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Maximizing Nature-Based Solutions for Sustainable National Development

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Abstract

In recent years, there has been a lot of focus on the conservation, restoration, management, and long-term use of natural and modified ecosystems to address climate change mitigation. These sorts of activities, however, are frequently not intended to address other global concerns, and hence they lose an opportunity to bring major non-mitigation benefits while jeopardizing their mitigation potential. We emphasize the importance of planning Nature-based Solutions for mitigation while taking into account the full range of global challenges that societies face, and we propose a set of considerations to ensure that those types of solutions also provide climate adaptation, biodiversity, and/or human well-being benefits. Nature-based solutions for climate mitigation that can also address other global challenges are very timely, because every nature-based effort should seize the opportunity to address a variety of pressing issues in order to continue delivering mitigation and other benefits in this critical decade.

Keywords: Nature-based solutions, Climate mitigation, Ecosystem restoration, Biodiversity co-benefits, Climate adaptation, Human well-being

Introduction

Nature is essential to our livelihoods, well-being, and ability to tackle the issue of global warming. Nature offers a wide range of critical services to humans, including clean air and water, food, and pollination, as well as support for tourist and leisure activities, mental and physical health, and a variety of other functions. Nature is often the most effective insurance policy, safeguarding us against floods, landslides, fires, and excessive heat (European Commission, 2022). The loss of nature poses severe threats to our clean air and drinking water, wildlife survival, community prosperity, and nature's ability to protect us from natural disasters. Deforestation, along with

agriculture and other land-use changes, accounts for about a quarter of global greenhouse gas emissions (United Nations, n.d.). The twin crises of climate change and rapid loss of biodiversity threaten humanity's existence on Earth (Campaign for Nature, 2022).

The world's poorest nations experience the most severe socio-economic impacts of climate change and require robust and cost-effective adaptation responses (Seddon et al., 2020). For example, Nigeria's fragile economy, weak resilience, and low adaptive capacity make it highly vulnerable to severe adverse impacts from climate change, as much of the economy depends on climate-sensitive ecosystems and natural resources. Climate change severely threatens the country's Sustainable Development Goals (SDGs) (Federal Ministry of Environment, 2021).

Climate change is a global challenge that requires solutions on a global scale, and one of the most promising global solutions is already hiding within nature's sight (The Nature Conservancy, n.d.). Our lands offer an untapped opportunity to create proven ways to store carbon and reduce carbon emissions in the world's forests, grasslands, and wetlands (The Nature Conservancy, n.d.). However, biodiversity loss erodes the ability of ecosystems to function effectively and efficiently, undermining nature's ability to provide us with a healthy environment (Roe et al., 2021). Nature-based solutions (NbSs) are fundamental for climate protection and biodiversity conservation. Well-designed and implemented NbSs provide numerous benefits, enable synergies, and minimize trade-offs in achieving various global development goals. They can simultaneously address societal challenges, including climate change mitigation and adaptation, human health, food and water security, and biodiversity loss (Donatti et al., 2022). Thus, investments in NbS solutions have been identified as one of the primary building elements of a Green Economy transformation. Despite widespread awareness and growing interest in the function of NbS, NbS has yet to be widely used (ISDB). Action must now be taken to ensure they reach their full potential (Nature-based Solutions Coalition, 2019).

Investing in nature for development demonstrates that we can work with nature in a variety of ways that benefit people. These benefits can meet the short-term delivery goal of providing jobs and training while also promoting a sustainable future by protecting, restoring, and expanding nature's contributions to people in a variety of areas ranging from water supply and health to social cohesion and empowerment (Roe et al., 2021).

Humanity has already caused the loss of 83% of all wild mammals and half of all plants. $44 trillion in economic value added, more than half of the world's total GDP, depends moderately or heavily on nature and its services (World Economic Forum, 2020). The three largest sectors heavily dependent on nature, generate nearly $8 trillion in Gross Value Added (GVA) (World Economic Forum, 2020). The

availability of food that is accessible to all is one of the biggest problems facing the world today. It is estimated that more than 795 million people are malnourished, most of whom live in developing countries (Donatti et al., 2022). There are many starting points for nature-based solutions to address various pressing global issues (Cohen-Shacham et al., 2016).

Climate change constantly threatens Nigerian ecosystems, affecting the well-being and resilience of millions of citizens who depend on agriculture and fisheries for their livelihoods. Agriculture, deforestation, and energy are the main contributors to greenhouse gas emissions in Nigeria, but these sectors also have the highest mitigation potential (Laing, 2021). As climate change increasingly threatens lives and livelihoods, maximizing mitigation and adaptation opportunities will minimize its potentially catastrophic impacts (Sachs et al., 2009).

Over 800 million people live in tropical forests and savannas in developing countries (FAO and UNEP, 2020). Grassland ecosystems provide livestock grazing that supports millions of people, particularly poor, and marginalized groups (Coppock et al., 2017). Forests provide more than 86 million green jobs and secure the livelihoods of many more people. Some biomes could cross irreversible tipping points with far-reaching economic and societal impacts if current rates of nature degradation continue unabated (World Economic Forum, 2020). To improve this dire state, we must focus on it.

Development and Definition of Nature Based Solutions as a Concept. Nature-based solutions aim to work in partnership with nature rather than relying on traditional engineered solutions to adapt and mitigate the impacts of climate change (Cohen-Shacham et al., 2016). The term was first coined in a 2008 review of the World Bank's biodiversity portfolio and contributions to climate change mitigation and adaptation (MacKinnon et al., 2008). It is a relatively young concept that is still in the development phase. We need to deepen our understanding of NbSs and validate the principles to arrive at an operational framework that can help apply the concept (Cohen-Shacham et al., 2016).

Natural-based solutions have yet to be defined (Nesshver et al., 2017). Nonetheless, most conceptualizations are based on or refer to those developed by the International Union for the Conservation of Nature (IUCN) and the European Union (EU). The International Union for the Conservation of Nature defines NbS as "actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively while providing human

well-being and biodiversity benefits" (Cohen-Sachman et al. 2016). The European Commission defines low-cost, locally tailored, and resource-efficient solutions that are "inspired by, supported by, or copied from nature" and "provide environmental, social, and economic benefits while also helping to build resilience" (European Commission, 2015). I use the IUCN definition of NbSs because it covers most of this study.

Maximizing Nature Based Solutions for Sustainable National Development. How do we address the Anthropocene's three central challenges: climate protection and adaptation to climate change, biodiversity conservation, and human well-being? Much of the solution lies in addressing these interconnected challenges; failing to do so invites negative consequences and unintended feedback. The United Nations (UN) Agenda for Sustainable Development promotes connectivity, inclusivity, and collaboration (Seddon, Chausson, et al., 2020). The failure to stabilise and adapt to climate change (SDG 13) (IPCC, 2015) or protect biodiversity (SDGs 14 and 15) (IPBES, 2019) has been exacerbated by the fact that these issues are treated separately, even though they are deeply intertwined. NbSs are solutions to societal challenges that involve working with nature, and they are emerging as an integrated approach capable of reducing trade-offs and promoting synergies between the SDGs (Seddon et al., 2019). Planting trees and creating more green space in cities can help combat flooding while storing carbon, reducing air pollution, and promoting recreation and health (Seddon, Chausson, et al., 2020).

Nature based Solutions for Specific Societal Challenges

Nature Based Solutions for Water Security Built infrastructure alone is becoming increasingly unlikely to offer future water security and resilience in the face of expected climate change consequences (Dalton & Murti, 2013). In a global context where approximately four billion people - 60 percent of the world's population - live in regions with near-permanent water stress, where net withdrawals of surface and groundwater meet or exceed available supply, no additional water is available for ecosystem use or to meet future demand, new demands for water security solutions are emerging. Pollution exacerbates water stress; in poor nations, 80-90% of all wastewater is released directly into surface water bodies, posing serious health dangers (Corcoran et al., 2010).

Using NBS to harness the water-related services of 'natural infrastructure' including forests, wetlands, and floodplains may assist mitigate the possibility of a water crisis, especially in the face of future

climatic pressures (Ozment et al., 2015). In the case of flood risk management, for example, whereas flood-control infrastructures such as levees and dams frequently degrade aquatic habitat by altering the natural river flow regime and cutting off floodplains from rivers, preserving floodplains and/or reconnecting them to rivers can provide flood management benefits while also conserving ecosystem values and functions (Opperman et al., 2009). Because nature is both the source of our water and a water user, water security solutions must take 'water for nature and nature for water' into account (Smith, 2013).

Nature, however, cannot provide water security for humanity in every scenario. Both constructed and natural infrastructure are required for efficient and successful water resource management (Smith, 2013). Nature is a crucial building block of water security because of the significance of water-related ecosystem services to people's well-being, food and energy security, industry, the economy, and the engines of economic growth in cities. Nature can provide answers for water security if we account for its benefits and invest appropriately.

Nature Based Solutions for Food Security

Food security, defined as the availability of food that is accessible to all, safe and locally suitable, and consistent over time and location, is one of the most pressing concerns confronting the globe today (IUCN, 2013). Over 795 million people are projected to be malnourished, with the great majority living in poor countries (FAO et al., 2015).

Historically, food security was regarded as an issue of agricultural output. However, recent research implies that 'technological improvements' to food production will be insufficient to increase food security on their own. Multifaceted solutions will be required, such as adapting agricultural systems to environmental change, comprehending the broader concerns underlying food security, and mainstreaming climate change perspectives in development programs (Ericksen et al., 2009). When food security is conceptualized using an ecosystem-aware perspective, it goes beyond productivity, trade, and macroeconomic challenges to take on a comprehensive picture of sustainable food systems (Mohamed- Katerere, & Smith, 2013).

As a result, there are several entrance ways for Nature-based Solutions to solve food security concerns. These include, for example, the protection of natural genetic resources (animal and plant), the

management of wild species (particularly fish), and the provision of irrigation water. During times of natural disaster, climate change, or political instability, focusing on the restoration, protection, and management of ecosystems to offer services can help stabilize food availability, access, and usage (IUCN, 2013b). Protecting plant resources from pest and disease outbreaks (Macleod et al., 2016), managing water and food security simultaneously (Hanjra & Qureshi, 2010), adopting forest landscape restoration methodologies (Kumar et al., 2015), and resolving land tenure challenges are some specific examples.

Nature Based Solutions for Human Health

The natural environment, particularly ecosystems, climate, and biodiversity, is increasingly recognized as important drivers of human health, well-being, and social cohesion (Naeem et al., 2015). There is a substantial and diverse body of information describing these intricate connections and their underlying processes (Hartig et al., 2014). A number of studies have looked at how green space interactions (whether active or passive) might affect health and well-being. Improvements in environmental quality, such as heat regulation and noise reduction (Hartig et al., 2014), promotion of physical activity and associated Body Mass Index improvements (Thompson Coon et al., 2011), enhanced social interaction, social inclusion and cohesion, and perceived safety (Maas et al., 2009), and opportunities for spiritual well-being experiences, typically in more remote 'wilderness' green spaces (Warber et al., 2013). Ecosystems such as forests and coral reefs have also been discovered to have an important role in supplying a source of medications and pharmaceutical goods, which considerably contribute to human health and well-being (Stolton & Dudley, 2009).

Broader stakeholder engagement, as well as the integration of nature across policy domains at all levels, are required to harness the numerous benefits of nature for health and well-being.

Nature Based Solutions for Adaptation

Over the last decade, there has been a rising understanding that protected and well-managed eco-systems can be a more efficient and effective alternative to grey infrastructure in terms of climate adaptation and resilience (Islamic Development Bank, 2022).

The use, protection, restoration, and creation of ecosystems to reduce climate vulnerability and enhance the resilience of people and ecosystems to climate hazards such as riverine and coastal floods, droughts, soil erosion, landslides, and seasonal shifts are examples of NBS for adaptation. For example, NBS can reduce the severity of flood occurrences by enhancing the ability of the landscape to retain water or by increasing the ability of channels to transmit floodwaters. On a watershed scale, forest and wetland restoration improves ecosystems' inherent capacity to hold water, delaying and absorbing some storm runoff. Green roofs, permeable pavements, and green spaces assist to absorb water, facilitate infiltration, and reduce storm water runoff in urban settings. As a result, sewer system overflows and floods are reduced or prevented, and the burden on existing flood management equipment is reduced.

NBS for adaptation can be used to supplement, substitute, or protect traditional grey infrastructure while providing increased resilience and co-benefits (e.g., supporting biodiversity, local livelihoods, and so on). Green infrastructure (also known as natural infrastructure) is a type of NBS for adaptation that strives to protect, enhance, or restore natural systems like as forests, floodplains, riparian zones, and coastal forests. When green infrastructure and grey infrastructure are merged, they form 'green- grey infrastructure' (also known as hybrid solutions) to offer more robust and cost-effective services.6 Natural coastal ecosystems, such as mangroves and salt marshes, can be paired with grey infrastructure, such as breakwaters, to mitigate the effects of a coastal flood. Furthermore, protection and restoration of natural coastal habitats can increase the lifespan of gray infrastructure and save maintenance costs. As a result, the adaption solution is more resilient and cost-effective than if the solutions were done separately.

The incorporation of NBS for adaptability in strategies and action plans can assist a variety of industries. NBS have shown to be successful in addressing climate-related concerns in agricultural,

water, infrastructure, urban, and coastal sectors, therefore increasing climate resilience and strengthening the country's green economy.

Nature Based Solutions for Disaster Risk Reduction

Major catastrophes in the last decade have clearly highlighted the function of nature in mitigating natural hazards risks. Following Hurricane Katrina, the US Congress granted $500 million in funding for the rehabilitation of its coastal national parks and salt marshes, based on evidence that the parks and

marshes had helped mitigate damage. Similarly, the Japanese government proclaimed the growth of its coastal forests in the form of the Sanriku Fukko Reconstruction Park, citing how these woods helped mitigate the effects of the tsunami produced by the Great East Japan Earthquake in 2011 (Renaud & Murti, 2013). These examples show that the regulating function of ecosystem services may be cost-effective in minimizing disaster risks to society. According to a research undertaken by Swiss Reinsurance, every dollar invested in the conservation of the Folkestone Marine National Park in Barbados can save US$ 20 million in yearly storm losses (Mueller & Bresch, 2014). Wetlands, forests, and coastal systems, for example, can limit physical exposure to natural dangers by acting as protective barriers or buffers. Furthermore, such NBS can help to preserve development infrastructure and property while also assisting in the faster recovery of livelihood sources. A research from the Bhitarkanika Conservation Area in India, for example, found that without the presence of mangrove forests along the shoreline, rice crops can take three times longer to recover from salt intrusion following coastal storms (Duncan et al. 2014). Such historical learning has resulted in the creation of the ecosystem-based disaster risk reduction (Eco-DRR) strategy.

It is critical to recognize that a natural catastrophe occurrence has the potential to become a disaster if the community or society is unable to cope with the consequences using its own resources (UNISDR 2007). Disaster risk reduction efforts can significantly reduce the likelihood of a natural hazard event becoming a disaster "through systematic efforts to analyse and manage the causal factors of disasters, including reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events" (Renaud et al. 2013). NBS, such as the Eco-DRR method, may be extremely beneficial to a community's risk-reduction initiatives. Over the last two years, this approach has gained traction within global policy frameworks such as the Convention on Biological Diversity (2014), the Sendai Framework for Disaster Risk Reduction (2015), and the Ramsar Convention on Wetlands (2015). While past disasters have increased recognition of nature as a critical solution for disaster risk management, scaling up these NBS requires active facilitation of dialogues and capacity development among scientists, policymakers, and conservation and disaster management practitioners.

Nature Based Solutions for Climate Change Mitigation

Climate change is one of humanity's most important problems today. The world's ecosystems depending on how they are maintained may either add to the issue or provide effective Nature-based Solutions for climate change mitigation and adaptation. First, by limiting the destruction and loss of natural ecosystems, NBS in the form of ecosystem-based mitigation (EbM) may make a significant contribution to the battle against climate change. For example, deforestation and forest degradation emit an estimated 4.4 Gt of CO_2 per year into the atmosphere (Matthews & van Noordwijk, 2014), accounting for approximately 12% of human CO_2 emissions (IPCC, 2014). When the land sector as a whole is examined, encompassing agriculture, forestry, and other land uses (AFOLU), the contribution is around 24% of annual worldwide anthropogenic emissions (ibid). Avoiding these emissions through better conservation and land management is a potent intervention that can contribute significantly to global mitigation efforts.

Secondly, both natural and modified ecosystems may make significant contributions to addressing climate change by acting as a 'natural carbon sink' by absorbing and sequestering CO_2 emissions. Approximately 60% of all anthropogenic GHG emissions have been stored on land (in plants and soils) or in the ocean since the pre-industrial period (IPCC, 2014). Conservation, restoration, and sustainable management of forests, wetlands, and seas are therefore important to the carbon cycle's healthy operation and the balanced control of the planet's climate. For example, it has been estimated that restoring 350 million hectares of degraded or deforested landscapes by 2030 can sequester 1-3 billion tonnes of CO_2 per year while also generating approximately US$ 170 billion in benefits from other ecosystem services, making it a cost-effective NBS to climate change (New Climate Economy, 2014).

Finally, ecosystems can help vulnerable communities; particularly those that rely on natural resources, better adapt and become more resilient to the adverse effects of climate change, including extreme weather events and climate-related disasters, through ecosystem-based adaptation (EbA) and ecosystem-based disaster risk reduction (Eco- DRR). Natural infrastructure, or ecosystem-based interventions, may complement and increase the efficacy of physical infrastructure, such as sea walls and dykes, in a cost-effective and integrated manner.

It should be underlined that in order for global climate change measures to be effective in keeping temperature rises far below 2 degrees Celsius, action from all sectors, at all levels, and involving all players is essential. However, NBS are a critical component of this mix, and no long-term solution to climate change will be successful until they are adequately utilized.

Nature Based Solutions in Practice

NBS has been used in a wide range of sectors and to address a wide range of societal issues. For example, NBS interventions can include:

Restoring and sustainably managing wetlands and rivers to maintain or boost fish stocks and fisheries-based livelihoods, reduce the risk of flooding, and provide recreational and tourism benefits.

- Forest conservation is important for food and energy security, local revenue, climate change adaptation and mitigation, and biodiversity.

- Restoring dry lands to improve water security, local livelihoods, and resistance to the effects of climate change.

- Creating green infrastructure in urban areas (for example, green walls, roof gardens, street trees, and vegetated drainage basins) to enhance air quality, assist wastewater treatment, minimize storm water runoff and water pollution, and improve inhabitants' quality of life.

- Using natural coastal infrastructure like barrier islands, mangrove forests, and oyster reefs to protect shorelines and towns from coastal floods and to mitigate the effects of sea-level rise.

Conclusion

Since the Industrial Revolution, our modes of production and consumption have increased the concentration of gases in the atmosphere, increasing the greenhouse effect and endangering our natural ecosystems. Greenhouse gas emissions carbon dioxide (CO_2), methane (CH_4), nitrous oxide, and some fluorinated chemicals have a significant impact on global warming. These naturally occurring gases have grown in the past 150 years as a result of a development paradigm based on a linear economy. We need to address these issues. Natural and modified ecosystem conservation, restoration, and management have the ability to address climate change mitigation while also addressing environmental

concerns such as climate change adaptation, biodiversity loss, improving human well-being, and food and water security. However, Nigeria will only be able to meet its Paris Agreement goal of limiting temperature increases to less than 2°C if NBS is accompanied by immediate and aggressive decarbonization efforts in the energy and industrial sectors.

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