NATURE HIRES: How Nature-based Solutions can power a green jobs recovery

October 2020

WWF

International Labour Organization

TABLE OF CONTENTS

For contact details and further information, visit our international websites at www.panda.org or www.ilo.org

Cover photography: © Mito Tsukamoto

FOREWORD

As we entered 2020, the dual global crises of climate and nature loss were in the public eye as never before. Within weeks, the COVID-19 pandemic had triggered a third crisis, plunging countries around the world into recession as governments struggled to halt the spread of the novel coronavirus and prevent health systems becoming overwhelmed.

That third crisis, and the economic disruption and loss of employment it has brought with it, is further increasing global inequality, and threatening prosperity around the world. It is also contributing to the first two crises, as efforts to address climate change are deprioritized, and as desperate communities lean more heavily on the natural systems on which they depend.

These natural systems play a vital role in supporting employment. Some 1.2 billion jobs in sectors such as farming, fisheries, forestry and tourism are dependent on the effective management and sustainability of healthy ecosystems. Half of the world's Gross Domestic Product is, to a greater or lesser degree, dependent on nature. Stressing or destroying vital ecosystems will have enormous economic as well as environmental and social costs.

Too often, nature and the economy are placed in opposition – where there is believed to be a trade-off between human well-being and a healthy planet. But while this trade-off may seem real in the short term, it is also obvious that, over the long term, it is false; there will be no decent jobs on a dead planet.

Instead of a trade-off, the interdependence of economic well-being and nature can present an enormous opportunity. A range of Nature-based Solutions exist that can help address the crises of nature and climate on the one hand whilst creating jobs and prosperity on the other.

Whether it is restoring forests, building green infrastructure, protecting mangroves, practising agroecology or planting urban forests, practical and implementable Nature-based Solutions can be deployed to protect and enhance nature while creating, sustaining or enhancing decent employment, and contributing to the achievement of the Sustainable Development Goals (SDGs).

As governments respond to the COVID-19 pandemic, they have an opportunity to design stimulus packages that integrate Nature-based Solutions, simultaneously supporting nature, creating employment and increasing resilience. This report offers examples of Nature-based Solutions that have been successfully deployed around the world that can provide inspiration and guidance for governments as they do so.

Nature-based Solutions are not, of course, a panacea. Many of our problems cannot be addressed using such approaches, and the misapplication of Nature-based Solutions techniques can harm nature and human well-being. The aim of this publication is to map out the societal challenges where Nature-based Solutions can be effective, how they have been used, and provide evidence and examples as to show how they integrally support the achievement of the SDGs.

We are delighted that the ILO and WWF were able to collaborate on this publication and combine our respective expertise on nature and employment. We hope it will contribute to greater awareness and shifts in policy that will allow for more widespread use of these approaches.

Manuel Pulgar-Vidal	**Sangheon Lee**
Chair, Nature-Based Solutions Steering Committee	Director of the Employment Policy Department
WWF International	International Labour Organization

WWF is working with ILO on creating awareness around nature and employment.

KEY MESSAGES:

1

Globally, we are witnessing job losses of unprecedented magnitude with as many as **1.6 billion workers, nearly half the global workforce, at risk of losing their livelihoods.**

2

COVID-19 risks accelerating the crises of climate change and nature loss that humankind faced before the onset of the pandemic, while its resulting economic impacts are **exacerbating inequality and poverty.**

3

There is an urgent need to address these two crises in the **unprecedented response measures** that governments are deploying to primarily address the economic impacts of COVID-19.

4

For recovery packages to be sustainable, they should:
- Improve human well-being without harming nature;;
- Aim for setting the foundations for the transformation of sectors and systems
- Use existing institutional arrangements and proven measures;
- Adopt multi-level and cross-sectoral approaches. Recovery packages that focus on synergies between development, climate and nature are more likely to increase national well-being; and
- Maximize the creation of decent jobs.

5

Some multilateral development banks are already recognizing that the economic recovery from COVID-19 is **an opportunity to both tackle the climate crisis and build higher societal resilience through nature.**

6

Nature-based Solutions often provide cost-effective approaches that could contribute to **achieving a number of the Sustainable Development Goals**, particularly those relating to poverty, food and water security, human health and climate action.

7

A growing range of Nature-based Solutions exist, for which real-world experience and expertise are available, that could effectively be harnessed to **create employment while simultaneously protecting nature, mitigating climate change, and making human societies safer, healthier and more resilient.**

8

Some of the most job-intensive activities that are an integral part of many Nature-based Solutions include **reforestation, ecosystem or watershed rehabilitation and restoration, management of invasive species** and t**he use of agroecological approaches in food production.**

9 **POLICYMAKERS NEED TO URGENTLY EXPLORE THE POTENTIAL OF NATURE-BASED SOLUTIONS, AND SEEK TO INTEGRATE THEM IN THEIR RESPONSES TO COVID-19.**

I. INTRODUCTION

The COVID-19 pandemic has shown just how vulnerable countries and global systems are to major shocks. The response of many governments to the pandemic — social distancing and the closure of large parts of the economy — has triggered an economic crisis, with rapid and unprecedented job losses.

While the effects of the pandemic on economies and labour markets are still unfolding, indications so far are dire. The International Labour Organization (ILO) estimates that as many as 1.6 billion workers, nearly half the global workforce, are at risk of losing their livelihoods. During the second quarter of 2020, there was an estimated 17 per cent drop globally in hours worked, equivalent to the loss of 495 million full-time jobs (ILO 2020a and ILO 2020b). As women workers are over-represented in some of the economic sectors worst affected by the crisis, such as accommodation, food, sales and manufacturing, it is also anticipated that they will be more severely impacted.

At the same time, crises that pre-dated the COVID-19 pandemic have not gone away. The informal economy accounts for more than half the global workforce, with the share of those working in the informal economy defined as poor likely to have risen from 26 per cent to 59 per cent in the first months of the crisis (ILO 2020a). Despite a likely short-lived dip in greenhouse gas emissions, global average temperatures continue to rise and the loss of natural habitats and the biodiversity they shelter continues relentlessly (see Figure 2).

In response to this economic catastrophe, many governments have introduced job retention or social protection measures for their citizens at an unprecedented scale while also pushing forward with massive economic 'stimulus' or 'recovery' measures. At present, COVID-19 stimulus packages are five times bigger than climate funding on an annualized basis, opening opportunities to invest in greening economies. There have been promising signs (for example the European Union — see Figure 1), but, in general, most spending is being directed towards conventional solutions, with limited job sustainability impact. Most current packages are pushing towards 'grey' recoveries, while only 4 per cent of COVID-19 stimulus can be categorised as 'green' (Vivid Economics, 2020).
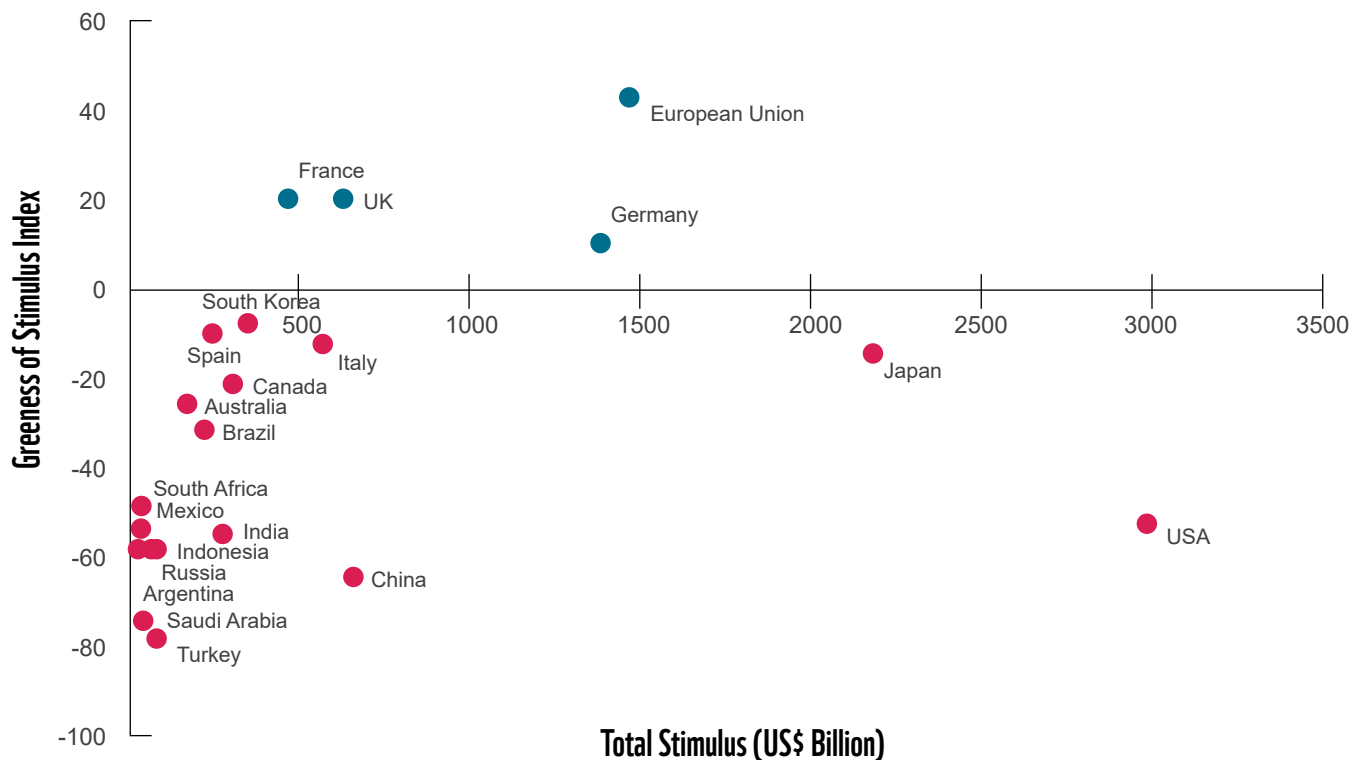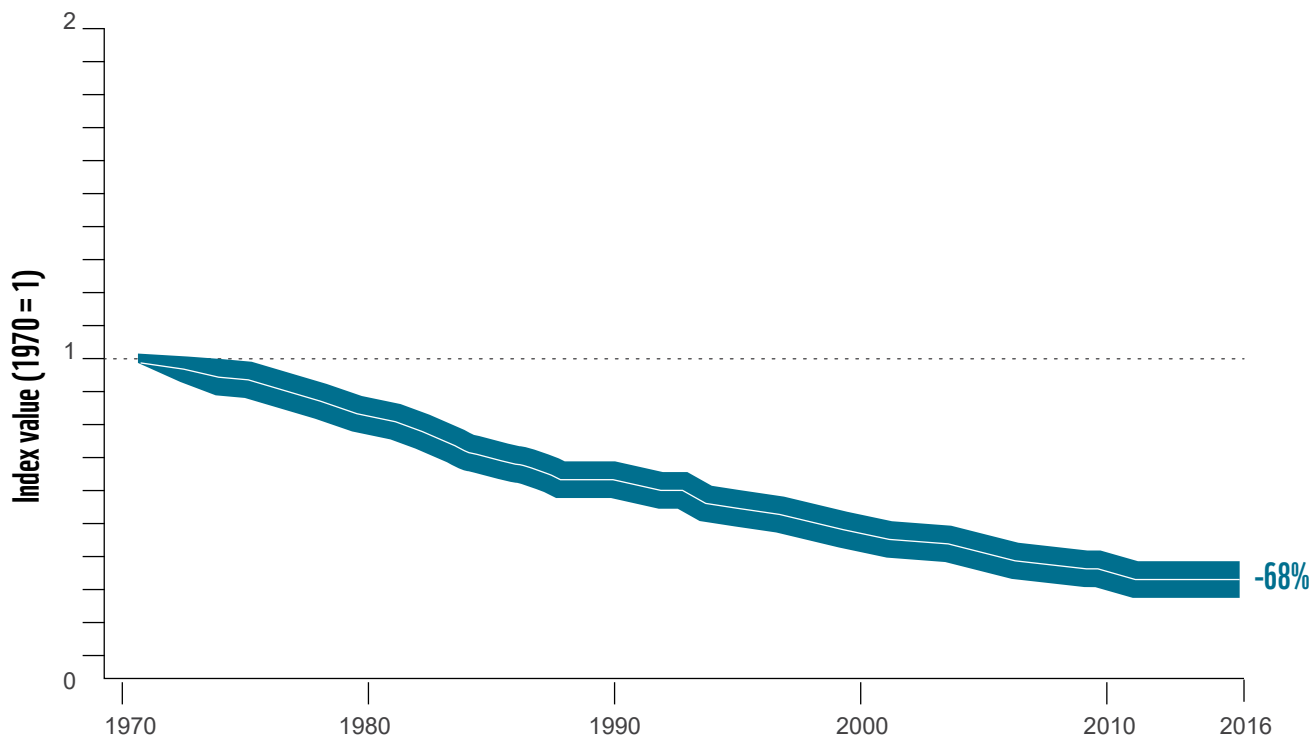

Figure 1. Size and 'greenness' of stimulus packages. Source: Vivid Economics, using a variety of sources, updated on 28 August 2020.

Figure 2. The Global Living Planet Index: 1970 to 2016. The average abundance of 20,811 populations representing 4,392 species monitored across the globe declined by 68%. The white line shows the index values and the shaded areas represent the statistical certainty surrounding the trend (range: -73% to -62%). Source: WWF/ZSL (2020)

However, multilateral development banks (MDBs) such as the Asian Development Bank are showing leadership, recognizing that the economic recovery from COVID-19 is an opportunity to both tackle the climate crisis and build resilience, including through natural and hybrid infrastructure projects and Nature-based Solutions (ADB, 2019).

In order for these recovery packages to be sustainable, they should:

1. **Improve human well-being without harming nature,** recognizing that nature constitutes the foundation of any prosperous socio-economic development.

2. **Aim for setting the foundations for the transformation of sectors and systems**, prioritizing actions that support the transition to climate and nature-positive economies that support climate and nature goals and long-term sustainable growth in line with the Sustainable Development Goals (SDGs) and the Paris Accord.

3. **Use existing institutional arrangements and proven measures**, leveraging proposals with current frameworks and legislations aimed at propelling climate and nature goals. For example, Nationally Determined Contributions (NDCs) or National Biodiversity Strategy and Adaptation Plans (NBSAPs) could be enhanced using Nature-based Solutions.

4. **Adopt multi-level and cross-sectoral approaches.** Recovery packages that focus on synergies between development, climate and nature are more likely to increase national well-being.

5. **Maximize the creation of decent jobs.** The response to COVID-19 should prioritize the immediate creation of decent jobs with a focus on investments in sectors which can easily absorb workers who have lost jobs and income while supporting sustainable growth and aim to follow the ILO's Guidelines on a Just Transition to environmentally sustainable economies and societies for all (ILO, 2015).[1]

Growing pressures on nature

The current global recession risks increasing the severity of global inequality through unprecedented job losses and loss of income. It is disproportionately affecting low-income communities who are already most vulnerable to pressures from climate change and biodiversity loss as they are often dependent on local natural resource systems for water and food as well as their livelihoods. Meanwhile, these severe social impacts may in turn deepen the dual crises of biodiversity loss and climate change by increasing human pressures on nature and prompting the resort to conventional and polluting solutions, which are more accessible in the short-term. Ecosystem degradation is now also clearly recognized as a threat to peace and social stability, with the Syrian conflict just one example of how the adverse effects of climate change and related impacts, such as population displacement, can play a critical role in igniting violence and armed conflict (Institute for Economics & Peace, 2020).

However, governments have an opportunity to design stimulus packages that simultaneously support nature, create employment and increase resilience by integrating Nature-based Solutions that support some of our key societal goals, such as food and water

---

1   Developed by the authors, inspired by tenets of diverse organizations such as the World Health Organization, the European Commission, Oxford University, Vivid Economics and the OECD.

security, human health and provision of decent work, while also addressing climate change and biodiversity loss. Furthermore, among green stimulus measures, the greatest potential for job creation lies in natural capital investments through direct government spending both in rural and urban settings on Nature-based Solutions and urban green infrastructure respectively (Vivid Economics, 2020). Nature-based Solutions have been deployed around the world and should be an integral part of these packages. If their value was more generally recognized, and more conducive policy and regulatory frameworks were put in place, they could be deployed at a much larger scale, generating massive long-term public benefits.

Defining Nature-based Solutions

The International Union for the Conservation of Nature (IUCN) defines Nature-based Solutions as ''actions to protect, sustainably manage, and restore natural or modified ecosystems, which address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits'' (Cohen-Shacham et al., 2016). Nature-based Solutions can be used at different scales and in combination with more conventional or 'grey' solutions. In contrast with grey infrastructure or conventional techniques, Nature-based Solutions are distinguished by their multifunctionality and ability to conserve and add stocks of natural capital, and increase the overall resilience and connectivity of landscapes (Maes and Jacobs, 2015; Keestra et al., 2018).

Examples of Nature-based Solutions range from simple techniques, such as using native vegetation rather than concrete to control soil erosion and reduce water runoff along road embankments, to landscape-scale watershed restoration to improve water quality and availability for entire regions. Increased use of Nature-based Solutions has a number of advantages, including: delivering integrated environmental outcomes (ecosystem services, biodiversity net gain, etc.); promoting human health and well-being; and empowering local people and encouraging public participation (Kabisch et al., 2016).

An important element of Nature-based Solutions is that the asset often appreciates over time — for example, vegetation grows denser and becomes resilient over time — while the opposite tends to be the case for engineered structures which require maintenance and replacement.

And even though Nature-based Solutions require a long-term perspective, many of them can also be implemented in the short-term as part of large-scale public employment programmes and so mobilize particularly vulnerable parts of the population to contribute to ecosystem restoration. Such approaches have a long history, going as far back as Civilian Conservation Corps in the United States in the 1930s, but continuing with contemporary large-scale programmes in India, Ethiopia and South Africa (Norton et. al, 2020). A framework for deploying such programmes at scale including options for aligning them with environmental and poverty reduction investments, high-impact opportunities and financing mechanisms, was developed in response to the 2008-09 financial crisis and remains relevant today (Lieuw-Kie-Song, 2009). Such programmes can be an integral part of responses to COVID-19, especially for enabling a less disruptive recovery of the labour market (ILO, 2020c). Annex 1 provides an overview of the various work activities that are integral to the implementation of various Nature-based Solutions and, where available, figures for their direct job creation potential, as well as jobs generated from spillovers into other sectors of the economy.

Nature-based Solutions can also help build resilience against future shocks. As the World Economic Forum has observed, the current crisis is linked to our relationship with nature, and our response should consider nature in plans for economic recovery, especially given that half of the world's GDP is highly or moderately dependent on nature (Quinney, 2020). Specifically, the ILO estimates that 1.2 billion jobs in sectors such as farming, fisheries, forestry and tourism are directly dependent on the effective management and sustainability of healthy ecosystems (ILO, 2018).

The ILO has for many years supported projects to promote job creation while helping local communities adapt to climate change under its "Green Works" banner (ILO, 2011). Many of these projects incorporated Nature-based Solutions and were found to be both labour-intensive and able to use a high share of local resources. In the current context, with an urgent need for immediate job creation, the potential of Nature-based Solutions to quickly create direct jobs is of particular interest, but the longer-term employment creation impacts are often even more substantial and should not be disregarded, even if there is pressure to focus on immediate benefits.

There is a considerable body of experience of putting Nature-based Solutions into practice around the world. This report presents some of the most relevant examples that have had positive impacts on job creation as well as income generation.[2] These demonstrate how investments using Nature-based Solutions can also be an effective way to address some of our key societal challenges, and enhance biodiversity while also maintaining and creating employment and improving labour productivity.

---

2   Inclusion of examples in this report does not imply that either WWF or the ILO endorses the particular Nature-based Solutions in question or its application.

II. NATURE-BASED SOLUTIONS AS INVESTMENT OPPORTUNITIES FOR MULTIPLYING PUBLIC DIVIDENDS

While it is critical to identify private funding opportunities as well as bankable solutions, when discussing Nature-based Solutions it is useful to think of them as public investment opportunities as they present a means for investing in much-needed public goods and services, often with social multiplier effects. Conversely, failing to invest in nature can have downward spiral effects in the achievement of SDGs.

Nature-based Solutions can help reverse this, and be part of the solution to societal challenges such as climate change, food insecurity, water insecurity, the impacts of natural disasters and the urgent need to improve human health. Collectively, they can generate a range of benefits to nature and the economy.

Given the wide range of possible interventions that fall under the umbrella of Nature-based Solutions, we have grouped them here by the societal challenges they can primarily address, as well as by their contributions in achieving the SDGs.

Figure 3 shows different Nature-based Solutions interventions (such as agroforestry, green corridors, etc.) in relation to the societal challenges they address and the SDGs they contribute to. The figure also shows how one Nature-based Solution approach can contribute to multiple developmental goals, and how they collectively all support SDG 1 (Reducing poverty) and SDG 8 (Creating decent work).
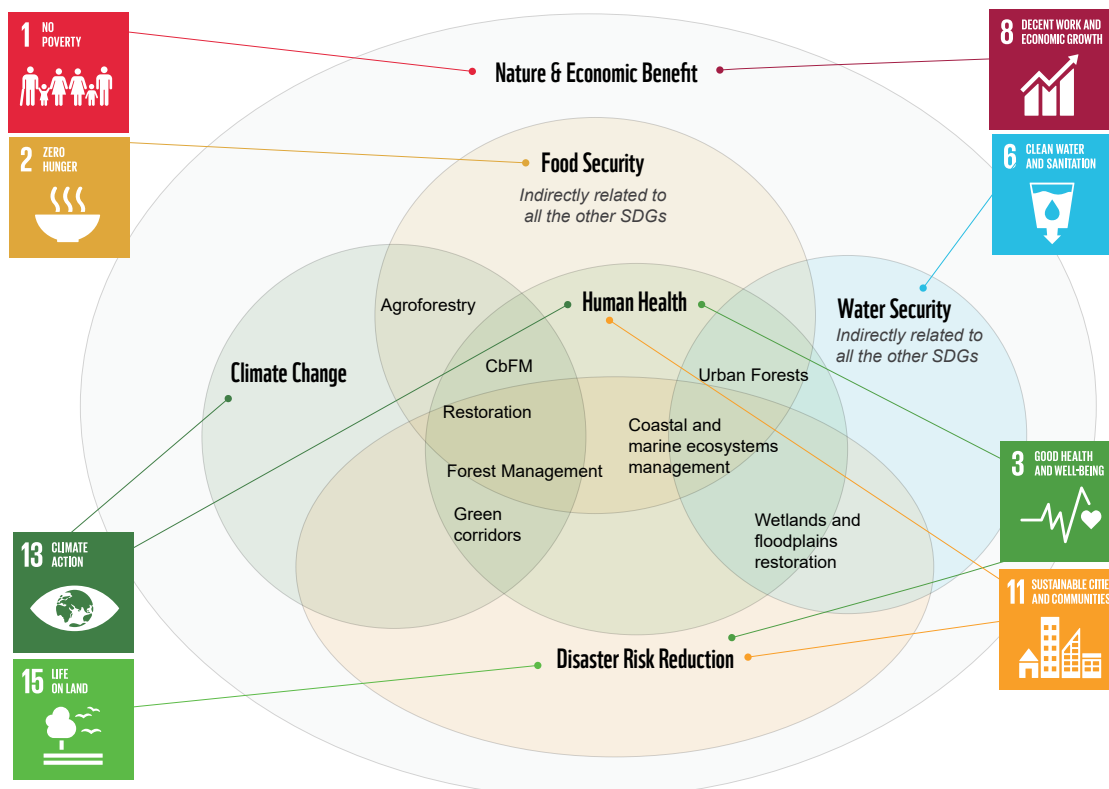
Figure 3. Societal challenges and Nature-based Solutions interventions reviewed **Source:** Authors

Acronym
 CbFM: Community-based Forest Management

As Figure 3 shows, most Nature-based Solutions contribute to addressing multiple societal challenges and SDGs. For example, Vasseur et al (2017) showed that achieving four critical SDGs (SDGs 6, 13, 14 and 15) indirectly supported the remaining goals.

It also shows how SDGs 1 and 8 cut across all these interventions. Figure 3 also makes evident that the benefits of Nature-based Solutions go beyond a local community and/or stakeholder. Their often multiple, layered and distributed benefits can also pose a challenge to generating a single financial return flow. This is why the role of public investment, which values the common good, is critical for attracting, focusing and complementing other investments to make Nature-based Solutions financially viable.

Development finance institutions have a critical role to play to leverage private funding towards investments that create higher public dividends. Green infrastructure projects typically exhibit strong public good characteristics, but may also present lower returns and higher levels of risk for private investors (Browder et al., 2019). Considering this, Multilateral Development Banks (MDBs) for example can encourage investments from the private sector in green projects by mitigating or offering guarantees to reduce some of these risks. MDBs have shifted their focus in recent years to increase their support to issues such as climate adaptation, climate finance tracking and reporting and environmental and social standards and practices. In 2018, climate financing by MDBs reached a record high of US$43.1 billion (Asian Development Bank, 2018).

The literature and cases presented below all aim to show how deploying Nature-based Solutions can address a wide range of urgent societal challenges while at the same time stimulating job creation and sustainable economic activity. The interventions listed are divided by the main societal challenge they address (disaster risk reduction, climate change mitigation and adaptation, food security, water security and human health) with a respective description of how they also contribute to economic development and job creation. However, it should be stressed that Nature-based Solutions interventions contribute to several of these societal challenges simultaneously; this will be highlighted accordingly.

General considerations for Nature-based Solutions implementation

While Nature-based Solutions provide multiple social benefits, some particular considerations should be taken into account when considering their use. The IUCN Global Nature-based Solutions Standards provide a framework for ensuring these considerations are taken into account. However there are some which are of specific concern which we would like to highlight.

- The potential impacts on gentrification and displacement of indigenous and poor communities should be considered upfront. These should be avoided, and when needed, managed observing the highest existing international standards of social inclusion and informed consent.[3]

- Carbon credits generated by well-planned Nature-based Solutions projects should align with jurisdictional approaches and not be considered appropriate offsets unless they are additional to a 1.5°C decarbonisation trajectory informed by the Science Based Targets initiative or another credible reference.

- Commercial forest plantations are not considered a nature-based solution. They are generally monocultures and do not provide the biodiversity net gains which are a precondition of Nature-based Solutions interventions.

- A successful Nature-based Solution intervention in one place cannot necessarily be directly transplanted to other contexts and regions. Nature-based Solutions results will be determined by the natural, cultural, socioeconomic and policy contexts in which they are applied.

A. Nature and socio-economic benefits

Before presenting the specific societal challenges to which Nature-based Solutions can be applied, their broader nature and socio-economic benefits warrant discussion, as they are important arguments for their adoption. While there are also many solutions to the societal challenges above that do not work explicitly with nature, many do so without generating the broad and mutually supportive environmental and socio-economic benefits generated by Nature-based Solutions.

Nature-based Solutions as a socio-economic policy and intervention supports decent work and produces and sustains productive natural capital and assets (alongside physical capital). In many cases, it is also a low-cost investment option for boosting jobs, productivity and economic activity.

For example, the low productivity of agriculture in developing countries, in particular in Africa, lies at the root of rural poverty and this low productivity partially caused by depleted natural capital and the inability of ecological capital to provide key ecosystem services, leads to low returns and incomes. Nature-based Solutions, such as restoring water catchments, can increase water availability and reduce soil erosion, contributing to increased agricultural productivity. Similar benefits can be found in sectors such as fisheries and forestry, where the use of Nature-based Solutions can sustain or enhance the jobs and productivity of those working in these sectors.

---

3   Including the ILO Indigenous and Tribal Peoples Convention, (Convention 169 of 1989) (ILO1989)

© Marcel Crozet / ILO / Flickr

However, natural capital is also important for sustaining other economic sectors beyond agriculture, fisheries and forestry and securing associated employment. The state of nature is a key enabler of the tourism sector, not only for ecotourism businesses but also for urban tourism, which depends on clean water and air. Similarly, much manufacturing is dependent on access to water, while it is estimated that approximately 90 per cent of all energy generation is water intensive (WWAP, 2014).

B. Disaster risk reduction

The United Nations considers disaster risk reduction an integral part of social and economic development (UN, 2020). It has international recognition in global policy frameworks such as the Convention on Biological Diversity, the Sendai Framework for disaster risk reduction and the Ramsar Convention on Wetlands. Its contributions to the SDGs are covered mainly by SDG 11 (Sustainable cities) and SDG 13 (Climate action). Nevertheless, by implementing disaster risk reduction, other SDGs are addressed, including SDG 1 (No poverty), SDG 2 (No hunger), SDG 3 (Good health and well-being), SDG 6 (Clean water) and SDG 15 (Life on land) (Cohen-Shacham et al., 2016).

Cities present a particular challenge for disaster risk reduction. In most cases, they are built with impermeable structures (grey infrastructure) which can increase the likelihood that storms result in high levels of run-off, leading to floods and pollution. Flood damage to urban properties is estimated to cost US$120 billion annually, while it is forecast that 1.3 billion people will live in flood-prone areas by 2050 (Browder et al., 2019).

Flooding already causes average annual losses of nearly €40 billion around the world (Cooley, 2006). Forecasts suggest that even relatively small increases in the global average temperature will result in an increase in the frequency of intense and damaging storms and floods and the modelled predictions are already being confirmed with extreme flood events across the world (Mallakpour and Villarini, 2015). Beyond climate change, flood risk is rising for other reasons. In regions with mature flood defense systems, engineered structures, such as dams and dikes, are often deteriorating with insufficient budgets for repairs and maintenance. Furthermore, ongoing changes in river basins – including conversion of forests and wetlands into agriculture land and the expansion of urban areas dominated by impervious surfaces – are increasing the size and frequency of floods. Nature-based Solutions, including wetland and forest restoration and floodplain reconnection, can be part of a diversified portfolio of strategies to reduce flood risk.

Nature-based Solutions such as reforestation and wetland restoration interventions planned for disaster risk reduction promise to create opportunities for employment at relatively large scale and over longer time frames than other Nature-based Solutions approaches. The World Resources Institute notes that these approaches can reduce the risk of erosion, landslides and flooding, and therefore also increase the resilience of ecosystems to climate change (Ross et al., 2019).
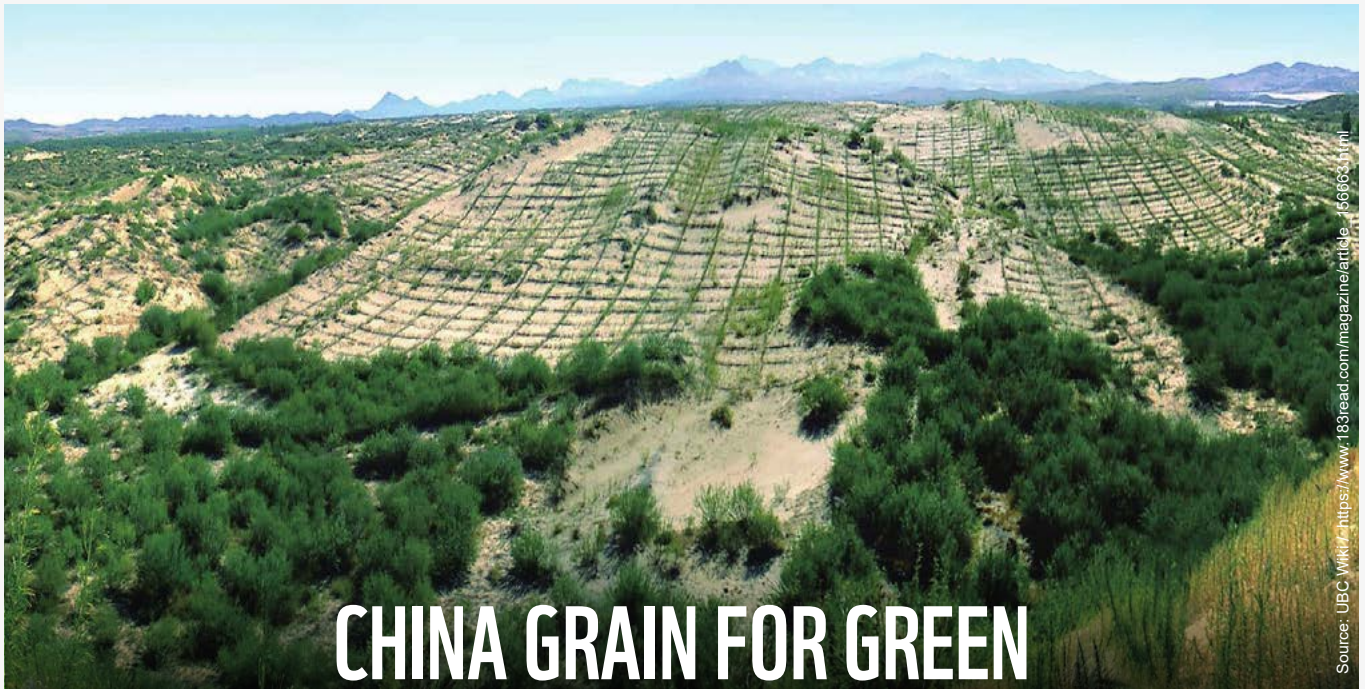
CHINA GRAIN FOR GREEN

China's Grain for Green (GfG) programme, launched in 1999, is considered the largest reforestation programme in the world, involving 124 million people in 25 provinces (Delang, 2018; Global Times, 2019). The programme reduced soil erosion, enhanced biodiversity and enabled the conservation of natural resources by converting steep-sloped land, degraded cropland and barren land into forest and grassland. These were the main sources of silt flowing into the Yellow and Yangtze rivers.

It is part of the Chinese emerging national poverty reduction strategy and resulted in a 12.8 per cent yearly increase of household income for local farmers (Delang, 2018; Gutiérrez Rodríguez et al., 2016; Hue et al., 2016).) The programme combined monoculture endemic plantations and mixed-forest plantations where the latter were found to be more economically attractive (Hue et al., 2016).

The programme has seen a decrease in farmland coverage and a significant increase in vegetation coverage, including the recovery of vital ecosystems functions such as water resources (Han et al., 2019).

An interesting aspect of GfG is that more than 32 million farming households received cash incentives to engage in conservation and reforestation activities (ILO, 2015). While these households received these incentives through a cash transfer mechanism and so were not employed to engage in conservation and reforestation, it is estimated that their total labour input is approximately the equivalent of four million full-time jobs per year. The programme highlights the high levels of labour inputs, and employment potential of engaging in reforestation and conservation. It also shows the potential for integrating such large-scale reforestation programmes into recovery packages, as they are public investments that simultaneously deliver large-scale ecological, social, economic and income benefits to rural households (Payen and Lieuw-Kie-Song, 2020).

Nature-based Solutions can also contribute to sustainable coastal management. There are numerous studies into the economic advantages to adaptively managing coastal habitats, especially given that more than 40 per cent of the population lives in or near coastal areas (Temmerman et al., 2013). In 2005, it was estimated that coastal flooding and erosion in 136 coastal cities around the world had annual costs of up to US$6 billion (Browder et al., 2019). These losses are expected to increase to US$52 billion per year by 2050, and as high as US$1 trillion per year in adverse climate change scenarios (Hallegatte et al., 2013). A study examining the economic impact of coastal habitat protection concluded that, on average, 17 jobs were created per million dollars spent, which is similar to other conservation endeavours such as parks and land conservation, and much higher than industries including coal, gas and nuclear power generation (Edwards et al., 2013).

Mangrove protection and restoration, specifically, holds significant potential. A case study in Viet Nam showed that investing US$9 million to restore 9,000 hectares of mangroves in 166 communities, including the protection of 100 kilometers of dikes, resulted in US$15 million in avoided damages to private property and public infrastructure (Browder et al., 2019). Bapna et al (2019) found that restoring mangroves is not only two- to five-times cheaper than conventional engineered structures that protect against sea-level rise, but their protection could also generate total net revenues of US$1 trillion, while at the same time securing food supply and livelihoods, improving water quality, reducing storm impacts and generating incomes for the local communities. Conversely, inappropriately applied hard infrastructure to control flooding can create new vulnerabilities by simply shifting vulnerability to flood risk elsewhere (Barreteau et al., 2019). Another study found that, based on economic and hydrodynamic modelling, mangroves are estimated to provide flood protection benefits exceeding US$65 billion per year; their loss globally would lead to 15 million more people being flooded annually across the world (Menéndez et al., 2020).

C. Climate change

When applied to climate change, Nature-based Solutions should deliver climate mitigation and/or adaptation outcomes that are economically, socially, and ecologically beneficial to both local stakeholders and local, regional and national authorities. Recently, both public and private institutions and the international community have begun to seriously consider Nature-based Solutions as a key component in addressing the climate emergency, alongside the needed transformations in our energy, urban and industrial systems, as pointed out by the Intergovernmental Panel on Climate Change (IPCC) in its landmark *Special Report on the Impacts of Global Warming at 1.5°C* (IPCC, 2015).

In terms of the contribution of Nature-based Solutions to mitigation, the IPCC's 2014 *Fifth Assessment Report* notes that agriculture, forestry and other land uses (AFOLU) accounted for 24 per cent of global greenhouse gas emissions in 2010 (Smith et al., 2014). Reducing these AFOLU emissions while simultaneously using the land sector to remove CO_2 from the atmosphere is critical to limiting warming to a 1.5°C threshold. Other studies suggest that Nature-based Solutions could account for up to 30 per cent of the world's climate mitigation potential (Seddon et al., 2019).

Forest restoration can also be highly labour-intensive. Using US data, Garrett-Peltier and Pollin (2019) found that restoration and sustainable forest management created more jobs per million dollars of investment than other industries covered in the study (agriculture, gas, mass transit and freight rail construction, aviation, etc.), with 39.7 direct and indirect jobs per million dollars of investment. In developing countries, figures can be much higher. For example, estimates from a comprehensive forestry-based stimulus programme in response to the 2009 crisis estimated that it could create the equivalent of 275 direct jobs per million US dollars invested. The proposed total package would create 10 to 16 million new jobs, while also restoring or conserving 50 million hectares of land for an investment of US$36 billion (Nair and Ruth, 2009).

Meanwhile, protecting ecosystems can be a cost-effective and sustainable way to reduce people's vulnerability to climate change impacts while maintaining or restoring local, regional and/or global ecosystem services. Positioning Nature-based Solutions to stop further degradation of critical ecosystems can build communities' resilience in three main ways: (1) reducing exposure to inland and coastal flooding; (2) building adaptive capacity and empowering local communities to manage their local environment; and (3) increasing resilience to climatic shocks (Seddon et al., 2020; Lavorel et al., 2019).

It is key to recognize the mitigation and job creation opportunities of other key ecosystems such as wetlands, floodplains, mangroves and grasslands (WWF, 2019a). Mountain grasslands ecosystems store between 60.5 and 82.8 gigatonnes of carbon (Gt C) (Ward et al., 2014). Likewise, mangroves are considered to have an enormous potential to store carbon for thousands of years (IUCN, 2020). The estimated capacity for carbon stored in mangroves globally is about 11.7 Gt C - an aboveground carbon stock of 1.6 Gt C and a belowground carbon stock of 10.2 Gt C (Kaufmann et al., 2020). The whole carbon storage capacity in oceans builds-up to 39,000 Gt C of which, only 700–900 Gt C exist near the ocean surface (Ussiri and Lal, 2017).

When looking at these figures, it becomes even more pressing to decarbonize economies and industrial sectors fast and aligned to a 1.5°C trajectory as the chances of losing critical ecosystem service functions increases considerably when we exceed the 1.5°C threshold (IPCC, 2019).

Importantly, most Nature-based Solutions approaches that address climate change mitigation can simultaneously promote climate adaptation. For example, Reduced Emissions from Deforestation and Degradation (REDD+) programmes which seek to reduce emissions from deforestation and forest degradation also reduce local communities' vulnerabilities to climate change (UN REDD, 2014).

REDD+ IN GUYANA

A recent report from Guyana found promising results for the development of REDD+ in tropical countries. Despite its promotion by the international community, the REDD+ approach has faced intense criticism from diverse civil society groups, with accusations of a lack of results at scale, and insufficient funding from donors (Sills et al., 2014). However, the research elaborated by Overman et al. 2018 in Guyana provides promising insights to consider for the implementation of REDD+ in tropical rainforests.

Guyana, with 83.3 per cent forest cover, started implementing REDD+ in 2006 (UNFCCC, 2020). It was the first country to have a Forest Reference Emission Level (FREL) approval from the UN, which enabled it to undertake a comprehensive and transparent accounting of the historical emissions from deforestation and forest degradation in the country (UNFCCC, 2020). In addition, Guyana undertook nationwide consultations with Indigenous leaders, via its so-called Opt-In-Mechanism, which granted them land-tenure rights (including in forest areas) and established conditions for and benefits from Indigenous communities' involvement in the national REDD+ scheme (Forest Carbon Partnership Facility, 2017). Later, in 2009, the Norwegian government signed a five-year agreement (covering 2010 to 2015) to pay the government of Guyana up to US$250 million for the implementation and facilitation of its REDD+ programme (Benn et al., 2020; Overman et al., 2019).

The result of the process highlighted a number of positive differences with respect to other locally based REDD+ experiences in other countries. Specifically, Guyana's national REDD+ scheme avoided structural difficulties faced by smaller projects, which often faced complications such as setting reference levels, national leakage and issues around permanence (Overmann et al 2018).

During this period, REDD+ revenues in Guyana of around US$5 per ton of CO2 were competitive with high-value commodities such as gold and timber (the country's main emission drivers). Other studies in Guyana reported similar results, where REDD+ revenues were sufficient to discourage gold prospecting and deforestation. Over the period, deforestation decreased in Guyana by 35 per cent, equivalent to 12.8 million tons of avoided CO2 emissions (Roopsind et al., 2019). Cash income for the majority of households with legal forest tenure also increased 3.5- to 12-fold over this period.

In the five years since the end of the Guyana and Norway agreement, deforestation levels have increased again in the country (Cummings and Martin, 2020; Laing, 2018; Roopsind et al., 2019).

For the Centre for International Forest Research (CIFOR), the Guyana case study still represents one of the most advanced REDD+ cases with important positive lessons, including successful development pathways to secure national forest resources (Benn et al., 2020).

The management and protection of protected areas through the use of forest resources are not always necessarily considered as Nature-based Solutions but, when they are purposefully designed to tackle climate change while generating income and improving livelihoods, they certainly can be. Community-based forest management, for example, has been promoted for some years as an effective way to guarantee land rights for local communities and ensure sustainable incomes while addressing climate change and preventing biodiversity loss. There are a myriad of cases documented in Africa, Asia and Latin America where sustainable natural resource management projects play a particularly important role for Indigenous communities (WRI, 2020). In Guatemala, community-owned forest enterprises have created employment at twice the minimum wage and generated annual incomes of up to US$4.75 million from timber sales and US$150,000 from non-wood forest products (FAO, 2018a).[1] Center for International Forestry Research (CIFOR) showcases extensive evidence of the economic benefits of community-based forest enterprises in countries such as Mexico, Nepal, Peru and Tanzania (Cossio et al., 2014; Ellis et al., 2015; Adhikari et al., 2018; Rantala et al., 2012).

At the same time, in many countries the institutions responsible for the management and protection of protected areas are understaffed and, as a result, struggle to adequately exercise their functions. Based on staffing numbers per hectare of protected area and the area currently designated as so, it is estimated that between 370,000 and 1.7 million people could be employed globally as rangers (Payen and Lieuw-Kie-Song, 2020). Doing so would mean that land is better protected and managed, generating greater societal and ecological benefits. However, building resilient ecosystems should consider future climate risk (UN Water, 2018; WWF, 2020a). Recent studies stress the importance of anticipating climate risks to ecosystems and their novel ecosystem services (emerging from new biophysical and social contexts) as an indispensable planning element to ensure the long-term effectiveness of Nature-based Solutions (Lavorel et al., 2019; WWF, 2020a). In many forested areas, fire risks have increased dramatically and investments in fire management, including employing more people to work in this domain, will become increasingly necessary.

D. Food security

Food security refers to food quantity, quality and accessibility. SDG 2 (No hunger) is the main SDG related directly to food security but, indirectly, many other SDGs, such as SDG 6, 13, 14 and 15, contribute to food security (Rockström & Sukhdev, 2016). According to the ILO, around 80 per cent of nature-dependent jobs are found in the agricultural sector and, in many developing countries, agriculture remains the main source of employment and income (ILO, 2018). At the same time, the *Global Biodiversity Outlook 4* (GBO 4, 2016) analysis shows that the agriculture sector accounts for 70 per cent of the projected biodiversity loss, while its follow-up report found growing greenhouse gas emissions from the sector (GBO 5, 2020). The sector is at risk from biodiversity loss. Annual global crop output worth between US$235 billion and US$577 billion is at risk due to the pollination crisis (IPBES, 2019). Transforming food systems while at the same time addressing food security and keeping jobs poses a fundamental challenge. Nature-based Solutions approaches such as agroecology, or green infrastructure — including innovations in urban agriculture — could address food security and generate economic benefits at the same time.

Agroforestry is an approach within agroecology that integrates trees and shrubs into farmland and enables income diversification into other crops, supporting livelihoods and contributing to food security (IPCC, 2018). It mixes ecological and agronomic principles to offer solutions that increase yields while using fewer inputs, often taking into consideration ancestral traditional and Indigenous knowledge. It can also contribute to healthy and sustainable soils and other abiotic ecosystem components (Gupta, 2020). The promotion of agroforestry offers policymakers an immediate means of alleviating poverty and famine by improving smallholders' productivity permanently and giving them tools to diversify their incomes (Bapna et al., 2019; Worku Kassie, 2016). Research has found higher cost-benefit ratios and higher net returns per households from agroforestry than from traditional agricultural systems (Rohini et al., 2017; Vikram et al., 2019; Vijaykumar et al., 2018). Investing in dryland agriculture crop production, for example, can provide net benefits of US$0.7 trillion by 2030 (Bapna et al., 2019).

Silvopastoral systems, meanwhile, could help more than 268 million pastoralists adapt to climate-related hazards such as more erratic rainfall (FAO and UNEP, 2020). In Colombia, for example, silvopastoral systems (integration of trees, forage and grazing of domestic animals) were found to generate higher milk and meat yields per hectare than land-extensive systems (Ross et al., 2019) and so help improve farmer incomes.

In Bangladesh, an innovative agroforestry approach called 'the Triple F model' (forest, fish and fruits) enabled farmers to earn revenues from a wide array of products, including timber, livestock, fish and crops (Ahammad et al., 2013; Asia and Pacific Network, 2015). Moreover, studies in Brazil, Cameroon and South Africa have found that agroforestry promotes gender equality, with between 40 per cent and 50 per cent of women becoming involved with agricultural activities (FAO, 2018a).

---

1   FAO (2014) defines non-wood forests products as being "goods of biological origin other than wood derived from forests, other wooded land and trees outside forests"

AGROECOLOGICAL APPROACHES IN CUBA

Family farming is in crisis in many parts of the world (FAO, 2018b). Agroecology creates productive systems that preserve natural resources, and are culturally sensitive, socially just and economically viable (Gliessman, 2014).

They often combine ecological and agronomic principles with traditional and Indigenous knowledge to display solutions that increase agricultural yields with fewer off-farm inputs, which in turn aims to improve the state of soils and the impact of agriculture on the environment (Holt and Altieri, 2013).

A case study of a family farm in Cuba has proven to be extremely relevant in showing how to underpin food security by combining agroecology approaches such as agroforestry applications (including cover crops, intercropping and living fences), diversity of trees, crop-livestock integration, application of organic fertilizers and crop associations (polycultures), among others (Lucantoni, 2020). After turbulent political conditions in the last 70 years, the 1990s marked a turning point in the agricultural history of the country when it was decided to adopt agroecology and food sovereignty as a national strategy (Gamboa et al., 2013). Now, almost 30 years after the initiation of the strategy, successful examples have been documented.

Studies since the turn of the century found that Cuba's transition to agroecology has had a direct impact on the reduction of extreme poverty (Altieri et al., 2011; Altieri, 2002). The practices provided higher levels of food security to local communities, a more diverse diet, and resulted in better health conditions than conventional farming. A recent study conducted by Lucantoni (2020) in the same country yielded the same positive results. By analysing the transition to agroecology for one farm family, the research demonstrated that agroecology approaches allowed the family to diversify into a high number of food crops, providing them with a balanced, high-quality diet and food security. The transition to agroecology imposed initially higher costs, especially during the first three years, but subsequently resulted in increased income and better living conditions (Lucantoni, 2020).

This evidence is replicated in studies of other family farms, who saw improved productivity, sustainability and resilience from adopting agroecology. **The sustainable management of agricultural systems led to the following outcomes:**

- Year on year increases in the total productivity of the farm;

- Permanent reduction of risks and improvement of resilience;

- Increased economic viability, social equity and cultural diversity;

- Conservation of natural resources, improvement of biodiversity and ecosystem services;

- Optimization of natural cycles and reduction of dependence on non-renewable resources; and

- Prevention of soil and environmental degradation (Lucantoni, 2020).

It should be noted that the promotion of agroecology is tied to the political and economic policies of the host country, as seen in Cuba with the implementation of the national strategy described above. Current incentives for conventional agricultural practices are still in place in Cuba, and may hinder the wider implementation of agroecology practices (Lucantoni, 2020).

Urban agriculture can also contribute to increasing food security and has the potential to rapidly create jobs. The *New Urban Agenda* from UN-Habitat stresses the importance of cities involving urban agriculture in their landscape planning as a means to improve food accessibility and to promote local markets, consumption and commerce (Habitat III, 2016). In Nigeria, another study suggested that urban agriculture may reduce social inequalities by alleviating poverty, especially among young people (Adeyemo et al., 2017).

THE GREAT GREEN WALL INITIATIVE

Source: Time Magazine / https://api.time.com

The Great Green Wall Initiative of the Sahel is an exmple of a continent-scale Nature-based Solutions approach to tackle food security.

The Great Green Wall initiative is being implemented along the southernmost border of the Sahara Desert, in one of the poorest regions of the planet (Great Green Wall initiative, 2020). The continued expansion of the Sahara Desert threatens the well-being of millions of people, worsening their food and water security, triggering conflict over natural resources and encouraging mass migration to Europe (FAO, 2020a). Since 2007, 21 African countries and international organizations are developing the Great Green Wall initiative, which aims to restore 100 million hectares of land and halt the advance of the Sahara Desert.

The joint initiative aims to provide food security for 20 million people, create 350,000 jobs and sequester 250 million tonnes of carbon by 2030 (GLF, 2020). The Great Green Wall initiative has enabled other regional initiatives, such as the African Forest Landscape Restoration Initiative (AFR100), a country-led effort to restore 100 million hectares of deforested and degraded landscapes across Africa by 2030 (AFR100, n.d.).

According to the UNCCD (2020), the initiative had met the following milestones:

- Ethiopia: 15 million hectares of degraded land restored, land tenure security improved;

- Senegal: 11.4 million trees planted, 25,000 hectares of degraded land restored;

- Nigeria: 5 million hectares of degraded land restored and 20,000 jobs created;

- Sudan: 2,000 hectares of land restored; and

- Burkina Faso, Mali, Niger: about 120 communities involved, a green belt created over more than 2,500 hectares of degrad land and drylands, and more than two million seeds and seedlings planted from 50 native species of trees.

In addition, the FAO has announced the Great Green Wall for Cities initiative, which builds on the progress made by the Great Green Wall for Africa and extends it to incorporate resilient cities (FAO, 2020b).

Conserving and strengthening marine and coastal ecosystems using Nature-based Solutions may also present significant contributions to job creation and food security through improved fisheries management. Around the world, 45.6 million workers directly depend on fish capture and aquaculture for their livelihoods (ILO, 2018).

Approximately two thirds of this — equivalent to 30.6 million jobs — are dependent on wild-catch fisheries. In addition, another 55.1 million people work in fisheries-related industries, resulting in a total of 85.7 million jobs being dependent on the health of fisheries around the world (ILO, 2018). In terms of food quality, fisheries may have a strategic role in preventing severe modern diseases by supplying coastal communities in low- and middle-income countries with essential micronutrients (iron, zinc, calcium), particularly in low-income countries that are more likely to suffer from malnutrition, disease and the adverse impacts of climate change (Vianna et al., 2020). However, recent studies show that many fisheries will experience significant loss in productivity due to climate change, particularly in the tropics (Lam et al., 2020). This, coupled with the recognition of the public health benefit of coastal fisheries in low income countries, points to the urgent need of deep and rapid decarbonization of countries and industries on the one hand and, for precautionary fisheries management, informed by climate impact predictions, to avoid a nutrition crisis in vulnerable countries.

Successful Nature-based Solutions for fisheries management include integrated mangrove and fisheries farming systems (IUCN, 2016), community-based and scientific-oriented fisheries management (Iwasaki, 2013), as well as the design of marine reserves for improved long-term productivity and spill-over effects of increased fish catches in adjacent areas (Green et al., 2014).

Promoting Nature-based Solutions approaches for sustainable fisheries will also reduce demand for land while supporting healthier and more diverse diets (WWF, 2020).

E.   Water security

Achieving SDG 6 (Clean water and sanitation) and SDG 15 (Life on land, which includes metrics for freshwater ecosystems) will require improvements in water security. Making water resource management more resilient is estimated to generate net benefits of US$1.4 trillion globally (Bapna et al., 2019). Nature-based Solutions can help achieve a range of integrated objectives, including water availability, quality and reduction of associated disaster risks, addressing the main barriers to water security.

Nature-based Solutions projects in and around urban areas that protect forests, wetlands, soils and crops can reduce sediment loads, capture and retain pollutants, and enhance recycling of nutrients, improving water quality. Developing Nature-based Solutions projects that, for example, increase the size of floodplains, can increase water filtration and store and convey floodwaters, reducing flood risks (UN Water, 2018).

There is evidence that water-related Nature-based Solutions approaches that address water quality, availability and associated risks have moderate to substantial impact on all the SDGs. Some approaches that combine these three features can be found in natural infrastructure interventions. Within the suite of Nature-based Solutions, natural infrastructure is the term given to natural or semi-natural components that provide an alternative to built infrastructure (WWF and HSBC, 2017). Examples include wetlands that provide water purification and flood risk reduction services, augmenting the services of engineered infrastructure for water treatment and flood management.

CONNECTING CITIES THROUGH NATURE-BASED SOLUTIONS IN GERMANY

The versatility of Nature-based Solutions interventions is well noted in the Emscher Landscape Park (ELP), consisting of an urban forest and the largest ecosystem restoration project in Europe.

The park, located in the Northern Ruhr region of Germany, involves 20 German cities and is part of a river revitalisation programme comprising more than 100 complementary green projects (European Commission, 2019). The project has been running for almost 20 years and is funded by governmental stakeholders (national, regional and local authorities), the private sector, and non-governmental organizations (Naturvation, 2020).

Apart from its enormous positive impacts on local ecosystems, surface water quality and urban regeneration, the ELP also has important employment generation effects, and so far it is estimated to have created 55,892 jobs in the North Rhine-Westphalia region, and 687 jobs across the rest of Germany. The value of direct ecosystem services the park provides are estimated at €21 million, while the additional benefits to users are estimated at €107 million annually.

The north-western side of the park, the Duisburg Landscape Park, attracts around one million visitors a year, representing nature and industrial heritage (Drexel University, 2020; Landschaftspark Duisburg Nord, 2020). The Guardian newspaper named the park as one of the 10 most beautiful urban oases in the world (The Guardian, 2015).

Wetlands, whether man-made or natural, can also prevent pollutants from entering water courses, reduce flows of water and pollutants in the pre-treatment stage, and remove major solids and reduce the need for biochemicals at the sewage treatment stage (European Commission, 2020).

Diffuse pollution — widespread pollution from many sources that can have significant negative effects on water quality — is a concern for both upper and low watersheds. The main sources of pollution are storm water, urban run-off, agricultural inputs and sediment deposition. The European Green Deal includes the Zero Pollution Europe initiative, in which Nature-based Solutions interventions such as sustainable drainage are expected to play a major role in tackling diffuse pollution, improving water quality for freshwater, estuarial and marine environments while creating jobs (European Commission, 2020).

SOUTH AFRICA - WORKING FOR WATER

In South Africa, invasive alien plant species cause significant damages, jeopardizing economic activities, biodiversity, water security and soil integrity (ILO, 2018). Investments in Nature-based Solutions, including management to remove alien species and restore native vegetation, can potentially address these challenges and provide multiple benefits. For example, in the watersheds that supply Cape Town's water, restoration of native vegetation can increase available water.

Non-native species, such as eucalyptus, are 'thirstier' than the native plants they have replaced, sucking up through their roots and evaporating an additional 1.4 trillion litres of water across the country per year. This loss is equivalent to 4 per cent of the nation's water supply (and, because non-natives are spreading, the loss could quadruple to 16 per cent) (WWF-SA, 2016).

At the same time, the country has high rates of unemployment, enabling it to mobilize its underutilized labour force to work on addressing this problem. Since 1995, the South African government has implemented the Working for Water (WfW) programme, led by the Department of Environment in coordination with diverse public sector and civil society organisations (WWF, 2019b).

The programme provides short-term contracts to local people to remove invasive species from key water catchments, increasing the availability of water in the process (ILO, 2018). Different technical methods are used to control invasive species, including mechanical, chemical, biological and integrated control techniques. While not all the technical applications are considered Nature-based Solutions, the programme at all times aims to ensure that methods of control protect and promote native species. So far, over 1 million hectares have been cleared of invasive species, providing 50 million cubic metres of water a year, and supporting more than 20,000 jobs (ILO, 2018; WWF, 2019b). Based on the extensive experience of WfW over the past 25 years, it was found that on average one full-time equivalent of labour inputs is required to control invasive alien species on 40 ha of land. This of course varies considerably depending on the type of ecosystem, level of infestation and the type of invasive species. There are now more than 300 WfW projects in all nine of South Africa's provinces (WWF, 2019b).

WfW has now been integrated into the department's larger Sustainable Land Based Livelihood set of programmes, which includes similar initiatives such as Working for Wetlands, Working for the Coast and Working on Fire. Job creation for disadvantaged groups such as women, youth and people with disabilities remains one of the cornerstones of these programmes. In the 2019-2020 financial year, more than 60,000 jobs were created, with more than 70 per cent going to young people, 55 per cent to women and 1.5 per cent to people with disabilities (DPW, 2020).

F. Human health

Human health is a fundamental objective of the SDGs, specifically for SDG 3 (Good health and well-being), but it is also integral to SDG 11 (Sustainable cities) and SDG 13 (Climate action) (Cohen-Shacham et al., 2016). Nature-based Solutions approaches that address human health improve the quality of life of people by enabling access to nature, supporting better health, well-being and social cohesion. FAO's (2016) key message, ''place-making, place-keeping'', aims to engage and motivate citizens to take part in community life and create a sense of belonging to common environments. Research by Bertram and Rehdanz (2015) found a strong positive relationship between the distance to green spaces and people's life satisfaction. Meanwhile, the replacement of natural infrastructure with inappropriate 'hard' engineered infrastructure can provide a false sense of security and affect people's meaning of and attachment to place (Quinn et al. 2019).

There are quantifiable economic impacts from the health co-benefits delivered by some Nature-based Solutions projects. Urban trees have been found to help cool the surrounding environment, reducing the need for air conditioning, and to reduce air pollution. The value of urban trees to 10 megacities has been estimated at roughly US$ 500 million (Endreny et al., 2017). Creating jobs in the protection and conservation of natural ecosystems in cities can reduce health energy and costs (FAO, 2016).

US URBAN FORESTS

Increasing forest cover within cities has become more popular in recent years.

In the United States, the US Forest Service (USFS) estimates that over 130 million acres of forest are located within or in close proximity to cities (USFS, 2020). Urban forests is a concept within the umbrella of Nature-based Solutions which relates to infrastructure-based approaches. Research into the economic benefits of urban forests in the US showed cost-reduction opportunities in areas such as energy-saving (both in winter and summer), run-off reductions, security and public health (Donovan, 2017). Exposure to nature is considered by medical practitioners as a cost-effective health intervention, especially in congested residential areas. Four mechanisms are essential to understand the positive effects of trees on public health: they improve air quality, reduce stress, encourage exercise and improve social connections (Hystad et al., 2014).

An 18-month study funded by the USFS and undertaken by Ecotrust and PolicyLink in collaboration with Verde Landscape, a Portland-based green community development organization, aimed to gather information on urban forests in cities throughout the United States, from Portland to Philadelphia. The study showed that urban forests have potential to create living-wage jobs and support communities of colour and low-income communities (Ecotrust and PolicyLink, 2017). The economic impact analysis of Verde Landscape reached the following conclusions:

- For every US$1 million invested in such a project, 24 year-round, full-time, living-wage jobs are created;

- For every dollar spent on a project such as the ones conducted by Verde, nearly two are returned to the economy.

- For every full-time job created through green infrastructure projects, nearly two are created throughout the economy.

Another study, conducted by McPherson et al (2005), reached similar conclusions, finding that every dollar invested in urban forests generated benefits ranging from US$1.37 to3.09. Failure to include tree benefits in American cities is likely to result in low levels of investment in urban forestry (Donovan, 2017).

Another interesting example of Nature-based Solutions addressing human health is found in the connection between the rural and urban environments. Urban and peri-urban forests can promote connectivity between ecosystems, whether within the city, in rural areas, or both (FAO, 2016). The USFS lists a number of economic and social benefits provided by green corridors, such as recreational activities such as hiking and birdwatching (US Forest Service, n.d.).

Connecting ecosystem patches and/or edges with green urban areas can be a particularly effective means of supporting nature while being socially and economically attractive. Ecotourism (either in cities or in rural areas) can strengthen community ownership and generate a wide range of formal employment. For example, Nature 2000, a network aiming to protect and sustain threatened species and habitats in both urban and rural contexts in Europe, provides 4.4 million jobs and economic benefits up to €200 billion to €300 billion/year; with recreational benefits worth €5 billion-€9 billion annually (European Commission, 2019). Another example is Singapore, where the famous Gardens by the Bay, a 101-hectare nature park, generated a surplus of US$22.7 million over the 2017-18 financial year, with the visit of more than 10.2 million tourists (Garden by the Bay, 2017). These examples show that Nature-based Solutions should be viewed as important public goods with identifiable and capturable money streams, particularly in cities.

Amid the turmoil of COVID-19, the tourism sector has shrunk considerably. If this is not addressed immediately by governments, one of the results will be that workers will be likely to turn to illicit natural extraction activities, especially in developing countries such as Costa Rica which are highly-dependent on tourism (FAO, 2018a). The solution is to facilitate local people's access to the economic benefits provided by nature, through payments for ecosystem services, nutritional benefits through consumptive use of natural resources, vulnerability reduction and improved production and efficiency of agro-ecosystems (Ntuli & Muchapondwa. 2015). This should also include ways to mitigate nature-related risks through risk management tools, extension services and insurance schemes (Busby et al., 2014).

Lastly, the conservation and protection of natural ecosystems has a crucial role to stop the outbreak of infectious diseases that pose a serious threat to human health. Investing in the same old practices that accelerate the loss of biodiversity, habitat destruction and pollution or modification of natural environments lead to the spread of emerging infectious diseases (Everard et al., 2020; WWF, 2020b). The first guiding principle of Nature-based Solutions is to embrace nature conservation norms, which call for a better understanding of how our ecosystems function, including their role in defending us from the spread of diseases (Cohen-Shacham et al., 2019; WWF 2020b). Nature-based Solutions such as large-scale ecosystems restoration with a sea/landscape vision are considered public health interventions that can tackle some of our most critical challenges, as it becomes clear that human and ecological health crises are interwoven (Breed et al., 2020).

The mechanisms that regulate our ecosystems and the links between ecological restoration and human health are not yet fully understood. Investing in nature now could not only provide the ecosystem services we already recognized but could also yield novel and latent ecosystem services that reduce the incidence of diseases and other climate risks (Lavorel et al., 2020).

III. POLICY RECOMMENDATIONS

A large number of national and international organizations are calling for the integration of Nature-based Solutions into COVID-19 related economic or social recovery packages.

Nature-based Solutions offer an opportunity to create immediate "no harm" jobs, while at the same time supporting a transition to a greener and job-rich economy. They also enable better alignment and integration of agriculture and energy sectors with economic, employment, social, climate and biodiversity goals. Nature-based Solutions also provide a way to bridge the immense mental disconnect between residents of rural and urban areas. Yet obstacles and constraints to the wider adoption of Nature-based Solutions remain. These include:

1. Leveraging financing;

2. Creating an enabling regulatory and legal environment;

3. Improving cross-sectoral collaboration;

4. Improving the knowledge base.

While many actors and stakeholders have been working on implementing such measures, the conditions generated by the COVID-19 pandemic provide a unique opportunity to make much more rapid progress on these four enablers. The clearest opportunity lies in the leveraging of financing, but the pandemic-induced crisis also creates opportunities regarding the other constraints.

1. Leveraging sustainable finance

Planned COVID-19 stimulus and social and economic recovery packages provide a huge and unique opportunity for increased financing of interventions that are based on or integrate Nature-based Solutions, especially because of their high job creation potential, as well as their ability to absorb workers from sectors that have been highly impacted by the pandemic. It is recommended that investments in economic and social COVID-19 recovery are directed to Nature-based Solutions in areas where they are proven to be effective and to generate immediate employment and income opportunities, such as:

• Inland and coastal ecosystem restoration, agroforestry, urban forestry, community-based ecosystem management, integrated mangrove and fisheries farming systems, community-based and precautionary ecosystem based fisheries management, the design of marine reserves for improved long-term productivity and ecosystem-based adaptation. Such interventions have the potential to generate high public returns, and are likely to have a positive impact on both climate change mitigation and adaptation as well as generating substantial employment, especially for rural workers and/or informal workers who are bearing the heaviest burden of the COVID-19 pandemic.

• Existing sustainable natural resource management sectors, such as community-based forestry and ecotourism, particularly in critical ecosystems. These approaches not only give governments the opportunity to lock-in future income opportunities, they also promise to maintain social capital.

• Large-scale ecosystem restoration projects that increase the sustainability and climate resilience of the forestry and agricultural sectors, while at the same time generating employment opportunities for rural workers and low-income communities.

• Green public employment programmes that integrate Nature-based Solutions, creating jobs for vulnerable members of society while at the same time investing in the environment and restoring ecosystems.

• Initiatives to green cities through the protection and expansion of natural ecosystems in urban areas, creating employment opportunities with direct future revenues in tourism and water security. These initiatives can also indirectly reduce costs in other sectors such as the energy sector and healthcare.

• Initiatives to contribute to disaster risk reduction in vulnerable and disaster-prone areas through, amongst others, Nature-based Solutions to control flooding, reduce water runoff, increase groundwater recharge and reduce soil erosion and instability.

• Deploying sustainable urban agriculture to quickly generate jobs while increasing food accessibility, promoting local markets and production chains, and reducing the pressure on nearby ecosystems.

2.   Creating a more conducive policy and regulatory environment

The current crisis has also created the space to introduce policies that were previously considered unfeasible. The unprecedented spending by many governments has already been noted. In the area of social protection, the expansion of social transfers and unemployment benefits is also unprecedented. As it is becoming increasingly clear how the COVID-19 crisis is linked and further fuelled by the social and economic crises that preceded it, the policy space for deploying more integrated solutions to what are increasingly integrated crises has widened. It is recommended that policymakers:

- Promote diverse portfolios of nature-based income benefits to local and national economies, ranging from payments for ecosystem services, direct consumption, vulnerability reduction and cultural benefits.

- Ensure the wider adoption and localization of Nature-based Solutions standards such as the IUCN GLobal Standards for Nature-based Solutions and ILO Guidelines for a Just Transition.

- Steer agricultural incentives towards Nature-based Solutions. These might include promoting agroecology approaches including agroforestry practices and providing access to insurance mechanisms.

- Ensure that industries that depend on natural ecosystems for their primary economic activity, such as ecotourism, are included in early support and recovery packages during and after COVID-19. This will discourage shifts to informal economic activity and the illegal extraction of natural resources which undermine the long-term sustainability of these sectors.

3.   Boosting cross-sectoral collaboration

COVID-19 has also demonstrated the interrelated nature of many of the challenges we face and has led to the increasing awareness that many problems cannot be solved within a single domain. This creates opportunities for enhanced collaboration between actors and stakeholders who previously tended to focus on a single domain such as the economy, the environment or social development. Nature-based Solutions are, by their nature, interdisciplinary and cross-sectoral interventions and thus require but also create an imperative for cross-sectoral collaboration. It is recommended that policymakers:

- Encourage the use of water-related Nature-based Solutions approaches (e.g. restoration of wetlands and floodplains, sustainable drainage and environmental flows) that simultaneously address water quality, availability and associated risks.

- Place more emphasis on cross-sectoral collaboration through financing mechanisms whose governance requires such collaboration.

- Recognize that, because of their multiple dimensions, Nature-based Solutions must incorporate inclusive, transparent and empowering governance processes.

- Encourage the use of landscape- or watershed-based approaches that enable consideration of their multiple economic, social and natural dimensions and which can lead to the wider recognition and adoption of Nature-based Solutions.

4.   Improving the knowledge base

Improving the knowledge base underpinning Nature-based Solutions also presents an opportunity for COVID-19-related stimulus in Research and Development (R&D). Such increased investment in R&D will also stimulate job creation in this sector and generate long-term benefits by enabling the wider adoption of these more sustainable solutions. Key recommended areas for additional investment include:

- The integration of Nature-based Solutions into national, urban and rural infrastructure plans.

- Further research into the integration of Nature-based Solutions integrated use with more conventional infrastructure.

- Increasing research into the monitoring, quantification and assessment of the multiple co-benefits of Nature-based Solutions, in particular their impacts on socioeconomic benefits such as job creation, as well as biodiversity and ecosystem integrity.

- Improving integration of Nature-based Solutions into engineering standards and risk management frameworks to facilitate their more widespread application.

- Building evidence on the costs and benefits of Nature-based Solutions so that planners, architects and engineers can better assess their merits and conduct more informed comparisons against and that intertwine with grey infrastructure options.

IV. ANNEX: JOB INTENSITY AND JOB RETURNS OF NATURE-BASED SOLUTIONS AND RELATED ACTIVITIES AND INVESTMENTS

Activities which are integral to implementation of Nature-based Solutions	Notes and more detailed work activities	Types of Jobs	Total direct job [1] (FTE[2])/ US$ million	FTE/[3]ha	Opportunities and job spillovers	Related Nature-based Solutions
Afforestation, reforestation, and desertification control (Box 1 Grain for Green and Box 3 Great Green Wall)	Land preparation, nurseries, planting trees and shrubs, monitoring & reporting, watering/ protecting seedlings, landscape management, law enforcement	Environmental science jobs (forester), farmers, lawyers, administrative positions	275 to 625	0.40 to 1.1	Can allow for part-time employment/ supplementary income for rural workers, spillovers into increasing jobs in forestry and timber	Forest restoration
Watershed improvement	Structures/measures to reduce soil erosion, allow for groundwater recharge, rehabilitating native vegetation, stakeholder engagement & inclusion	Urban planners, Environmental science jobs (hydrologists), construction workers	166 to 500	1 to 3	Can allow for part-time employment/ supplementary income for rural workers	Forest restoration, Agroecology, Wetlands & floodplains restoration,
Indigenous forest management (Box 2 REDD+ in Guyana)	Collection of wood and NTFP, stakeholders engagement & inclusion, law enforcement, monitoring & reporting, indigenous & technical knowledge transfer, ecotourism	Administrative positions	200 to 400	0.25 to 0.50	Sustainable timber harvesting and other forest products. Improved ecosystem services, timber, NTFP, jobs in processing of forest products, ecotourism	CbFM, REDD+
Agroforestry including conversion of land (Box 3 Cuba)	Ploughing, sowing, composting, watering, raising livestock, tree planting, raised beds for agriculture, landscape planning, monitoring & reporting, indigenous & technical knowledge transfer, among many others	Farmers, pastoralists, agronomists, environmental science jobs	500 to 750	0.25 to 0.375	Can lead to higher incomes for farmer, as well as increased labour demand in agriculture and agro processing	Agroecology

1 These figures are mostly for developing countries and will generally be lower in developed countries. The figures are very sensitive to prevailing wage rates in the area they are implemented, and the very wide range in wage rates globally makes it difficult to capture global ranges.

2 The measure for labour demand used is FTE which stands for Full Time Equivalent. It is calculated by dividing the labour demand arising from an activity expressed days of work by the average number of days worked per year in a region. This will vary per region based on local norms and legislation.

3 These figures are mostly for developing countries and will vary with the level of mechanization used. However for many of these activities the use of very large scale equipment is difficult.

Fire management	Fire prevention, removal of combustible materials, cutting and maintenance of fire breaks, selected burning, fire fighting	Environmental science jobs, foresters, fire fighters	200 to 250	0.1 to 0.125	Increasing demand for work in this area will lead to more employment	**Forest restoration**
Creation and management of urban green spaces (Box 5 Connecting cities in Germany and Box 7 Urban forests in the US)	Land preparation, nurseries, planting trees and shrubs, watering/ protecting seedlings, landscape management, construction of paths, cycle lanes, stairs, recreation facilities, removal of selected trees, ecotourism, among others	Gardening, landscaping, horticulture Environmental science jobs, administrative jobs, tourist guides	24 to 250	1 to 5	Can allow for employment of urban unemployed, spillover for jobs in tourism and recreation	**Urban and peri-urban forestry**
Mangrove restoration and other coastal ecosystems	Ecosystems monitoring & reporting, tree planting, law enforcement, indigenous & technical knowledge transfer, ecotourism	Environmental science jobs, landscape planners, administrative positions, rangers, tourist guides	N.A	N.A	Increased productivity of fishermen, increased employment and fishing and related processing, increase employment in tourism (diving), reduced job and income losses from flooding	**Coastal & marine ecosystems management**
Removal and management of invasive alien species (Box 6 Working for water)	Removing invasive weeds, shrubs and trees. ecosystems monitoring & reporting, indigenous & technical knowledge transfer,	Manangers, semi-skilled workers, administrative jobs, Environmental science jobs	N.A	0.05 to 0.14 FTE per ha for clearing of heavily infested areas 0.002 to 0.014 for lightly infested areas [4]	Can allow for part-time employment/ supplementary income for rural workers Jobs in economic use of some invasives (timber, fodder, bioenergy), jobs in sectors dependent on ecosystems preserved (agriculture, water, forestry, tourism)	**Forest restoration, wetlands & floodplains restoration**
Management and conservation of protected areas & buffer zones	Management and education, monitoring & reporting, stakeholder involvement and inclusivity, indigenous & technical knowledge transfer, ecotourism	Rangers, managers and educators, community liaison officers, environmental science jobs, tourist guides	N.A.	0.004 to 0.0002[5]	Important employment spillovers for tourism sector	**Forest and ecosystem restoration, REDD+; CbFM**
Construction of wetlands systems for treatment of sewage	Ecosystem monitoring & reporting, landscape planning, diverse forms of construction, stakeholder involvement and inclusivity	Construction workers, engineers, maintenance workers, Environmental science jobs	As per similar construction work in the area	Not Relevant.		**Natural water treatment systems. Construction of wetlands, urban and peri-urban forestry**

Source: Compiled by authors from Nair and Rutt 2009 and Payen and Lieuw-Kie-Song 2020.

---

4   Based on figures from Working for Water program in South Africa

5   Based on figures from USA, Canada, India and South Africa

V. REFERENCES

Adeyemo, R., Ogunleye, A., Kehinde, A. & Ayodele, O. (2017). Urban Agriculture (UA) and Its Effects on Poverty Alleviation: A Case Study of Vegetable Farming in Ibadan Metropolis, Nigeria. American Journal of Environmental Science and Engineering; 1(3): 68-73 .

Adhikari, S., Baral, H. & Nitschke, C. (2018). Adaptation to Climate Change in Panchase Mountain Ecological Regions of Nepal. Environments Vol. 5, pp. 42.

AFR100 (n.d.) African Forest Landscape Restoration Initiative. Retrieved from: https://www.afr100.org/sites/default/files/AFR100%20Overview_ENG.pdf.

Ahammad, R., Nandy, P. & Husnain, P. (2013). Unlocking ecosystem based adaptation opportunities in coastal Bangladesh. The Journal of Coastal Conservation, Vol. 17, pp. 833–840.

Altieri, M. 2002. Agroecology: The science of natural resource management for poor farmers in marginal environments. Agriculture, Ecosystems & Environment 1971, pp. 1–24.

Altieri, M., F. Funes-Monzote, and P. Petersen. (2011). Agro-ecologically efficient agricultural systems for smallholder farmers: Contributions to food sovereignty. Agronomy for Sustainable Development. INRA (Institut National de la Recherche Agronomique).

Asian and Pacific Network (2015). Forest, Fish and Fruit Model or Triple F model. Retrieved from: http://www.asiapacificadapt.net/adaptation-technologies/database/forest-fish-and-fruit-model-or-triple-f-model.

Asia Development Bank (2019). Strategy 2030 Operational plan for priority 3: Tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability 2019-2024. Manila.

Bapna, M., Brandon, C., Chan, C., Patwardhan, A. & Dickson, B. (2020). Adapt Now: A Global Call For Leadership On Climate Resilience. Global Commission on Adaptation. Retrieved from: https://reliefweb.int/sites/reliefweb.int/files/resources/GlobalCommission_Report_FINAL.pdf.

Barreteau, O., J. M. Anderies, C. Guerbois, T. Quinn, C. Therville, R. Mathevet, and F. Bousquet. (2020). Transfers of vulnerability through adaptation plan implementation: an analysis based on networks of feedback control loops. Ecology and Society, Vol. 25, No 2, Art. 3.

Bertram, C. & Rehdanz, K. (2015). The role of urban green space for human well-being. Ecological Economics, Vol. 120, pp. 139-152.

Bek, D., Etienne, N., Binns, T. (2017). Jobs, water or conservation? Deconstructing the Green Economy in South Africa's Working For Water Programme, Environmental Development, Vol 24, pp. 136-145.

Belecky, M., Singh, R. and Moreto, W. 2019. Life on the Frontline. (2019). A Global Survey of the Working Conditions of Rangers. WWF.

Benn, V.; Pham, T.T.; Moeliono, M.; Maharani, C.; Thomas, R.; Chesney, P.; Dwisatrio, B.; Ha, C.N. (2020). The context of REDD+ in Guyana: Drivers, agents and institutions. CIFOR.

Breed, M., Cross, A., Wallace, K., Bradby, K., Flies, E., Goodwin, N., Jones, M., Orlando, L., Skelly, C., Weinstein, P. & Aronson, J. (2020). Ecosystem Restoration: A Public Health Intervention. EcoHealth.

Browder, G., Ozment, S., Rehberger, I., Gartner, T. & Lange, G. (2018). Integrating green and gray: Creating next generation infrastructure. The World Bank Group and WRI.

Busby, J. W., K. H. Cook, E. K. Vizy, T. G. Smith, and M. Bekalo. (2014). Identifying hot spots of security vulnerability associated with climate change in Africa. Climatic Change, Vol. 124, pp. 717–731.

Cohen-Shacham, E., Walters, G., Janzen, C. and Maginnis, S. (eds.) (2016). Nature-based Solutions to address global societal challenges. Gland, Switzerland: IUCN. xiii + 97pp.

Cooley, H., (2006). Floods and droughts. In The World's Water 2006–2007: The Biennial Report on Freshwater Resources (p. 392). Island Press.

Cossio, R., Menton, M., Cronkleton, P. & Lar, A. (2018). Community forest management in the Peruvian Amazon A literature review. CIFOR, Working Paper 136.

Costello, C., Ovando, D., Clavelle, T., Strauss, C.K, Hilborn, R., Melnychuk, M.C., et al. (2016). Global fishery prospects under contrasting management regimes. Proc Natl Acad Sci.; Vol.113, No 18, pp. 5125–9.

Cummings, R. & Martin, S. (2020). Identifying the powers, players, and emotions associated with REDD+ implementation: The case of Guyana's LCDS. Ambio, Vol. 49, pp. 1241–1255. https://doi.org/10.1007/s13280-019-01253-3.

Ecotrust and PolicyLink (2017). Jobs & Equity in the Urban Forest. Retrieved from: https://ecotrust.org/media/Jobs_and_Equity_in_the_Urban_Forest_executive_summary_2_16_17.pdf.

Edwards, P., Sutton-Grier, A. & Coyle, G. (2013) "Investing in nature: Restoring coastal habitat blue infrastructure and green job creation". Marine Policy, Vol. 38, pp. 65-71.

Ellis, E., Kainer, K., Sierra-Huelsz, J.,Negreros-Castillo, P., Rodriguez-Ward, D. & DiGiano, M. (2015). Endurance and Adaptation of Community Forest Management in Quintana Roo, Mexico. Forests, Vol. 6, pp. 4295-4327.

Endreny, T., Santagata, R., Perma, A., De Stefano, R., Rallo, F. & Ulgiati, S. (2017). Implementing and managing urban forests: A much needed conservation strategy to increase ecosystem services and urban wellbeing. Ecological Modelling, Vol. 360, pp.328-335.

Escobedo, F., Adams, D., Timilsina, N. (2015). Urban forest structure effects on property value. Ecosystem Services, Vol. 12, pp. 209-217.

European Commission (2019). COMMISSION STAFF WORKING DOCUMENT Guidance on a strategic framework for further supporting the deployment of EU-level green and blue infrastructure. Retrieved from: https://ec.europa.eu/transparency/regdoc/rep/10102/2019/EN/SWD-2019-193-F1-EN-MAIN-PART-1.PDF.

European Commission (2020). Nature-based Solutions for Climate Mitigation: Analysis of EU-funded projects. Research & Innovation, Brussels.

Everard, M., Johnston, P., Santillo, D. & Staddon, C. (2020) The role of ecosystems in mitigation and management of Covid-19 and other zoonoses. Environmental Science & Policy, Vol. 111, pp. 7-17.

Delang, C. (2018). The effects of China's Grain for Green program on migration and remittance. Economía Agraria y Recursos Naturales, Vol. 18,2. pp. 117-132.

Donovan, G. (2017). Including public-health benefits of trees in urban-forestry decision making. Urban Forestry & Urban Greening, Vol 22., pp. 120-123.

DPW (2020), Annexures A-E, Annual Performance Report, Expanded Public Works Programme (EPWP), Department of Public Works, Pretoria, South Africa, Retrieved from http://www.epwp.gov.za/documents/Reports/Year16-19-20/Q4/2019-20_QTR4-Annexure_A-E3.pdf.

Drexel University (2020). Emscher Landscape Park. Retrieved from: https://drexel.edu/lindyinstitute/initiatives/a-vision-for-the-lower-schuylkill/Background%20information/Emscher%20Landscape%20Park/.

FAO (2020a). Actions against desertification: The great green wall. Retrieved from: http://www.fao.org/in-action/action-against-desertification/overview/great-green-wall/en/

FAO (2020b) The great green wall for cities. Retrieved from: http://www.fao.org/news/story/en/item/1234286/icode/.

FAO and UNEP. (2020). The State of the World's Forests 2020. Forests, biodiversity and people. Rome. https://doi.org/10.4060/ca8642en.

FAO (2018a). The State of the World's Forests 2018 Forest pathways to sustainable development. Rome.

FAO. (2018b). FAO's work on family farming: Preparing for the decade of family farming (2019–2028) to achieve the SDGs. Rome: FAO.

FAO. (2016). Guidelines on urban and peri-urban forestry, by F. Salbitano, S. Borelli, M. Conigliaro and Y. Chen. FAO Forestry Paper No. 178. Rome, Food and Agriculture Organization of the United Nations.

FAO (2014). Forest Resource Assessment 2015: Terms and definitions. Working papers 180.

Forest Carbon Partnership Facility (2017). Annual Report. Washington.

Gamboa, C. A. R., S. González, and A. Herrera. 2013. Soberanía y seguridad alimentaria en Cuba: Políticas públicas necesarias para reducir la dependencia alimentaria. Agrisost, Vol. 19, No 3.

Garrett-Peltier and Pollin, 2009. How Infrastructure Investments Support the U.S. Economy: Employment, Productivity and

Growth, Political Economy Research Institute, January 2009.

GLF- Global Landscape Forum (2020) Here stands the great green wall. Retrieved from: https://news.globallandscapesforum.org/46781/the-great-green-wall-is-officially-4-and-unofficially-18-complete/.

Gliessman, S. R. (2014). Agroecology: The ecology of sustainable food systems. Third ed. Boca Raton, FL: CRC Press.

Global Times (2019). Extensive reforestation in China makes Earth greener. Retrieved from: http://www.globaltimes.cn/content/1139006.shtml.

Gupta, V. (2020). Role of agroforestry in soil conservation and soil health management: A review. Journal of Pharmacognosy and Phytochemistry, Vol. 9, Issuw 4, pp. 555-558.

Gutiérrez Rodríguez, L., Hogarth, N., Zhou, W. & Putzel, L. (2016). China's conversion of cropland to forest program: A systematic review of the environmental and socioeconomic effects. Environ Evid, Vol. 5, Issue 21.

Great Green Wall (2020). The Great Green Wall. Retrieved from: https://www.greatgreenwall.org/about-great-green-wall

Green, A., Fernandes, L., Almany, G., Abesamis, R., McLeod, E., Aliño, M., White, A., Salm, R., Tanzer, J. & Pressey, R. (2014) Designing Marine Reserves for Fisheries Management, Biodiversity Conservation, and Climate Change Adaptation, Coastal Management, Vol. 42, Issue 2, Vol. 143-159, DOI: 10.1080/08920753.2014.877763.

HABITAT III (2016). The New Urban Agenda. Quito.

Holt, E., and M. Altieri. (2013). Agroecology, food sovereignty, and the new green revolution. Agroecology and Sustainable Food Systems, Vol. 37, Issue 1, pp. 90–102.

Hue, F., Wang, X., Zheng, X., Fisher; B., Wang, L., Zhu, J., Tang, Y. & Yu, D. & Wilcove, D. (2016). Opportunities for biodiversity gains under the world's largest reforestation programme. Nat Commun, Vol. 7, No. 12717.

Hystad, P., Davies, H.W., Frank, L., Van Loon, J., Gehring, U., Tamburic, L., Brauer, M., (2014). Residential greenness and birth outcomes: evaluating the influence of spatially correlated built-environment factors. Environ. Health Perspect. Vol. 122, Issue 10, pp. 1095–1102.

Institute for Economics & Peace. Global Peace Index 2020: Measuring Peace in a Complex World, Sydney, June 2020. Available from: http://visionofhumanity.org/reports (accessed Date Month Year).

ILO (1989). C169 - Indigenous and Tribal Peoples Convention, 1989 (No. 169), International Labour Organization, Geneva Accessed on: https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO:12100:P12100_INSTRUMENT_ID:312314:NO.

ILO (2011). Local investments for climate change adaptation: green jobs through green works / ILO Regional Office for Asia and the Pacific. - Bangkok: 288.

ILO (2015). Guidelines for a just transition towards environmentally sustainable economies and societies for all, International Labour Organization, Geneva.

ILO (2020a). ILO Monitor: COVID-19 and the world of work. Third edition Updated estimates and analysis.

ILO (2020b). ILO Monitor: COVID-19 and the world of work. Sixth edition Updated estimates and analysis.

ILO (2020c). The role of public employment programmes and employment guarantee schemes in COVID-19 policy responses, Development and Investment Branch Brief, Employment Policy Department, ILO, Geneva. Retrieved from: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_746368.pdf.

ILO (2018). World Employment Social Outlook 2018: Greening with jobs.

IPBES (2019). Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio E.S., H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany. 56 pages.

IPCC (2018). Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield

(eds.)]. In Press.

IUCN (2016). Farmed fishing: a nature based solution to increased resilience. Retrieved from: https://www.iucn.org/news/india/201610/farmed-fishing-nature-based-solution-increased-resilience.

IUCN (2020a). Blue carbon. Retrieved from: https://www.iucn.org/resources/issues-briefs/blue-carbon#:~:text=Blue%20carbon%20is%20the%20carbon,role%20in%20mitigating%20climate%20change.

IUCN (2020b). Global Standard for Nature-based Solutions. A user-friendly framework for the verification, design and scaling up of NbS. First edition. Gland, Switzerland: IUCN.

Iwasaki S. (2014). Adapting Fisheries to Climate Change: Community-Based and Scientific-Oriented Fisheries Management of Saroma Lake, Hokkaido. In: Shaw R. (eds) Community Practices for Disaster Risk Reduction in Japan. Disaster Risk Reduction (Methods, Approaches and Practices). Springer, Tokyo. https://doi.org/10.1007/978-4-431-54246-9_13.

Kabisch, N., Qureshi, S. & Haase, D. (2016). Human–environment interactions in urban green spaces—A systematic review of contemporary issues and prospects for future research. Environmental Impact Assessment Review, Vol. 50, pp. 25-34.

Kauffman, J. B., M. F. Adame, V. B. Arifanti, L. M. Schile-Beers, A. F. Bernardino, R. K. Bhomia, D. C. Donato, I. C. Feller, T. O. Ferreira, M. C. Jesus Garcia, R. A. MacKenzie, J. P. Megonigal, D. Murdiyarso, L. Simpson, and H. Hernandez Trejo. (2020). Total ecosystem carbon stocks of mangroves across broad global environmental and physical gradients. Ecological Monographs 90(2): e01405. 10.1002/ecm.1405.

Keestra, S., Nunes, J., Novara, A., Finger, D., Avelar, D., Kalantari, Z. & Cerda, A. (2018). The superior effect of nature based solutions in land management for enhancing ecosystem services. Science of the Total Environment, Vol. 610-611, pp. 997 -1009.

Laing, T. (2018)., Guyana's REDD+ Agreement with Norway: Perceptions of and Impacts on Indigenous Communities. Center for Global Development Working Paper No. 476, Available at SSRN: https://ssrn.com/abstract=3129784 or http://dx.doi.org/10.2139/ssrn.3129784.

Lam, V., Allison, E., Bell, J., Blythe, J., Cheung, W., Frölicher, T., Gasalla, M. & Sumaila, U. (2020). Climate change, tropical fisheries and prospects for sustainable development. *Nat Rev Earth Environ*, Vol. 1, pp. 440–454. https://doi.org/10.1038/s43017-020-0071-9

Landschaftspark Duisburg Nord (2020). LANDSCAPE PARK. Retrieved from: https://www.landschaftspark.de/en/visitor-information/landscape-park/.

Lavorel, S., Colloff, M. J., Locatelli, B., Gorddard, R., Prober, S. M., Gabillet, M., … Peyrache-Gadeau, V. (2019). Mustering the power of ecosystems for adaptation to climate change. Environmental Science & Policy, Vol. 92, pp. 87–97.

Lieuw-Kie-Song M. (2009). Green Jobs for the Poor: A public employment approach, Poverty Reduction Discussion Paper PG/2009/002, UNDP, New York.

Lucantoni, D. (2020). Transition to agroecology for improved food security and better living conditions: case study from a family farm in Pinar del Río, Cuba. Agroecology & Sustainable Food Systems, Vol. 44, Issue 9, pp. 1124-1161.

Maes, J. & Jacobs, S. (2015). Nature-based Solutions for Europe's sustainable development. Conservation Letters, Vol. 10, pp. 121-124.

Mallakpour, I. and Villarini, G., (2015). The changing nature of flooding across the central United States. Nature Climate Change, Vol. 5, Issue 3, pp.250.

Menéndez, P., Losada, I.J., Torres-Ortega, S. et al. The Global Flood Protection Benefits of Mangroves. (2020). Sci Rep, Vol. 10, pp. 4404. https://doi.org/10.1038/s41598-020-61136-6

McPherson, G., Simpson, J., Peper, P., Maco, S. & Xiao, Q. (2005). Municipal Forest Benefits and Costs in Five US Cities. Us Forest Services.

Naturvation (2020). Emscher Landscape Park. Retrieved from: https://naturvation.eu/nbs/essen/emscher-landscape-park-programme

Nair C.T.S. and Rutt R. (2009). Creating forestry jobs to boost the economy and build a green future, Article developed for the special event "Impacts of Global Economic Turbulence on the Forest Sector" at the nineteenth session of the FAO Committee on Forestry, Rome, 20 March 2009.

Norton, A., Seddon, N., Agrawal, A., Shakya, C., Kaur, N. & Porras, I. (2020). Harnessing employment-based social assistance programmes to scale up nature-based climate action. Philosophical Transactions of the Royal Society B, Vol. 375, Issue 1794.

Ntuli, H., and E. Muchapondwa (2017). Effects of wildlife resources on community welfare in Southern Africa. Ecological

Economics, Vol. 131, pp. 572–583.

Overman, A., Cummings, A., Luzar, J. & Fragoso, J. (2019). National REDD+ outcompetes gold and logging: The potential of cleaning profit chains. World Development, Vol. 119, pp.16-26.

Payen, J. and Lieuw-Kie-Song, M. (2020). Desk Review Study on Employment Impact Assessment (EmpIA): Potential of Natural Resource Management (NRM) Investments on Employment Creation. STRENGTHEN Publication Series, Working Paper No.24, ILO Geneva.

Parthiban, Sudhagar, J., Fernandaz, C. & Krishnakumar, N. (2015). Consortium of Industrial Agroforestry: an institutional mechanism for sustaining agroforestry in India. General Articles. Retrieved from: https://www.currentscience.ac.in/Volumes/117/01/0030.pdf.

Quinn, T., F. Bousquet, and C. Guerbois. 2019. Changing places: The role of sense of place in perceptions of social, environmental and overdevelopment risks. Global Environmental Change, Vol. 57:101930.

Quinney, M. (2020). COVID-19 and nature are linked. So should be the recovery. World Economic Forum. Retrieved from: https://www.weforum.org/agenda/2020/04/covid-19-nature-deforestation-recovery/.

Rantala, S., Bullock, R., Mbegu, M. & German, L. (2012). Community-based forest management: what scope for conservation and livelihood co-benefits? experience from the East Usambara Mountains, Tanzania. Journal of Sustainable Forestry, Vol. 31, pp. 777-797.

Rockström, J. & Sukhdev, P., (2016). How food connects all the SDGs. Stockholm Resilience Centre. Retrieved from: http://www.stockholmresilience.org/research/research-news/2016- 06-14-how-food-connects-all-the-sdgs.html.

Rohini, A., Fernandaz, C., Karthick, V. & Parthiban, K. (2017). Yield and economic analysis of tamarind under an agroforestry system in Tamil Nadu to enhance farmers income. Indian Journal of Economics and Development, Vol. 13, pp. 282-286.

Roopsind, A., Sohngen, B. & Brandt, J. (2019). Evidence that a national REDD+ program reduces tree cover loss and carbon emissions in a high forest cover, low deforestation country. Proceedings of the National Academy of Sciences, Vol. 16, Issue 49, pp. 24492-24499. https://doi.org/10.1073/pnas.1904027116.

Ross, K., Hite, K., Waite, R., Carter, R., Pegorsch, L., Damassa, T. & Gasper, R. (2019). Enhancing NDCs opportunities in agriculture. World Research Institute, Washington, USA.

Seddon, N., Sengupta, S., García-Espinosa, M., Hauler, I., Herr, D. and Rizvi, A.R. (2019). Nature-based Solutions in Nationally Determined Contributions: Synthesis and recommendations for enhancing climate ambition and action by 2020. Gland, Switzerland and Oxford, UK: IUCN and University of Oxford.

Seddon, N., Daniels, E., Davis, R., Chausson, A., Harris, R., Hou-Jones, X., . . . Wicander, S. (2020). Global recognition of the importance of nature-based solutions to the impacts of climate change. Global Sustainability, Vol. 3, E15. doi:10.1017/sus.2020.8.

Sills, E.O.; Atmadja, S.S.; de Sassi, C.; Duchelle, A.E.; Kweka, D.L.; Resosudarmo, I.A.P.; Sunderlin, W.D. (Eds.) (2014). REDD+ on the Ground: A Case Book of Subnational Initiatives across the Globe; CIFOR: Bogor, Indonesia.

Smith P., M. Bustamante, H. Ahammad, H. Clark, H. Dong, E.A. Elsiddig, H. Haberl, R. Harper, J. House, M. Jafari, O. Masera, C. Mbow, N.H. Ravindranath, C.W. Rice, C. Robledo Abad, A. Romanovskaya, F. Sperling, and F. Tubiello, (2014). Agriculture, Forestry and Other Land Use (AFOLU). In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Temmerman, S., Meire, P., Bouma, T., Herman, P., Ysebaert, T., De Vriend, J. (2013). Ecosystem-based coastal defence in the face of global change, Nature, 504, pp. 79-83.

The Guardian (2015). Top 10 parks. Retrieved from: https://www.theguardian.com/culture/2015/aug/07/10-best-parks-urban-green-spaces-high-line-new-york-hampstead-london-park-guell-barcelona.

UN (2020). Disaster-risk reduction. Retrieved from: https://sustainabledevelopment.un.org/topics/disasterriskreduction

UN REDD (2014). REDD+ and adaptation: Identifying complementary responses to climate change. UN REDD programme, Info Brief.

UN Water (2018). The United Nations World Water Development Report 2018: Nature-based Solutions for Water. Paris, UNESCO:

UNCCD (2020).The Great Green Wall Initiative. Retrieved from: https://www.unccd.int/actions/great-green-wall-initiative

USFS. US Forest Service (n.d.). Chapter 4: Corridor Benefits. Retrieved from: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_014927.pdf.

USFS: US Forest Service (2020). Urban Forest. Retrieved from: https://www.fs.usda.gov/managing-land/urban-forests.

Ussiri D.A., Lal R. (2017). The Global Carbon Inventory. In: Carbon Sequestration for Climate Change Mitigation and Adaptation. Springer, Cham. https://doi.org/10.1007/978-3-319-53845-7_4.

Vasseur, L. Horning, D., Thornbush, M., Cohen-Shacham, E., Andrade, A., Barrow, E., Edwards, S., Wit, P. & Jones, M. (2017). Complex problems and unchallenged solutions: Bringing ecosystem governance to the forefront of the UN sustainable development goals. Ambio, vol. 46, pp. 731-742.

Vianna, G., Zellet, D. & Pauly, D. (2020). Fisheries and Policy Implications for Human Nutrition. Current Environmental Health Reports, Vol. 7: pp. 161–169.

Vikram, S., Sameer, D., Yogesh, K. & Brajesh (2019). Performance Analysis and Economics of Leaf Litter Fall and Baby Corn Intercrop Under Poplar Based Agroforestry System. Int. Arch. App. Sci. Technol; Vol 10, Issue 4, pp. 56-60.

Vijaykumar,R., Mehera, R., Khare,N., Sameer, D. & Shweta K. (2018). Evaluate the organic manure for growth and economics for rice cultivation using the system of rice intensification (SRI) method under citrus based agroforestry system. Journal of Pharmacognosy and Phytochemistry, Vol. 7, pp. 1798-1802.

Vivid Economics (2020). Integrating climate change and biodiversity into the response to COVID-19: International financial flows.

Ward, A., Dargusch, P., Thomas, S., Lui; Y., Fulton, E. (2014). A global estimate of carbon stored in the world's mountain grasslands and shrublands, and the implications for climate policy. Global Environmental Change, Volume 28, pp. 14-24.

World Economic Forum (2020). The future of nature and business. In collaboration with AlphaBeta.

Worku Kassie, K. (2016). Agroforestry and land productivity: Evidence from rural Ethiopia. Journal of Cogent Food & Agriculture, Vol. 1.

WRI - World Resource Institute (2020). Nature is An Economic Winner for COVID-19 Recovery. Retrieved from: https://www.wri.org/news/coronavirus-nature-based-solutions-economic-recovery.

WWF and HSBC, (2017). Greening the Belt and Road Initiative. https://www.sustainablefinance.hsbc.com/-/media/gbm/reports/sustainable-financing/greening-the-belt-and-road-initiative.pdf .

WWF (2020a). Enhancing NDCs through Nature-based Solutions. Available through: https://c402277.ssl.cf1.rackcdn.com/publications/1318/files/original/enhancing_ndcs_through_nature_based_solutions.pdf?1585149353.

WWF (2020b). The loss of nature and rise of pandemics: Protecting human and planetary health. Gland.

WWF (2019a). Climate, Nature and our 1.5°C Future: A synthesis of IPCC and IPBES reports. WWF International, Gland.

WWF (2019b). Working for Water. Retrieved from: https://www.wwf.org.za/?1500/Working%20for%20Water.

WWF/ZSL (2020). The Living Planet Index database. Retrieved from: https://livingplanetindex.org/data_portal.

WWF-SA (2016). Water: Facts & Futures. Retrieved from http://awsassets.wwf.org.za/downloads/wwf009_waterfactsandfutures_report_web___lowres_.pdf.

WWAP (United Nations World Water Assessment Programme). (2014). The United Nations World Water Development Report 2014: Water and Energy. Paris, UNESCO.