IUCN Nature-based Recovery Initiative

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Nature-based Solutions for recovery – Opportunities, policies and measures

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Content

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List of acronyms

DRR	Disaster Risk Reduction
Eco-DRR	Ecosystem-based Disaster Risk Reduction
FLR	Forest landscape restoration
IPCC	Intergovernmental Panel on Climate Change
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
LDN	Land degradation neutrality
NbS	Nature-based Solutions
NDCs	Nationally Determined Contributions
SDGs	United Nations Sustainable Development Goals
UNCCD	United Nations Convention to Combat Desertification

Key findings

- **Pandemics need to be integrated into existing Disaster Risk Reduction (DRR) Frameworks.**
- **Nature-based Solutions (NbS) support all stages of the crisis management cycle.**
- **NbS propose mechanisms for transformative approaches to achieving global sustainability targets.**
- **NbS are intended to support the achievement of society's development goals and safeguard human well-being in ways that reflect cultural and societal values, and enhance the resilience of ecosystems, their capacity for renewal and the provision of services.**
- **Successful NbS implementation and scaling up for recovery and beyond hinges on both alignment and convergence of of sectoral policies at national level.**
- **NbS can be leveraged for creating a more resilient future by forming smart investment opportunities in nature, as well as those that create green and clean jobs, deliver value for people, economies and nature, and accelerate ecosystem services as a tool for economic recovery.**
- **The IUCN Global Standard provides distinctive parametres for defining NbS and a common framework to increase the scale and impact of the NbS approach, prevent unanticipated negative outcomes or misuse, and help funding agencies, policy makers and other stakeholders assess the effectiveness of interventions.**

1 Introduction

There is a growing acknowledgement of the role that nature plays in our society. However, for most of the 20th century, decision makers treated the conservation of nature as peripheral to national and global agendas. At best, it was considered a worthy interest and, at worst, an obstacle to development. However, a growing scientific consensus indicates that such views were deeply flawed and that 'nature is essential for human existence and good quality of life'. Failure to recognise this fact not only results in a model of economic growth that undermines future economies and significantly contributes to the loss of biodiversity, but it also misses the opportunity to effectively deploy nature in helping resolve major societal challenges, such as climate change, human health, food security, disaster risk reduction, etc. Doing so offers the possibility of mainstreaming conservation approaches into other sectors, including agriculture, infrastructure, water, health, urban planning and rural development.

The world has suffered considerably from the economic impacts of the COVID-19 pandemic and countries are designing stimuli packages to recover economic activities. It is anticipated that decision makers may turn to further exploitation of natural resources as a short-term solution, which will contribute the loss of biodiversity and climate change crisis. While the planetary crises we face today may seem overwhelming, society has also shown it can work together to solve major global threats. Changing the predicted trajectory of a crisis needs readily available, reliable and effective solutions. In this respect, Nature-based Solutions (NbS) are considered an umbrella framework for ecosystem-based approaches that offer the world a real chance to meaningfully address multiple sustainability crises, including climate change, food and water security, land degradation and biodiversity loss. Most ecosystems are capable of providing multiple benefits to diverse beneficiaries, while simultaneously supporting the protection of the natural resource base. Protecting, sustainably managing and restoring nature can deliver substantive benefits for society. This fact means that ecosystem management is often the most promising route by which societal challenges can be addressed, securing the role of biodiversity in the 'Building Back Better"[1] strategy for post-COVID-19 recovery attempts.

The following paper is a consolidation of published literature that elaborates on the opportunities NbS offer for crisis management and post-COVID-19 economic recovery packages. This paper discusses NbS in the context of transformative changes, biodiversity loss, climate crisis and their threat to the global economy and human well-being. Demonstrative examples of the effectiveness of NbS in addressing societal challenges are also included, and the capacity of IUCN Global Standard for Nature-based Solutions to measure the performance and impact of NbS interventions is examined. The case studies discussed in the subsequent sections are not tested against IUCN's Global Standard, as the intention is to demonstrate the potential of NbS interventions in action and what opportunities they present.

1 The Build Back Better approach, first described in UN's Sendai Framework for DRR, is a strategy to use post-disaster recovery attempts as opportunities for risk reduction to societies. For further information, please visit: https://www.unisdr.org/files/53213_bbb.pdf

2 Transitioning from crisis to opportunity

During the COVID-19 pandemic, the focus of many countries has been on the management of the response phase and its multiple aspects. However, once the COVID-19 outbreak subsides eventually, countries will enter a period of recovery. Due to the complexity and the global impact of the COVID-19 pandemic, the actions policy makers will take for the recovery phase are to be different from traditional recovery actions. One of the primary efforts for many governments is transitioning the economic activities to normalcy.

On the path to recovery, it is important to be consider the following policies (Fakhruddin et al., 2020):

- The world needs to stay mindful of future pandemics and change the mindset from "if" to "when".

- The recovery actions and policies are to be built on the already agreed policy frameworks, such as the climate agreements, United Nation's Sustainable Development Goals (SDGs) and the Sendai Framework for Disaster Risk Reduction.

- Investments need to target multi-sector pandemic planning. Based on the characteristic of the outbreak, pandemics can affect multiple sectors, such as agriculture, logistics and finance. Multi-sector planning can help countries and communities to prepare for an effective response for such occasions.

Furthermore, during the COVID-19 pandemic, countries continued to suffer from natural hazards, such as earthquakes, flooding and typhoons (Ishiwatari et al., 2020; Walker, 2020). The world is facing difficulties managing disasters while fighting the spread of the COVID-19. Given the projections of climate change and biodiversity loss, the rapid development of the urban areas and increased travel, global efforts to develop better preparations for future pandemics should be integrated into policies. It is therefore important to include the concept of pandemics into existing frameworks of DRR (Bedford et al., 2019).

Nature-based Solutions for Societal Challenges was defined by IUCN and adopted in 2016, during IUCN's Members' Assembly at the World Conservation Congress in Hawaii as follows:

> actions to protect, sustainably manage and restore natural or modified ecosystems, that address societal challenges (e.g. climate change, food and water security or natural disasters) effectively and adaptively, simultaneously providing human well-being and biodiversity benefits (IUCN, 2016, p. 2).

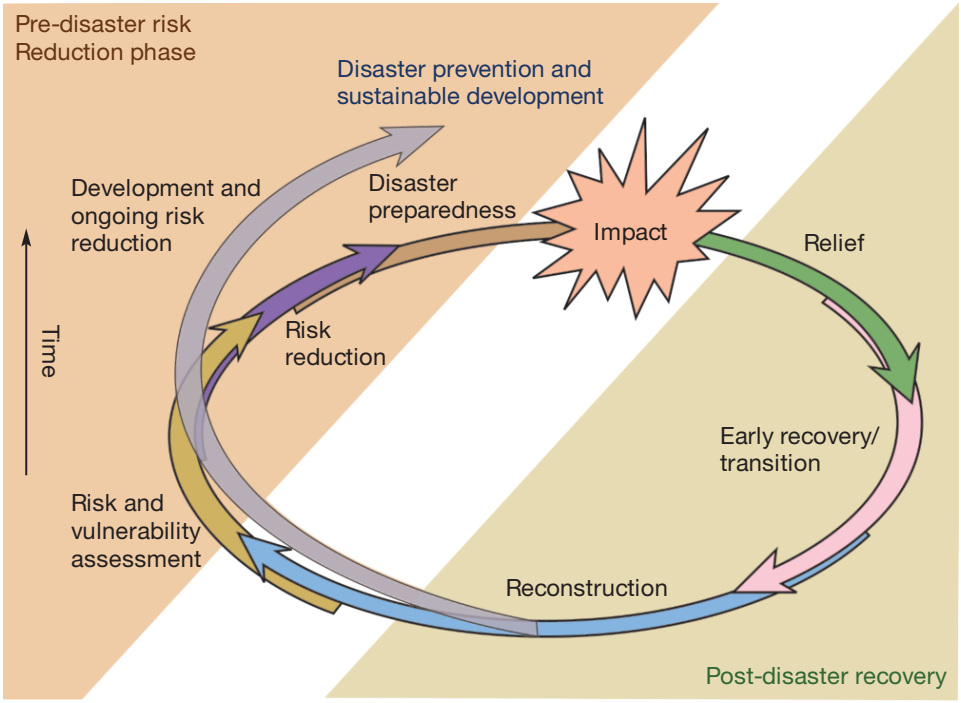
Many members – State, Government agencies and non-government institutions – endorsed this definition, as documented in WCC-2016-Res-069-EN (IUCN, 2016).

NbS are intended to support the achievement of society's development goals and safeguard human well-being in ways that reflect cultural and societal values and enhance the resilience of ecosystems, their capacity for renewal and the provision of services. NbS are designed to address multiple societal challenges and provide multi-sector solutions. Furthermore, NbS can support all stages of the crisis management cycle. The spiral (RICS, 2009) is widely utilised to plan risk reduction, relief and reconstruction efforts by the disaster management community (Figure 1). It is based on the theory that if countries are doing effective DRR, the loss and damage from each disaster reduces every time, which enables them to 'break out' of the event cycle and progress/spiral upwards towards disaster prevention and consequently, sustainable development. This is the model used to promote risk reduction measures as opposed to a continuous cycle of moving from one disaster (impact) to relief, recovery, reconstruction and back to another disaster or impact. Similarly, with COVID-19, countries can be supported through sustainability transition by using

FIGURE 1

Disaster management and risk reduction spiral

Source: RICS (2009, p. 17)



NbS for response and relief, recovery, reforms and eventually green growth (Table 1).

Similarly, the NbS definition contains three actionable entry points that can also serve as a guide for different opportunities for post crisis policy shifts (Table 2).

2.1 Nature-based Solutions in the context of transformative changes

The environmental crisis that our planet is facing today requires adapting transformative changes. The general idea of transformative changes refers to major and fundamental changes in technological, economical and socio-ecological activities to address human needs while preserving Earth's systems (Gillard et al., 2016; Feola, 2015). These transformative changes are essential for achieving several SDGs, the post-2020 biodiversity targets and the Paris Agreement (IPBES, 2019; IPCC, 2018). Given their contribution to biodiversity, conservation of nature and human livelihood, NbS can propose mechanisms to transformative approaches for achieving global sustainability targets. As NbS integrates societal challenges and nature conservation across scales and landscapes, they have the potential to offer long-term transformative pathways to sustainability. A study of 93 NbS in the socio-economic systems show that the majority of these solutions consist of four elements that contribute to transformative changes: i) nature's value; ii) community engagement and capacity building processes; iii) knowledge types; and iv) ecosystem management practices such as monitoring and protection (Palomo et al., 2021).

2.2 Nature-based Solutions in the context of biodiversity

The exploration of natural resources has caused long-lasting impacts on natural resources, ecosystems and biodiversity. Consequently, ecosystem processes that provide services, such as supplying food and energy and purification of water and air, are at risk of instability or permanent damage. The growing scientific consensus indicates that there is a need for a change of perspective for the human-nature relationship (IUCN, 2020a). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Global Assessment Report on Biodiversity and Ecosystem Services emphasises that "nature is essential for human existence and good quality of life" (IPBES, 2019, p. 10).

This report highlights the critical and unreplaceable role nature plays in providing a wide range of services that are crucial and fundamental for people's well-being. The first New Nature Economy Report series published by World Economic Forum (WEF) states that "$44 trillion of economic value generation –

TABLE 1

Examples of NbS interventions as crisis response

STAGES	INTERVENTION	EXAMPLES OF POLICY SHIFT
Crisis response, relief	NbS for short term and immediate gains to people and nature	New Zealand's shovel-ready jobs that are not carbon-heavy: NZD 1.1 billion investment to create 11,000 environmental jobs (Department of Conservation, 2020).
Recovery	Integrating nature and NbS into medium-term recovery and reconstruction, once the emergency is over	In end-2005, the Coastal Protection and Restoration Authority (CPRA) was established, following Hurricane Katrina, merging hurricane protection and coastal protection activities and oversight under one roof, in order to make NbS central to recovery efforts and realignment of government agency mandates.
Reforms	New or strengthened actions for longer term planning and implementation of nature positive actions	Japan's National Resilience Plan 2014, following the 2011 Great East Japan Earthquake: environmental measures are strongly referenced in all chapters, e.g. coastal forests and wetlands, and promote disaster prevention and mitigation measures that utilise the functions of the natural environment as 'green infrastructure' according to the characteristics of each region, as well as promote the disposal of coastal debris from the perspective of preventing secondary disasters caused by coastal debris (National Resilience Promotion Office of Japan, 2014).
Green Growth	NbS embedded into economic growth plans and models, ideally with quantifiable measures	Chile's revised NDC 2020 states NbS as an implementation criterion to measure just transition to sustainable development Government of Chile (2020).

more than half of world's total GDP (Gross Domestic Product) – is moderately or highly dependent on nature and its services and is therefore isexposed to risks from nature loss" (WEF, 2020a, p. 13) and, therefore, is potentially threatened by the degradation of nature. Many countries have high absolute economic values in nature-dependent sectors and are vastly reliant on nature's ability to provide resources and services. WEF's 2020 Global Risks Report recognised that ecosystem degradation and biodiversity loss are a threat to social stability and peace and are ranked as one of the top five global risks in the next 10 years, in respect of likelihood and impact (WEF, 2020b). Similarly, the latest report of IPBES estimates that one million out of approximately 10 million existing species are vulnerable to extinction along with the ecosystems they inhabit (Frantzeskaki et al., 2019).

Deforestation, habitat destruction, habitat fragmentation and land-use changes have been identified as the main processes that are enabling the zoonotic infections transmission. Increased interactions amongst humans, domestic livestock and pathogen-carrying wildlife have increased the risk of interspecies transmission and the emergence of new infectious diseases (Bloomfield et al., 2020; Gibb et al. 2020; Tollefson, 2020). In 2020, mankind was reminded that pandemics could pose a significant threat on a global scale. The COVID-19 pandemic has caused severe impacts on public health and economies worldwide. Global inequality is affected by the current global recession through the loss of income. The current situation is putting even more distress on low-income, vulnerable communities, especially those who are dependent on local natural

TABLE 2

NbS entry points for policy shifts

ENTRY POINT	ACTION	EXAMPLES OF POLICY SHIFTS
Conservation	Investing in area-based conservation and protection efforts to safeguard ecosystem services being derived while protecting the biodiversity of the area	Expansion of Sanriku Fukko National Park along the Sendai coast, following the Great East Japan Earthquake of 2011. This national park has integrated ecotourism, cultural and educational activities (Government of Japan, n.d.).
Restoration	Investing in the recovery of lost ecosystem functions and ecological integrity of spaces, upon which ecosystem services for human well-being needs depend	• The Great Green Wall, comprising 11 countries and spanning over 100,000 km^2 of restoration of vegetation cover in the next 10 years (Great Green Wall, 2020). • Pakistan's launch of Ecosystem Restoration Fund at COP 25 in Madrid, together with other COVID-19 responses related to NbS (Khan, 2021).
Sustainable use	Changing the use, management and governance of natural resources to more sustainable practices	Colombia's investment in Latin America Water Funds Partnership and Establishing multi-stakeholder dialogue among government, local communities, Indigenous people and industries to secure fresh water (The Nature Conservancy, n.d.).

resource systems as their sources of livelihoods and are already suffering from climate change and biodiversity loss. IPBES reports that negative effects are disproportionate and will especially affect marginalised and Indigenous peoples and rural communities, who directly depend on nature's benefits for their survival.

Many governmental agencies, financial institutions and the private sector are attempting to create recovery plans and packages. Meanwhile, it is anticipated that decision-makers may turn to further exploitation of the natural resources as a short-term solution, which will create added pressure on natural resources, intensifying biodiversity loss and climate change. According to the Greenness of Stimulus Index report published in February 2021, "stimulus to date will have a net negative environmental impact in 15 of the G20 countries and economies, and in five of the 10 other analysed countries" (Vivid Economics, 2021, p. 3). The stimulus packages analysis suggests that nature and biodiversity have been particularly neglected. Although approximately one-third of the global total US$ 14.9 trillion stimulus is allocated to environmentally relevant sectors that affect carbon emissions and biodiversity, such as waste management, farming, industry, energy and transport, only US$ 1.8 trillion has been identified as green spending (Vivid Economics, 2021).

For a solution to be considered as NbS, it is imperative that it can provide simultaneous benefits to biodiversity and human well-being. Therefore, each solution must either maintain or enhance biodiversity, without which an action cannot be classified as NbS. This is important for ensuring that the integrity and stability of the natural system is not undermined by practices that favour short-term gains, thus compromising the ability of the system to provide for future generations. Therefore, as opposed to biodiversity conservation merely being an output of an NbS, it is a critical input that, if maintained or enhanced, validates a solution as an NbS (Cohen-Shacham et al., 2019).

2.3 Nature-based Solutions in the context of the climate crisis

In the recent decades, challenges, such as heatwaves, extended dry periods, flooding, rising seas and coastal erosion, have contributed to increased disaster incidence globally, which have been affecting ecosystems and the livelihood of millions of people globally. Extreme events are predicted to occur more frequently, with higher impacts and overwhelming effects on biodiversity and human lives, leading to high economic costs. On the other hand, the Intergovernmental Panel on Climate Change (IPCC) 'Global Warming of 1.5°C' report provides enough evidence that human activities have caused approximately 1.0°C of global warming above pre-industrial levels (IPCC, 2018). Global warming is likely to reach 1.5°C between 2030 and 2052, putting all species in a very dangerous situation, if we do not achieve the target set by the Paris Agreement – that is to keep the global average temperature increase to 'well below 2°C above pre-industrial levels'. As humanity faces a catastrophic climate tipping point, there is an urgent need for innovative approaches to complement nature conservation as well as immediate transformational changes to reduce carbon emissions to limit global warming to 1.5°C (IPCC, 2018; Rockström et al., 2009; Steffen et al., 2015).

This interlinkage between people and nature offers an opportunity, in the shape of NbS, to address underlying societal challenges (such as food security) while contributing to climate adaptation and mitigation. The NbS concept provides an integrated approach that can help nations meet crucial international agreements and targets, such as the SDGs, the Paris Agreement, the Aichi Targets, the Bonn Challenge and the Sendai Framework for Disaster Risk Reduction. NbS was endorsed at the 2019 United Nations Climate Summit and highlighted in the IPCC's Special Report on Global Warming (de Coninck et al., 2018), the IPCC Climate Change and Land Report (IPCC, 2019) and the IPBES Global Biodiversity Assessment Report (IPBES, 2019) as having the potential to address major global societal and ecological challenges.

As the world tries to emerge from the COVID-19 pandemic and the economic damages caused by it, policy makers may be inclined to reduce environmental regulations, ignore their climate commitments and discard sustainability criteria as a response. This makes necessary that both biodiversity and climate change crises are analysed and addressed simultaneously through NbS, which also play a key role in the transformational changes required to achieve the global sustainability goals.

3 Thematic entry points for policy, measures and reforms

NbS are intended to support the achievement of society's development goals and safeguard human well-being in ways that reflect cultural and societal values and enhance the resilience of ecosystems, their capacity for renewal and the provision of services. NbS are designed to address major societal challenges, such as food security, climate change, water security, human health, disaster risk, social and economic development. The application of NbS for other societal challenges, such as peace and conflict resolutions, are under exploration. Innovative and evidence-based tools for the valuation of nature, along with ideas for NbS contributions to markets and jobs, encourage creative (blended) financing of NbS, thereby increasing the likelihood of their long-term success (Cohen-Shacham et al., 2016).

3.1 Climate change adaptation and mitigation

Climate change is one of the most pressing challenges confronting humanity today. NbS in the form of ecosystem-based mitigation (EbM) can make a powerful contribution to the fight against climate change by preventing the degradation and loss of natural ecosystems. It is estimated that deforestation and forest degradation contribute to the release of estimably 4.4 Gt of CO_2 per year into the atmosphere (Matthews & van Noordwijk, 2014), which is about 12% of anthropogenic CO_2 emissions (IPCC, 2014). When the land sector as a whole, including agriculture, forestry and other land uses, is considered, the contribution is about 24% of annual global anthropogenic emissions. Avoidance of these emissions, through better conservation and land management actions, is a powerful intervention that can make a significant contribution towards global mitigation efforts (Box 1). NbS also deploys, protects and strengthens ecosystems and the services they provide to address current challenges and safeguard human well-being in the face of climate change and its subsequent negative impact, such as the occurrence of extreme events, added pressure on natural recourses and biodiversity loss (Box 2). Nature-based Solutions to climate change are also addressed in part by SDG 13, which focuses on climate change.

3.2 Disaster risk reduction

Major disasters in the past decade have clearly demonstrated the role nature plays in reducing risks to natural hazards. The regulatory role of ecosystem services can be cost-effective in reducing risks posed to society by disasters. It is important to recognise that a natural hazard event has the potential to turn into a disaster, if the community or society is not able to cope with the impacts using its own resources. NbS, such as the Eco-DRR approach, can strongly support a community's risk reduction efforts (Box 3). NbS to disasters are addressed in part by SDGs 11 and 13, which focus respectively on making cities and human settlements safe and resilient and on mitigating and adapting to climate change. Through its implementation, NbS also contribute to various SDGs, such as SDG 1 (no poverty), SDG 2 (no hunger), SDG 3 (good health and well-being), SDG 6 (clean water and sanitation) and SDG 15 (life on land).

3.3 Food security

Food security is defined as the availability of food that is accessible to all, safe and locally appropriate, and reliable through time and across space, and is s one of the major issues facing the world today (IUCN, 2013a). There are many entry points for NbS to address food security issues. These include protecting wild genetic resources (animal and plant), managing wild species (especially fish) and providing irrigation water. Focusing on the restoration, conservation and management of ecosystems to deliver services can help stabilise food availability, access and use during periods of natural disaster, climate chang, or political instability (Box 4) (IUCN, 2013b).

3.4 Water security

Water security is vital for sustainable economic growth and poverty reduction. Investments are made worldwide in water infrastructure, for storage and flood control, water supply and quality, and disaster-risk reduction. Using 'natural infrastructures', such as forests, wetlands and floodplains and water-related services they provide (Box 6) will help combat the risk of water crisis and achieve water security, particularly in the face of future climate stresses (Ozment et al., 2015).

3.5 Socio-economic development

NbS can be a response to the economic impacts arising from the COVID-19 crisis. Nature-based activities can stimulate the economy through creating new, green jobs. NbS can create smart investment opportunities in nature, deliver value for people and accelerate ecosystem services as a tool for economic recovery. Deploying NbS as a national policy framework and an economic and development instrument can contribute to national economic and help achieve national commitments to international processes on climate change, human rights, human development and biodiversity (Box 7).

3.6 Human health

The natural environment, and more specifically ecosystems, the climate and biodiversity, are increasingly recognised as being influential determinants of human health, well-being and social cohesion (Naeem et al., 2015; Barton & Grant, 2006).

Several studies have focused on how the benefits of green space encounters (whether active or passive) can influence health and well-being. These include improvements in environmental quality, such as heat regulation and noise abatement (Hartig et al., 2014), the promotion of physical activity and associated Body Mass Index improvements (Thompson Coon, 2011), enhanced social interaction, social inclusion and cohesion and perceived safety, and opportunities for spiritual well-being experiences, typically in more remote 'wilderness' green spaces (Warber, 2013). Studies show that there is a global increase in the use and visiting frequency of urban green spaces during the COVID-19 pandemic.

These studies highlight the importance of green spaces, especially urban and community parks (Box 8), and the benefits they provide (Grima et al., 2020; Geng et al., 2021). Ecosystems, such as forests and coral reefs, have also been found to play a vital role in providing a source of medicines and pharmaceutical products, which greatly contribute to human health and well-being.

3.7 Ecosystem degradation and biodiversity loss

Ecosystem degradation and biodiversity loss are one of the two leading challenges of the current century. NbS are derived from services and products that are gained from ecosystems. Therefore, NbS interventions are strongly dependent on the health of ecosystems. According to IUCN Global Standard on Nature-based Solutions Criterion 3, NbS interventions must result in a net gain to biodiversity and ecosystem integrity.

The ecosystem-based approaches that are within the NbS umbrella, such as Forest Landscape Restoration (FLR), Ecosystem-based Adaptation (EbA) and Ecosystem-based Disaster Risk Reduction (Eco-DRR), and green infrastructures, contribute to the restoration, protection and strengthening of ecosystems they are implemented in (Box 9). Furthermore, parks and protected areas, which are primarily designed for management or conservation objective, can also serve as NbS.

BOX 1

NbS and climate change mitigation case study – Ramping land and forest restoration The Bonn Challenge

Hosted by IUCN and Germany, the Bonn Challenge is a global effort to bring 150 million hectares of degraded and deforested landscapes into restoration by 2020 and 350 million hectares by 2030. It is an implementation vehicle for national priorities, such as water and food security and rural development, while contributing to the achievement of international climate change goals, biodiversity and land degradation. It is estimated that a reduction of the current carbon dioxide emissions gap by 11%–17% will be achieved by meeting the challenge (InfoFLR, n.d.). A summary of the project challenges and outcomes are presented in Table 3.

TABLE 3

Summary of challenges and outcomes of the NbS and climate change mitigation case study

CHALLENGE	– Deforestation – Land degradation – Biodiversity loss – Forest landscape restoration (FLR)
NBS INTERVENTIONS	– Forest landscape restoration (FLR)
OUTCOMES	– Forestation – Ecosystem restoration – CO_2 emission reduction – Economic security – Food security – Water security
EXAMPLES OF POLICY SHIFT	– Creating multiple FLR platforms – Atlantic Forest Restoration Pact (PACTO) – Embarking landscape restoration programmes in several countries such as South Korea, Costa Rica, China, Rwanda, etc. – Brazil's commitment to restore and reforest 12 million hectares of forests by 2030 as part of its NDC

BOX 2

NbS and climate change adaptation case study – Ecological mangrove restoration, Thailand

During the past 55 years, the average temperature in Thailand has increased significantly. Climate variability in the form of intense rainfall days is increasing, while rainfall patterns are changing. From 1993–2008, the sea level in the Gulf of Thailand has risen about 3–5 mm per year when compared to the global average of 1.7 (±0.5) mm per year (Monty, 2017).

Within the Krabi River Estuary in the southwest of Thailand is Klang Island, which is where one of IUCN's EPIC projects (Ecosystems Protecting Infrastructure and Communities) carried out its interventions. This island is only about one metre above sea level and high sea tides that occur annually between October and December have become higher and cause flooding. Storms and winds during monsoon seasons adversely affect communities living on this island. Shrimp aquaculture has led to a significant loss of mangroves in the islands, and coastal erosion driven by mangrove destruction and water extraction inland has become very detrimental. Since 2003, this erosion has become very severe with one coastal community losing three to four metres of beach every year. During the dry season, there are water shortages and seawater intrusion (Ketsomboon & von der Dellen, 2013).

The overall goal of the EPIC* project in Thailand was to use the Community based Ecological Mangrove Restoration (CBEMR) method to restore abandoned aquaculture ponds to productive mangrove habitats, which will aid coastal protection and support resource-based livelihoods, especially fisheries. A multi-stakeholder approach was used during the entire process involving government, local people, and NGOs. A summary of the project challenges and outcomes is shown in Table 4.

TABLE 4
Summary of challenges and outcomes of NbS and climate change adaptation case study

CHALLENGE	– Rising sea levels – Storm surges and coastal floods – Erosion – Endangered biodiversity and habitat loss
CONVENTIONAL RESPONSE	– Construction of sea walls
NBS INTERVENTIONS	– Community based Ecological Mangrove Restoration to restore abandoned aquaculture ponds to productive mangrove habitats
OUTCOMES	– Flood protection – Restoration of the biodiversity of mangrove habitat – Providing supplementary livelihood (source of income from producing thatch and mud crab collection) – Capacity building – Establishing a stakeholder dialogue platform – Creating carbon storage capacities in mangrove ecosystems
EXAMPLES OF POLICY SHIFT	– Establishing Advisory Committees and local and national levels – Establishing multi-stakeholder platforms – Capacity building and raising awareness through several training events – Establishing a working group of local NG – Mangroves Action Plan – New Marine and Coastal Resilience Act

*For further information, please visit: https://www.iucn.org/theme/ecosystem-management/our-work/environment-and-disasters/ecosystems-protecting-infrastructure-and-communities-epic

BOX 3

NbS and disaster risk reduction case study – Restoration of wetlands and barrier islands for storm protection in the northern Gulf of Mexico, United States

The northern Gulf of Mexico frequently experiences smaller tropical storm surges. Wetlands and barrier islands play a key role in reducing wave energy, and thus help protect coastal communities from the effects of these storm surges (Barbier et al., 2013). In addition to their contribution to risk reduction, wetlands decrease salinity in estuarine areas that are important habitat for economically valuable species, such as oysters, shrimp and critically threatened species, such as the Gulf sturgeon. These wetlands, therefore, support the local fisheries industries in Mississippi and Louisiana, which are important economic sources for both these states (Walker, 2020). Given the benefits provided by wetlands and barrier islands, Louisiana and Mississippi have focused on the restoration of these natural features in order to protect against future flooding and storms. Table 5 presents a summary of the challenges and outcomes of the ongoing restoration projects of wetlands in Jean Lafitte National Historic Park and Preserve in Louisiana, and restoration of offshore barrier islands in the Gulf Islands National Seashore in Mississippi. Modelling of the storm surge attenuation suggests that the restoration of barrier islands results in the reduction of wave height and surge height as much as 1.25 metres (Ford, 2014). A summary of the project challenges and outcomes is shown in Table 5.

TABLE 5
Summary of challenges and outcomes of NbS and disaster risk reduction case study

CHALLENGE	– Storm surges – Coastal flooding
CONVENTIONAL RESPONSE	– Construction of canals, breakwaters and seawalls
NBS INTERVENTIONS	– Wetland restorations – Island restoration
OUTCOMES	– Coastal protection – Wave height reduction – Surge height reduction – Maintaining salinity levels – Maintaining habitat for commercial and recreational fisheries – Provide nesting habitat for threatened and endangered sea turtles and over-wintering waterfowl – Protect historical and cultural sites within the Gulf Islands National Seashore
EXAMPLES OF POLICY SHIFT	– Policy alignment for joint action through establishing the Coastal Protection and Restoration Authority (CPRA)

BOX 4

NbS and food security case study – Ecosystem-based approaches against salt intrusion, Senegal

Climate change in Senegal is characterised by erratic rainfall in time and space, resulting in a rainfall deficit and the disruption of the annual rainfall calendar. This variability in rainfall, combined with sea-level rise and inland freshwater and resource extraction, is driving soil salinisation and degradation, which has reduced agricultural productivity and hampered growth in all key economic sectors. Nearly three decades ago, research revealed that soil salinisation had affected an estimated 90,000 hectares in the Saloum estuary. IUCN implemented a sustainable land management approach to restore degraded land although the EPIC project in six villages in the Fatick region, Senegal. Anti-salt bunds (fascines) were used to reduce salt intrusion and contribute to freshwater retention. Assisted natural regeneration (ANR) is also implemented to increase tree cover and improve soil quality. Similarly, livelihood diversification is being targetted through duck and rooster breeding to increase income and reduce reliance on firewood. Around 104 hectares of land were protected, as well as 29,050 kg of food producing cultures and 19‘580 kg of peanuts and income culture were produced through EPIC interventions, benefitting 6,700 locals in that region. A summary of the project challenges and outcomes is shown in Table 6.

TABLE 6
Summary of challenges and outcomes of NbS and food security case study

CHALLENGE	– Salt intrusion – Drought – Land degradation – Food crisis
CONVENTIONAL RESPONSE	– Implementation of physical surface and subsurface barriers – Increased use of fertilisers and chemicals – Natural or artificial recharges – Adjustment or relocation of pumping wells and pumping stations
NBS INTERVENTIONS	– Ecosystem-based Disaster Risk Reduction and climate change adaptation approaches: – Use of anti-salt bunds (fascines) with local materials – Assisted natural regeneration – Livelihood diversification – Establishing forest nurseries to enrich fields with adapted trees
OUTCOMES	– Reduced soil salinisation and improved soil quality – Increase in freshwater availability – Increased crop yields – Increase of local poultry genetic biodiversity
EXAMPLES OF POLICY SHIFT	– of district authority risk management committee – Establishing a national platform to promote ANR – Development of action plan of the Central Disaster Risk Committee – Lead to the integration of conservation of wetlands and disaster risk reduction to the national policy of humid zones management

Box 5

NbS and water security case study – Water infrastructure solutions, Kenya

The Tana River Basin, Kenya's longest river has significant development opportunities for hydropower, domestic water provision, and irrigation. The basin provides 65% of the national electricity needs from hydropower, and nearly all of Nairobi's domestic water supply for 4 million people. The basin also supports the livelihoods of around six million people, and is home to major biodiversity hot spots – some amphibian species are even named after the river. Within the WISE-UP project, grey-green infrastructures and ecosystem services have been applied for sustainable water infrastructure development and climate change adaptation. A summary of the project challenges and outcomes is shown in Table 7.

TABLE 7
Summary of challenges and outcomes of NbS and water security case study

CHALLENGE	– Limited water resource – Multiple stakeholders including local communities – Increased soil erosion and river sedimentation in upper basin – Projection of dramatic rainfall occurrences
CONVENTIONAL RESPONSE	– Construction of more water storage infrastructure, such as dams and irrigation systems
NBS INTERVENTIONS	– Grey-green Infrastructures – Combination of dams and floodplains
OUTCOMES	– Flood risk management – Regulating downstream water quality and quantity – Climate change adaptation
EXAMPLES OF POLICY SHIFT	– Establishing African Collaborative Centre for Earth System Sciences (ACCESS) – Establishing a framework for action on climate change in Kenya, – The execution of the National Climate Change Act, implementation of the National Adaptation Plan and Green Economy Strategy, and formulation of County Integrated Development Plans.

BOX 6

NbS and socio-economic development case study – The Great Green Wall in 11 African countries

The expansion of the Sahara Desert has created a significant threat to the well-being and security of millions of people. Lack of resources has created tension in the region, triggering conflict over limited resources and leading to mass migration to Europe. In 2007, the Great Green Wall (GGW) initiative was established, which now has 21 African countries and international organisation members. The GGW initiative target is to restore 100 million hectares of land along the southernmost border of the Sahara Desert and halt the Sahara Desert advancement (Vizcarra, 2019). This initiative aims to provide food security for 20 million people, create 350,000 jobs and sequester 250 million tonnes of carbon by 2030 (Vizcarra, 2019). Between the years 2007 and 2018, approximately 18 million hectares of land were restored, more than 350,000 jobs were created, and around US$ 90 million was generated through GGW activities. This project is contributing to 15 of the 17 SDGs. A summary of the project challenges and outcomes is shown in Table 8.

TABLE 8
Summary of challenges and outcomes of NbS and socio-economic development case study

CHALLENGE	– Desertification – Land degradation – Food and water scarcity
CONVENTIONAL RESPONSE	– Construction of more water storage infrastructures, such as dams and irrigation systems
NBS INTERVENTIONS	– Sustainable land management
OUTCOMES	– Land restoration – Creating green jobs – Food security – Improvement of gender equity
EXAMPLES OF POLICY SHIFT	– Growing strategic partnerships to accelerate rural development across Africa – Activities of the Action Against Desertification initiative

BOX 7

NbS and human health case study – Urban forests in Barcelona, Spain

Barcelona, Spain is highly populated and one of the most popular tourist destinations in Europe. Studies carried out in 2012 revealed that the city fell short of the European Union's recommendations for accessing green spaces. If Barcelona's air quality were to improve, an estimated 3,500 lives could be saved annually. Increasing heat waves and temperatures from a change in weather and climate events also impact the health and quality of living in Barcelona. In 2013, the City of Barcelona started implementing a seven-year plan to integrate nature as solutions within the city's landscapes, in efforts to address human health issues and to further support the conservation of biodiversity in the area. The Green Infrastructure and Biodiversity Plan, together with the Trees Master Plan 2016–2035, are being used to drive such efforts and act at scale (Oppla, n.d.). A summary of the project challenges and outcomes is shown in Table 9.

TABLE 9
Summary of challenges and outcomes of NbS and human health case study

CHALLENGE	– Limited space, high population density, high level of pollution of air and water, increasing heatwave incidents
CONVENTIONAL RESPONSE	– Technology for cooling systems – Grey infrastructure for hazard risk mitigation
NBS INTERVENTIONS	– Street trees – Green corridors – Peri-urban forests – Hybrid dunes – Urban gardens
OUTCOMES	– Creating and improving ecosystem connections – Creating an ecological connection – Maintaining soil fertility – Pollination – CO_2 sequestration – Limiting rising temperatures – Reducing urban heat island effect – Reducing water runoff – Adapting to sea level rise – Flood risk reduction – Stormwater retention and infiltration; – Reducing the chance of combined sewer overflows
EXAMPLES OF POLICY SHIFT	– The Green Infrastructure and Biodiversity Plan – Trees Master Plan 2016-2035

BOX 8

NbS and ecosystem degradation and biodiversity loss case study – Achieving land degradation neutrality in 128 Countries

Land degradation affects between 25% and 30% of all land on the planet, and over 40% of all agricultural land. It contributes to biodiversity loss, climate change, food and water insecurity, drought, and other social and environmental challenges. These in turn contribute to global problems such as environmental migration and conflict. The global cost of land degradation has been estimated at US$ 6.3–10.6 trillion/: or between US$ 870 and US$ 1,450 per person per year (ELD, 2015). This cost is higher than the mean per capita income in Africa, the most affected continent.

The costs of land degradation indirectly affect everyone on earth, but they directly impact the lives of 1.4 billion people, most of whom are among the world's poorest. Land degradation is the outcome of numerous factors. Underlying drivers include population growth, increasing wealth, growing demand for natural resources, increasing economic power and technological change. These factors drive a number of pressures on land, including over-exploitation by agriculture, unsustainable natural resource extraction and pollution.

IUCN supported the United Nations Convention to Combat Desertification (UNCCD) secretariat and 81 countries to set voluntary national targets for land degradation neutrality (LDN), and currently supports countries to mobilise action and investments to reverse land degradation. Target setting has been completed in those 81 countries, embedded within national policy processes and public investments. At a conservative estimate, 600 million people could benefit directly from achievement of LDN targets in the 81 countries led by IUCN. The project is a major contributor to, and catalyst of, the overall global LDN target setting process under the UNCCD, which now includes 128 countries. A summary of the project challenges and outcomes is shown in Table 10.

TABLE 10
Summary of challenges and outcomes of NbS and ecosystem degradation and biodiversity loss case study

CHALLENGE	– Reduced land productivity, loss of livelihoods, loss of food sources, drought and desertification, water insecurity
CONVENTIONAL RESPONSE	– Abandon land, intensify and concentrate production in areas not degraded
NBS INTERVENTIONS	– Sustainable land management – Landscape restoration – Ecosystem based approaches – Protected areas
OUTCOMES	– Enhanced or restored ecosystem services for climate change adaptation, water security, food security – Removal of soil pollution, improvement of crop yields, increase of water table – Climate-smart agriculture, climate change adaptation of communities – Improved forest, watershed and range management, improved and inclusive governance and management of area
EXAMPLES OF POLICY SHIFT	– National LDN targets and implementation plans

4 National policy levers for enabling environment

Successful NbS implementation and scaling up for recovery and beyond hinges on both alignment and convergence of sectoral policies at national level. Cross-ministerial policy alignment is critical for establishing recognition and shared mandates related to NbS, considering that the solution (ecosystem management) is often the mandate of a ministry that is different from one that works on policies related to the problem (be it climate change, water security or socio-economic development). Nehren et al. (2017) mapped 13 legal and policy frameworks in Vietnam, ranging from civil code of conduct to exploration of minerals, which would need to be considered in recognising the role of urban coastal sand dune systems to be recognised for disaster risk reduction functions. Shared political commitments, mandates and resources, together with mutually beneficial work programmes, can facilitate such alignment for the implementation of NbS.

While alignment may be easier to achieve, there is still a risk of defragmented efforts. If each ministry or sector were to develop its own, stand-alone initiatives on NbS, there will be limited capitalisation opportunities from the solutions, given they can provide multiple benefits to equally multiple societal challenges from a single solution. These societal challenges may be spread across different ministries. Additionally, replicating skills and capacities each time for different, stand-alone initiatives creates replication of efforts and inefficiency of resource use. Therefore, an overarching national policy or plan that facilitates convergence of opportunities and actions is ideal for NbS to be implemented at scale.

Costa Rica's 1996 Forest Law is a good example, which combines both conservation and production forestry, as well as outlines roles and opportunities for public and private sector to contribute (FAO, n.d.). Similarly, Japan released its Fundamental Plan for National Resilience in 2018, outlining roles and opportunities for almost all its ministries (National Resilience Promotion Office of Japan, 2018). The opportunity with a crisis such as COVID-19 is being able to embed NbS within such an overarching policy mechanism, in the form of a recovery plan.

5 Measuring the performance and impact of Nature-based Solutions

NbS have gained considerable traction as a powerful tool to address societal challenges. However, mainstreaming NbS into policy and practice needs a systematic framework to help design, monitor, evaluate and measure the effectiveness of an NbS intervention. Furthermore, a common language and framework is required to bring together partners around such intersectional challenges, as the increased demand for NbS has led to cases of misuse of the concept. As NbS are increasingly adopted and scaled up, a Standard is necessary to ensure the quality and credibility of NbS interventions (Cohen-Shacham et al., 2019).

Through public consultation reaching hundreds of stakeholders from 100 countries, the IUCN Global Standard for Nature-based Solutions was developed to be facilitative, incentivising and enabling users to implement strong NbS interventions. The IUCN Global Standard provides distinctive parametres for defining NbS and a common framework to increase the scale and impact of the NbS approach, prevent unanticipated negative outcomes or misuse, and help funding agencies, policy makers and other stakeholders assess the effectiveness of interventions. This Standard aims to increase demand for NbS, while safeguarding people and nature to bring positive sustainable changes. The Standard consists of eight Criteria and 28 Indicators (Figure 2) (IUCN, 2020b), and has three purposes:

1) **Design.** The eight process-oriented criteria respond to the most important design (and future execution) aspects for an intervention to qualify as an NbS. As such, the criteria respond to a project management cycle, and highlight the critical aspects of thinking beyond the project's geographical space and timelines. This process also promotes the ability to practice adaptive management, since NbS design is based on a theory of change that will inevitably contain assumptions to be tested during implementation.

2) **Assurance.** The Standard can be used as a qualifier to ascertain if an existing solution is NbS or not. This function of the Standard is important for users, such as funders and investors, who may execute calls for submission of solutions. Additionally, past and ongoing NbS prior to the development of the Standard can also be evaluated against its criteria, if the intention is to have it recognised as an NbS.

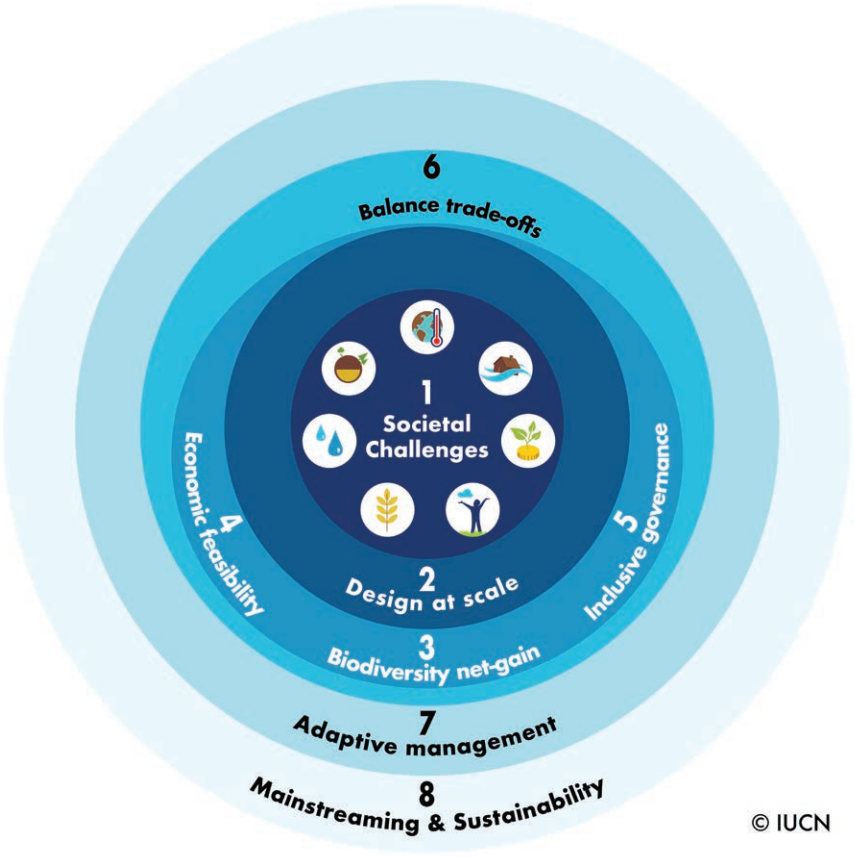
3) **Scaling up –** Some examples of NbS may be found to be in line with a good proportion of the eight criteria of the standard, lacking in just a few. A lot of these will likely be pilots or interventions that are currently of limited timeline, standalone approach. The Standard can be used to identify both strong candidates for scaling up and gaps to work on to transform the intervention into a strong NbS.

Criterion 1 of the Standard focuses on identifying the societal challenge to which the NbS is a response. While the scope of societal challenges currently includes climate change (adaptation and mitigation), DRR, ecosystem degradation and biodiversity loss, food security, human health, social and economic development and water security, there may be other specific challenges recognised within this scope as NbS evolve. One or more societal challenges can be the entry point; however, the priority is to leverage the potential NbS to provide multiple benefits, whereby one intervention addresses several challenges.

Criterion 2 guides the design of the solution responding to the scale of the issue. Scale in this context primarily refers to geographic scale across land and sea, as well as the economic, ecological and societal aspects of the land/seascape. The

FIGURE 2

The eight criteria of IUCN Global Standard for Nature-based Solutions



Source: IUCN (2020b, p. 3).

target area where the societal challenge is being addressed is often a part of a bigger system, be it ecological, economic or social. While intervention activities can be focused at the site scale, the robustness, applicability and responsiveness of the solution should take into consideration the broader systems at play.

Criterion 3, 4 and 5 correspond to the three pillars of sustainable development – environmentally sustainable, socially equitable and economically viable. For each Criterion, some understanding of the current resources and context, in the form of a baseline, as well as sustainable actions going forward are required to implement a strong NbS.

Criterion 6 addresses the balancing of trade-offs and choices that need to be made to achieve short and long-term gains, and how to ensure that there is a transparent, equitable and inclusive process to determine such trade-offs. Given the dynamic nature of the systems that influence the solutions (Criterion 2), it is important to manage the implementation of NbS systematically against established baselines. NbS harness the services of ecosystems, which are complex, dynamic and self-organising systems. Ecosystems may respond in desirable ways to an NbS intervention, or the intervention could create unintended, unforeseen and undesirable consequences. Consequently, Criterion 7 responds to the need for adaptive management, which facilitates continuous learning about system-wide processes and adapting the NbS according to systemic changes.

The true potential of NbS is realised through its long-term implementation at scale. Embedding the concept and actions into policy or regulatory frameworks as well as linking to national targets or international commitments can enable this, as promoted by Criterion 8.

Today, the IUCN Global Standard provides clear parametres for defining NbS and a common framework to help benchmark progress. Governments, companies, NGOs and others can use the IUCN Global Standard and its user guide and self-assessment tool to consistently design effective NbS projects that are ambitious in scale and sustainability, thus creating a shared language and framework for stakeholders and innovative partnerships. Donors and financers can invest in NbS with confidence that the Standard does provides a benchmark, minimising risks and adding assurance. All user groups across the public and private sectors can also further engage with the governance structure of the Standard, which connects stakeholders worldwide and ensures that the Standard is being used to its full potential to mainstream NbS around the world. This Standard has been developed while the world struggles to contain and arrest the spread of the COVID-19. Attention is currently turning to the post-pandemic economic recovery. As world leaders contemplate how to build back better, NbS offer a unique opportunity to invest in societal well-being and vibrant economies without having to return to the mistakes of the past.

6 Conclusion

It is time for the environment sector and the development sector to move away from the perspectives that separate people from nature. Human actions of land/seascape do not only have environmental impact but economic, social and cultural impacts too. Conservation is a development issue and NbS are solutions that address multiple societal challenges through the same intervention and at the same time support recovery from COVID-19 and accelerate our overall shift to sustainable ways of meeting the needs of society.

As the world attempts to emerge from the COVID-19 pandemic and move towards realisation of the SDGs, it is crucial that future actions contribute to the health and well-being of people and the planet by investing in nature. NbS are powerful solutions to current major societal challenges, such as food security, climate change, water security, human health, and social and economic development. NbS interventions can also support all stages of the crisis management cycle. Cases of successful NbS interventions have been discussed in this report, which clearly demonstrate the potential of nature's role in development.

NbS can be leveraged for creating a more resilient future by: forming smart investment opportunities in nature; investments that create green and clean job; delivering value for people, economies and nature; and accelerating ecosystem services as a tool for economic recovery. More importantly, the IUCN Global Standard for Nature-based Solutions can help further unlock the potential of nature in meeting human development needs.

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