a coherent, multi-fora strategy that puts halting ecosystem degradation in the middle of efforts to achieve positive health, climate, biodiversity and sustainable development goals. For example, currently, 65 countries are engaged in the Global Health Security Agenda (GHSA) and are finalizing a strategic plan for the next five years (the GHSA 2024 Roadmap) to better prevent, detect, and respond to infectious disease outbreaks in alignment with SDGs 2 and 3 on food security and human health. These nations are signatories to the Convention on Biological Diversity, the Convention on International Trade in Endangered Species, and the United Nations Framework Convention on Climate Change. Global efforts to decrease the risk of pandemics would benefit from a common focus on halting ecosystem loss across these four conventions and agendas.

FROM POLICY TO ACTION

Ecological changes are an important factor driving disease outbreaks and as such need increased

levels of attention at international, national and local levels. An approach relating to the integrity of ecosystems must be placed in the context of how much land degradation has already occurred in an area. In large wild landscapes, we need to retain ecosystem integrity to the greatest extent possible as by doing this we will minimize the various pathways that increase the risk of pandemics and other spillover events. Maintaining ecosystem integrity means not modifying ecosystems beyond their natural range of variation, which in practice means avoiding the expansion of large-scale extractive uses (industrial logging, large-scale harvest of animal and plant products), not fragmenting areas with human infrastructure such as pastures and farmland, and not disrupting natural fire and flood regimes. Since many of these areas are inhabited by, and protected by, Indigenous Peoples and local communities, we must strengthen health care infrastructure to meet the needs of these populations⁵⁷, and enhance emerging infectious disease surveillance in collaboration with them⁵⁸ as well as better understanding the patterns of exposure and immunity that they experience.

In landscapes that have already become fragmented, we should revisit nature-based or 'One Health' solutions that support the restoration of ecosystem integrity and human health to the fullest extent (see e.g. the Berlin Principles, IUCN's new standards for Nature-based Solutions). For example, instead of culling bats to limit the spread of bat-borne viruses, the human activities themselves that lead to spillover can be altered. In the case of Nipah virus (NiV) in Bangladesh, this is a simple tree skirt that prevents bats from urinating in vessels that are used to collect tree sap⁵⁹. In the case of insectivorous bats, an intervention used after the discovery of Marburg, and Bombali and Zaire Ebola viruses in West Africa was as simple as sharing information and resources on how to exclude bats from homes and cover food sources.

Solutions that benefit both human health and environmental targets have the advantage of contributing to multiple SDGs. Broad recommendations for these 'shared landscapes' are to ensure infectious disease interfaces and pathways that have been created must either be removed or mitigated. Forest edges are an example of an interface that can be reduced in extent in some settings, e.g. through restoration that reduces fragmentation. The commercial wildlife trade is an example of a high-risk interface that can be removed in many cases, and whose risks should be mitigated in the remaining cases. Where restoration is not attainable, management decisions should nonetheless avoid any further degradation of ecological systems.

In highly human-dominated, farmed and urban areas - the likelihood of zoonotic outbreaks spreading from any remaining wildlife populations is low, although it still exists (e.g. rabies from bats or skunks, or West Nile virus from birds via mosquito vectors). In these places, public health, biosecurity and disease surveillance and response systems tend to be more robust. However, such areas are still risky sinks for pathogens due to connections between remote source areas and urban

centers of demand for the wildlife trade. In these areas, commercial wildlife trade should be halted and other forms of domestic animal trade should ensure excellent hygiene standards. Public health, biosecurity and disease surveillance and response systems tend to be more robust for known pathogens in these places, but defenses are less robust for the new, emerging pathogens that also occur in commercial wildlife markets.

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