Natural Capital Accounting to Inform Climate, Biodiversity and Development Policies in Africa

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Executive Summary

(1) Combined climate change, nature loss, and pollution represent some of the most significant obstacles towards greener, healthier development. These multifaceted risks threaten to severely undermine future economic growth and the fragile prosperity of the fastest-growing economies, including many African countries that are particularly vulnerable to nature loss.

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(2) Opportunities to address such challenges are urgent and time bound. They require recognition of the inextricable linkages between climate and biodiversity, and the integration of natural capital information into decision-making and policy. This natural capital approach acknowledges attention to biodiversity as an integral part of climate change efforts (and vice-versa).

(3) Natural Capital Accounting is the statistical framework for systematically measuring and valuing natural capital, i.e., the natural stocks and the flows of benefits they provide. It offers a proven, accepted statistical standard to furnish the critical information that contributes to integrated country responses to the United Nations Framework Convention on Climate Change (UNFCCC) and Convention on Biological Diversity (CBD) commitments. It helps in developing actions and policy responses towards achieving the dual goals. NCA and related analyses help to identify mutually beneficial targets and objectives and design more robust solutions.

(4) As countries align their respective policy responses to achieve their part of the **global** goals – in both climate via the UNFCCC "Nationally Determined Contributions" (NDCs), and in biodiversity via the CBD Global Biodiversity Framework (GBF) "National Biodiversity Strategies and Action Plans" (NBSAPs) – the shift towards low-carbon and nature-smart development has become an overarching goal for African countries and for the continent as a whole.

(5) At the **national** level, NCA can inform macroeconomic policy planning in support of this transition to a low-carbon economy. Natural capital data – and the National Accounting System (NAS) in particular – can support integrated planning that meets climate, biodiversity and development goals, providing a win-win-win for the economy, people, nature and climate. We illustrate this with the case study of the Indonesia Low Carbon Development Initiative.

(6) At the **national to local** level, the implementation of Nature-based Solutions (NBS) offers a pragmatic and potentially transformative opportunity to make progress towards the low-carbon and nature-smart development aspiration of the Agenda 2063 'The Africa we want'. Examples of NBS are illustrated in Mozambique, South Africa, Guinea, Sierra Leone. These all rely on Natural Capital Accounting (NCA) or related analysis to reveal options where actions not only enhance both climate and biodiversity, but also address other societal challenges such as food and water security, while further contributing to development goals.

(7) Thus, NCA offers a compelling toolkit to help design, monitor and evaluate the benefits of nature-climate interventions. However, its use remains both an underdeveloped area and a tremendous opportunity. Innovating for integration of NCA with established interventions that connect climate, nature and people, most notably NBS, will reshape

our approach to sustainable development. This will pave that transformative pathway to a greener, healthier and more resilient development paradigm for the people of Africa.

1. Introduction

Global leaders have identified the triple planetary crisis of climate change, nature and pollution as one of the most significant obstacles to achieving greener, healthier development (UNDP, 2022). In the lead-up to the Stockholm+50 meeting in 2022, consultation with 56 countries, including 18 in Africa, underscored environmental governance as an important policy priority to be strengthened by legislation, inclusive decision-making, monitoring, and enforcement (ibid).

The African Development Outlook (2023) states that "*sustainable development, economic growth, and climate action are critical for Africa, and concurrently achieving these priorities requires commitments to green growth pathways*". However, the report further emphasizes that progress toward green growth has been slow, and that a more deliberate effort is needed for African countries to move away from their pervasive and excessive dependence on natural resources (ADB, 2023). Indeed, the over-reliance on natural resources combined with excessive ecosystems degradation and vulnerability to climate change are impediments to economic development in Africa. Johnson et al. (2021) estimate that the Africa region could be hit particularly hard with collapse of ecosystem services and experience a 9.7 percent contraction of gross domestic product (GDP) annually by 2030.

Intertwined issues as they are, climate change and biodiversity loss have been largely addressed separately and seldom integrated in management and policy (Shin et al., 2022; Petorelli et al., 2021). Often, the implementation of such efforts is in isolation of each another, without consideration of how climate change measures may harm biodiversity or alternatively, how biodiversity efforts can support climate efforts (Arnet et al., 2020). It is generally recognized that a more integrated approach is needed to address these global challenges, and to prevent threats to development, economic growth, and the wellbeing of people (World Bank, 2022).

Opportunities to address such challenges are urgently required and time-bound (Dinerstein et al., 2019). Amongst other actions, they will require the integration of natural capital data and analysis into decision-making and policy – a concept that is now often referred as a "**Natural Capital Approach**'' (Natural Capital Coalition, 2023). A natural capital approach recognizes the inextricable linkages between climate and biodiversity and elevates biodiversity as an integral part of climate change efforts (and vice-versa). Natural Capital Accounting and related analyses structure this recognition into information, facilitating linked policy options, effective strategies, and greater benefits for people, nature and economies.

The objective of this paper is to stimulate discussion on how Natural Capital Accounting and related analysis can help achieve climate, biodiversity loss and development goals together, particularly in the context of Africa. By clarifying the close interlinkage between climate, nature and development issues, we hope to support countries embarking on their commitments to the global goals set forth by the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD), and ultimately, to inspire well-designed and integrative solutions incorporated into their national development goals.

This paper is organized into four sections: (i) we start by discussing the climate-nature interface, particularly in light of countries' commitments to global goals of the UNFCC and CBD; (ii) we then discuss the imperative need for integration of nature into economic thinking and analysis; (iii) next, we discuss how efforts to measure and value nature, and Natural Capital Accounting in particular, can inform interventions for climate and biodiversity as well as development; this is followed by a (iv) a discussion of a set of solutions that bridge climate and biodiversity interventions using macro-economic modelling for low-carbon development and Nature Based Solutions as examples; and (v) by a set of illustrative case studies suggesting avenues to couple biodiversity and climate in support of national policy goals and greener development paths.

2.   The Connections between Climate and Biodiversity

There is strong evidence of the connections between climate, the oceans, the land, and nature within these realms (Shin et al, 2021). For example, mangroves store CO2, simultaneously supporting efforts to reduce greenhouse gas (GHG) emissions by capturing and storing carbon (climate mitigation) and to adapt to climate change by buffering against the impacts on local communities of tidal surges or storms (climate adaptation). Indeed, ecosystems increase resilience and/or reduce vulnerability of people to the effects of climate change. Such abilities are often related to the benefits ecosystems provide to people as "ecosystem services". These include regulating services, such as coastal and storm-surge protection; provisioning services, an important source of biomass for food, fibre and energy; and cultural services. Combined, regulating, provisioning and cultural services are now commonly referred as Nature's Contributions to People (NCP) and are explicitly mentioned in the Convention on Biological Diversity (CBD) Global Biodiversity Framework (GBF).

Loss of biodiversity and ecosystem services undermines our ability to tackle climate change. In turn, climate-induced environmental changes such as reduced vegetation growth rates associated with rising temperature, exacerbate biodiversity loss and impair the ability of ecosystems to provide ecosystem services. While the evidence of interconnection is strong, the approaches to tackle these challenges remain largely siloed in in policy and in practice.

Recent commitments under the UNFCCC and the CBD provide an opportunity for a more coherent policy framework that aligns targets across climate change and biodiversity (Petorelli

et al., 2021). Their integration can be facilitated by the fact that both conventions share common strategic approaches for implementation, i.e. (i) both have global goals and targets that help to identify threats, establish priorities, and incentives for action; (ii) both require the development of nationally determined plans and reporting on monitoring; (iii) both are implemented at various scales (national, sub-national, local) and by various entities, including the private sector and civil society; (iv) they are supported by official development assistance (ODA), multilateral assistance and private sector investment; and lastly (v) they both aim to achieve targets by 2030 (Cooper, 2023).

As countries align their respective policy responses to achieve their part of the global goals in climate via the UNFCCC "Nationally Determined Contributions" (NDCs)[2], and biodiversity via the CBD Global Biodiversity Framework (GBF) "National Biodiversity Strategies and Action Plans" (NBSAPs)[3], the shift towards low-carbon and nature-smart development has become an overarching goal for countries, and for the African continent as a whole. In "Agenda 2063: The Africa we want", the continent's strategic framework for inclusive and sustainable development (AUC, 2015) "environmentally sustainable and climate-resilient economies and communities" is a tacit part of the broader aspiration towards transformed economies – highlighting biodiversity, conservation and sustainable natural resource management, water security, climate resilience and natural disasters preparedness as components of this transformation (Ibid.)

The issues are indeed complex and in many African countries, the climate-nature interface is highly linked with land and forest degradation which, by some estimates, impact 43 per cent of Africa's land surface with over 4 million hectares of forests degraded annually over the past two decades due to a range of unsustainable practices (AUC, 2015). Given the mutual dependence between functioning ecosystems and climate and the potential impacts that degradation has on livelihoods, ecosystem services, and economic losses, it follows that nature protection and restoration have become core activities and are well reflected in NDC submissions from Africa (UNEP and IUCN, 2021).

Despite this preponderance of land-based interventions, other climate-nature strategies important to Africa should not be overlooked. "Rewilding" strategies such as the conservation of large wild animals offer the potential both to address biodiversity and to enhance the mitigation and adaptation capacity of ecosystems, although the prospect for both positive and negative outcomes must be considered (Malhi et al, 2022).

The questions to be addressed now are **how the climate-nature linkages can be more fully explored, how solutions toward one goal can support the other, and what is the evidence**

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[2] Nationally Determined Contributions (NDCs) are action plan required by parties of the UNFCCC Paris Agreement to cut emissions and adapt to climate change based on a set of targets. NDCs are updated every five years.

[3] National Biodiversity Strategies and Action Plans (NBSAPS) are action plan required by parties of the CBD to conserve and sustainably use biodiversity. NBSAPs are currently being revised or updated for alignment with the Kunming-Montreal Global Biodiversity Framework.

base and practice that we can draw to inform a range of solutions? These questions are critically important now, as countries are currently refining their national commitments and setting the stage for a more resilient low carbon development that acknowledges nature as an integral part of these effort.

We note that these questions are also important for the private sector. There is increasing awareness that combined impacts of nature loss and climate change can compound risk but also inform opportunities (F4B, 2021). A focus on nature and how it interacts with climate, and on solutions that reinforce common goals is gaining momentum among the private sector, as demonstrated in frameworks such as the Science-based Target Network (SBTN), the Task Force on Climate-related and Financial Disclosure (TCFD), the Task Force on Nature-related Financial Disclosure (TNFD) and Network of Central Banks for Greening the Financial System (NGFS).

Recognizing synergies between climate and biodiversity not only aids in the formulation of mutually beneficial targets and objectives, but also forges increased integration, relying on natural capital approaches to design more robust and cost-effective solutions.

3. Integrating Nature into Economic Thinking and Analysis: A Natural Capital Approach

Over the last fifty years the world has experienced remarkable economic growth and prosperity, but much has been at the cost of the natural systems that support life on Earth. About 2.7 billion people (70% of all tropical peoples) directly depend on nature to meet their basic needs: water, fuel, shelter, and/or livelihoods (Fedele, 2021). We also realize the magnitude of how nature underpins the economy, particularly for sectors that rely on direct natural resources extraction or the provision of ecosystem services. According to the WEF (2021), roughly half of the world's gross domestic product (GDP) depends on nature, and estimates show that 23% of African GDP comes from industries that are heavily dependent on nature (ibid).

The triple planetary crisis of climate change, nature and pollution risks significantly undermining future economic growth, particularly of the poorest economies of which many are in Africa (World Bank, 2021). The same multifaceted risks also threaten the fragile prosperity of the fastest-growing economies, including many African countries which are particularly vulnerable to nature loss (WEF 2021). This suggests that consideration of nature's role to these economies is essential, and urgently required.

When an economy or a business recognizes its dependence on nature, more systematic and continuous measurement of natural capital becomes necessary, including the stocks of natural capital assets, the flows of benefits to the human economy, and their changes over time. Fortunately, advances in natural capital methods, technology and practice have correspondingly advanced the use of such information in economic and development planning.

Natural capital data can be generated through different ways: (i) **natural capital assessment**, i.e., a process to measure and value natural stocks of natural resources and the flows of benefits they provide, often at sub-national level and implemented to answer a specific policy question; or alternatively, (ii) **Natural Capital Accounting**, commonly referred as NCA, i.e., a statistical framework for systematically measuring and valuing natural stocks and the flows of benefits they provide, often at the national level. NCA data is regularly published as national statistics alongside the economic data in national accounts and is deployed for a range of uses and policy applications, such as macro-economic analysis to inform development planning.

Natural capital accounts can be used on their own (e.g., for monitoring, evaluation and issue identification) or as an input to many existing analytical approaches (e.g., as an input to macroeconomic and simulation models). This not only allows for consideration of the value of nature for people and the economy, but also demonstrates how natural and produced capital are complementary rather than perfect substitutes. As such, NCA can improve policy process, macroeconomic planning, sectoral and cross-sectoral analysis, and the design of relevant solutions, including those for climate and biodiversity interventions.

4. Natural Capital Accounting: Measuring and Valuing Nature Assets and Flows of Benefits

The United Nations' System of Environmental-Economic Accounts (SEEA) is the internationally accepted framework for incorporating nature into national accounting systems, guiding Natural Capital Accounting efforts in the public sector. It includes the **Central Framework (CF)** and **Ecosystem Accounting (EA)**. While the SEEA CF focuses on the provision of environmental assets to the economy (e.g., land, fish, timber, water etc.)[4], the SEEA EA expands SEEA CF measurements to include ecosystems and the numerous services they provide, including regulating and cultural services, which are often overlooked. SEEA EA entails comprehensive spatial identification and mapping, resulting in a more complementary picture of ecosystems and the benefits they provide to various parts of an economy (UN et al, 2012; UN et al, 2021).

The SEEA provides the analytical framework for measurement of the environmental and economic data that is critically important to understand the linkages between climate and biodiversity, as well as the drivers of change. The SEEA EA (i.e., ecosystems extent, condition, ecosystem services, assets and thematic accounts provide information in a coherent, integrated, and organized accounting approach facilitating a better understanding of connections among ecosystems, climate change and biodiversity. Box 1 and 2 showcase how SEEA EA accounts can inform climate and biodiversity goals. The SEEA Central Framework can also be relevant for climate and biodiversity policies. For example, air emissions, energy, carbon, land, agriculture, forestry, and fisheries (AFF), as well as environmental activity accounts complement SEEA EA measurements. When combined, the SEEA CF and EA accounts

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[4] The natural capital assets covered in the SEEA Central Framework comprise mineral and energy resources, land, soil resources, timber resources, aquatic resources, other biological resources, and water resources.

directly link climate and biodiversity to the System of National Accounts (SNA), helping to inform the impact of related policies on economic development.

The data and related analysis of an accounting approach can support many important public sector objectives with regard to nature-positive and climate-friendly development planning, including:

(i) Determination of how countries can meet their climate, nature and development goals, such as through cross-sectoral, multi-objective policies, interventions and investments, including by:
- identification, alignment, and coordination of activities (e.g., halting deforestation, increasing energy efficiency) reflected in Nationally Determined Contributions (NDCs), National Biodiversity Action Plans (NBSAP) and long-term strategies (LTSs);
- spatial prioritization of activities or interventions (e.g., planning infrastructure development), by considering areas that are important for carbon, biodiversity, and people (i.e., the NCP) and conversely, the identification of areas where mitigation and adaptation enhance biodiversity or negatively impact it;
- identification of policy reforms and investments that recognize climate, nature and economic development needs together, and foster climate-nature resilience goals (e.g., improving measures of productivity for forestry, agriculture, energy sectors; eliminating subsidy reforms; and deploying ecological fiscal transfers);
- identification of financial needs and mobilization of nature and climate public, private and investments.

(ii) Integrated planning, reporting and coordination of NBSAPs, NDC and Country Climate and Development Report (CCDR)[5] submissions and implementation.

As a starting point for NCA, and to ensure the more effective use of SEEA data for climate and biodiversity decision-making, it is important to identify priority development goals and how they intersect with climate and biodiversity, e.g., assessment of a country's vulnerability to climate change, climate-related shocks, and the depletion of the country's natural resource wealth. This will determine which natural capital accounts are needed for a coherent integration of the climate-nature interface into development. Additionally, SEEA provides insights into the management of physical and transition risks as well as opportunities.

The derived data from SEEA accounts clearly illustrate the relationship between the environment and the economy, offering the necessary information for a more systemic, integrative and transformative approach to incorporating nature as a pivotal component of a country's development trajectory. Furthermore, the structured information generated through

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[5] Country Climate and Development Reports (CCDRs) are World Bank-led diagnostic reports to support countries to integrate climate change and development considerations. The reports pinpoints prioritization of actions to reduce greenhouse gas (GHG) emissions and boost adaptation, while delivering development goals.

accounting facilitates coordination among different governmental agencies, thereby enabling better planning, management, and monitoring of natural resources.

The World Bank Group, United Nations, European Union and others have invested in collaborative international efforts and funding to stimulate national applications of the SEEA through programs like Global Program on Sustainability (GPS) - formerly the Wealth Accounting and Valuation of Ecosystem Services (WAVES), the Natural Capital Accounting and Valuation of Ecosystem Services (NCAVES) and others. Through the adoption of the SEEA Ecosystem Accounting as an international statistical standard for the measurement of the environment and its relationship to the economy in 2021, and the CBD in 2022, which explicitly called for alignment of the GBF indicators with SEEA, it is expected that country progress and global support for NCA will continue to grow. Continued investment is expected to ease policy integration over time.

Box 1. The SEEA Ecosystem Accounts for Climate Goals

SEEA EA accounts can inform climate and biodiversity efforts and provide various indicators that are relevant for various uses, including monitoring and reporting at the national level, related analytical uses (e.g., environmentally adjusted GDP), and the formulation of economic policy at the macroeconomic level (Bram and Caparros, 2023).

SEEA Ecosystem Accounts (EA) focusing on carbon uptake and retention, e.g., global climate regulation service (as biocarbon) in derive various indicators important for mitigation and adaptation, as described below:

- *Ecosystem Extent Account* summarizes information on the extent of different ecosystem types within an ecosystem accounting area and its change over an accounting period. This provides the basis for measurements of stocks and changes in stocks of carbon over time and provision of other important services.

- *Ecosystem Condition Account* synthesizes information on the condition of ecosystem assets and their change over time relative to a baseline, (e.g., soil organic carbon content), providing valuable insights into the health (or degradation) of ecosystems.

- *Ecosystem Services Flow Account* records ecosystem services flows (physical and monetary) as contributions from ecosystem assets that benefit humans and the economy. The measurement of ecosystem services (e.g., coastal protection) can provide an understanding of adaptation benefits, helping to inform Nature-based Solutions (NbS) for climate, as well as numerous NCPs as added benefits of climate change interventions.

- *Ecosystem Assets Account* records information on stocks and changes in stocks of ecosystem assets in monetary terms, with consideration of degradation/enhancement. Such measurements can be incorporate the aggregated monetary value of numerous benefits, including climate regulating services.

- *Thematic Accounts* are complementary accounts to those described above and designed for a specific policy-relevant environmental interests, e.g., biodiversity, climate change, oceans, urban areas.

Numerous countries in Africa, including many that are part of the Africa Natural Capital Accounting (NCA) Community of Practice (CoP), have been investing in SEEA accounts. Recent estimates show that 17 countries in Africa are working on SEEA accounts at various stages of implementation, from compilation (stage I) to dissemination (stage II), to both repeated compilation and dissemination (stage III) (UNSD, 2022).

Box 2. The SEEA Ecosystem Accounts for Biodiversity Goals

SEEA EA accounts can inform the Global Biodiversity Framework Goals, Targets, and the Monitoring Framework* as follows:

- *Goals* - particularly those that enhance integrity, connectivity and resilience of all ecosystems (Goal A), and sustainable use and management of NCPs (Goal B).

- *Targets* - including those that (i) reduce threats to biodiversity (e.g., restoration of degraded areas (T2), conservation of important areas (T3), meeting climate goals (T8), etc.); (ii) meeting people's needs (e.g., access to, and benefits from green and blue spaces); and (iii) advance systematic solutions (e.g., integration of biodiversity into policy, planning and development, and national accounting (T14)).

- *Headline indicators of the monitoring framework* - including e.g., A2. (extent of natural ecosystems), B1 (services provided by ecosystems), target T9 (management and use of wild species) and T11 (nature's contributions to people).

*The GBF of the CBD comprises four long-term goals towards achievement of the 2050 Vision for Biodiversity (A-D) and a set of 23 action-oriented targets until 2030 (T1-T23). The proposed monitoring framework includes high-level national, regionally, and global "headline indicators" capturing the scope of goals and targets validated by countries. An ad-hoc technical advisory group is currently refining the monitoring framework prior to COP16 in 2024.

In summary, Natural Capital Accounting, as laid out in the System of Environmental Economic Accounting (SEEA) provides the statistical standard to furnish critical information that contributes to, and bridges between, country responses to the UNFCCC and CBD commitments (in the long term), as well as to develop actions and policy responses towards their dual goals. However, it is important to note that, while information derived from SEEA accounts may not yet be available, a broader range of existing natural capital data, including assessments, can also provide valuable insights for achieving the same objectives in the immediate term.

5. Towards Solutions to Achieve Climate, Nature and Development Goals

Given the strong connections between nature and climate, we know that properly designed interventions can help to achieve both climate and conservation goals; and yet, if poorly or separately planned, they can have negative consequences, including, e.g., biodiversity loss. The question arises: how do we best leverage our NCA information to integrate nature, climate, and

development goals? We contend that an integrative, holistic approach is needed for transformative action that spans global, national and local levels (World Bank, 2022).

In Figure 1, The World Bank illustrates this integrated and multi-scale response to climate, nature and development encapsulating the central themes of this paper. When viewed from the lens of scale, the structured information about the relationship between the environment and the economy, derived from NCA, can serve to standardize and reinforce responses across various scales of intervention.

At the national level, NCA can be used to inform macroeconomic policy planning that considers climate, biodiversity and development, as exemplified by **Indonesia's Low Carbon Development Initiative**, or LCDI. Indonesia's LCDI used natural capital information including energy, land, water resources, biodiversity, and carbon emissions as an input to a systems dynamics model. The model was employed to explore alternative scenarios for the country's transition to a low carbon economy. The scenarios explored included a (i) Base Case, reflecting no new policies and the resulting impacts of environmental degradation; (ii) a Moderate scenario aiming to achieve unconditional NDC targets[6], requiring investments in land – through enforcement of forests, peat land, mangroves, and mining moratoria, in addition to energy (LCDI Moderate); (iii) a High scenario with more ambitious policy measures, achieving the conditional NDC targets (and additional scaling up of efforts in restoration, forest protection, energy intensity reduction and an increase in renewable energy shares) (LCDI High); and (iv) a scenario reflecting LCDI High efforts until 2024, with even more ambitious targets following that (LCDI Plus).
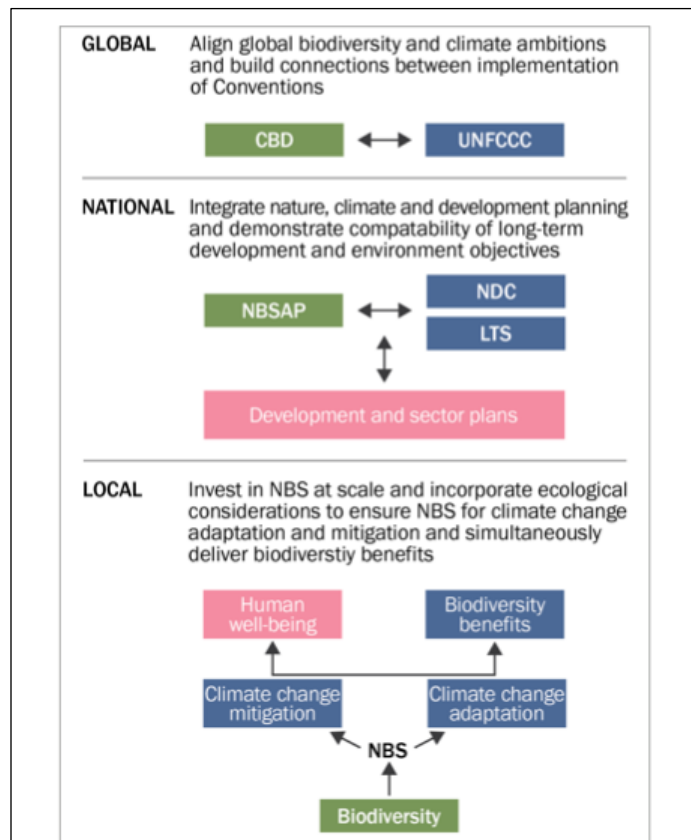

Figure 1. An integrated response to climate change, nature and development (Source: World Bank, 2022)

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[6] NDC unconditional targets are those set independent of what other countries commit to or on international financing.
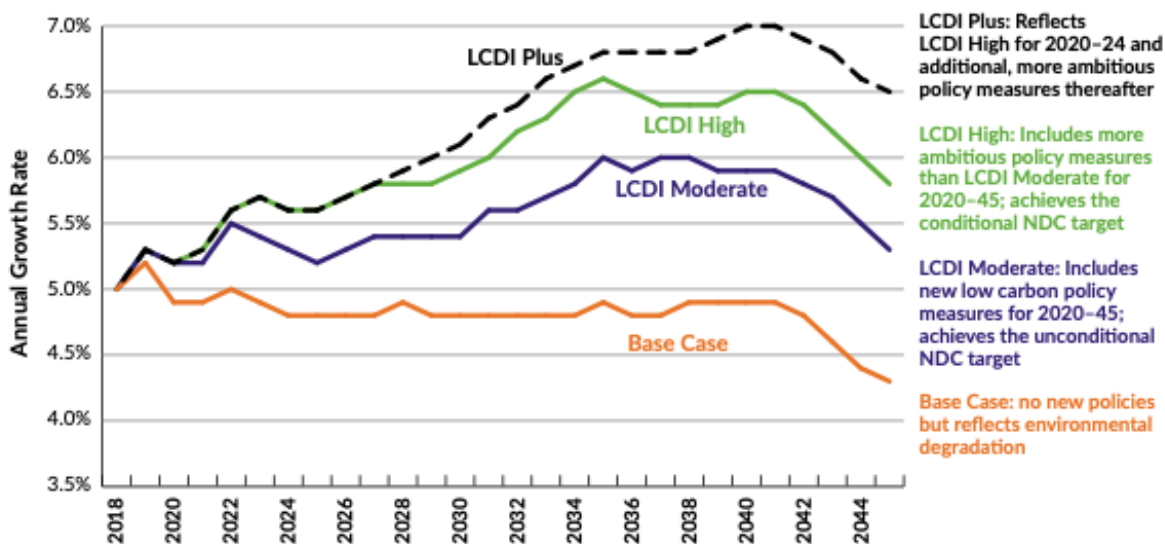
Figure 2. GDP growth for Low Carbon Growth Path modelled scenarios (Source: BAPPENAS, 2019).

Figure 2 shows the change in GDP growth rate over time for different scenarios of the LCDI. Findings show an average of 6% GDP growth for the LCDI High Scenario over time, and gradually declining for the Base Case which reaches 4.3% in 2045. Moreover, the LCDI High scenario led to a notable reduction of 43% in emissions by 2030 compared with the Base Case. Results also indicated various socio-economic and ecological benefits of the LCDI High scenario, including new jobs, reduced deaths, and improved air quality, among other positive impacts. This example illustrates how efforts and investment in natural capital data – and national accounting systems in particular – can support integrated planning that meets climate, biodiversity and development goals. Indeed, the Indonesia low-carbon development illustrates an example of a win-win-win for the economy, people and local and global environment (ibid).

This modeling exercise helps to identify enabling policies that are key for implementation of interventions at the national/local scale. One example worth noting is a broad suite of **Nature-based Solutions" (NBS)** which are *"actions to protect, sustainably manage and restore natural and modified ecosystems in ways that address societal challenges effectively and adaptively, to provide both human well-being and biodiversity benefits"* (IUCN, 2016).

NBS are based on the premise of sustainable deployment of natural capital, and also considered to be critically important in achieving the United Nations' Sustainable Development Goals (SDGs) (IUCN, 2020). Broadly speaking, NBS include a suite of *ecosystem-based approaches* ranging from protection, restoration, management of natural and semi-natural ecosystems, productive land and seascapes, the incorporation of green and blue infrastructure in urban areas, and the application of ecosystem-based principles to productive land and seascapes (Seddon et al., 2020). NBS deliver benefits for people through interventions that solve multiple *societal challenges,* i.e., climate change (adaptation and mitigation), disaster risk reduction, ecosystem degradation and biodiversity loss, food security, human health, social and economic development, and water security (see Figure 3). In doing so, NBS connect development, climate change and biodiversity policy goals. (WWF, 2021). Adoption of the NBS approach has been rapid and widespread, evidenced by resolutions by the G7, the G20, the United Nations General Assembly, IUCN, and in private sector guidance (World Business Council for Sustainable Development (WBCSD 2020; UNEP 2021a).

From a climate perspective, NBS are seen as part of the scope of the UNFCCC Agriculture, Forestry, and other Land Use (AFOLU). Though a major source of GHG emission, AFOLU accounts for 22% (13 GtCO2-eq) in 2019 (IPCC, 2022), the sector can also benefit from various NBS interventions, including those associated with protection, restoration and sustainable use of ecosystems.

In a review of implementation of NBS in the 168 NDCs that were submitted to the UNFCCC, Seddon et al. (2020) showed that 66% of countries expressed their intent to use diverse NBS activities for either mitigation, adaptation or both (see Figure 4). The study, however, noted

Figure 3. Diagram of Nature Based Solutions as defined by IUCN. (Source: IUCN 2020)

that proposed NBS were not based on measurable evidence-based targets, which suggests that a more deliberate, systematic and coherent approach is needed for the deployment of NDCs to meet strategic goals of climate and biodiversity. This is more important than ever, as more recent estimates show 102 nations (84% of all updated NDCs) committing to NBS in its various forms (NBSI, 2023).

From a biodiversity perspective, NBS is explicitly mentioned in the GBF targets that focus on climate mitigation and adaptation (Targets 8)[7], and Nature's Contributions to People (NCP)
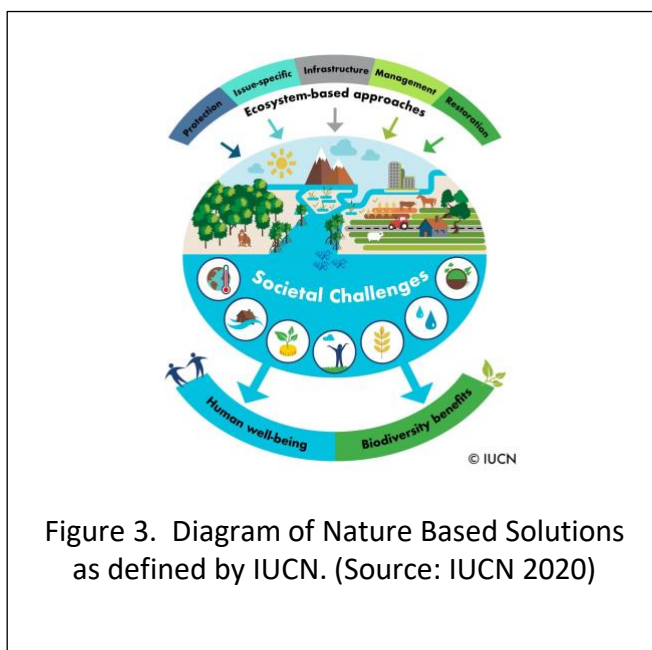
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[7] GBF Target 8: Minimize the impact of climate change and ocean acidification on biodiversity and increase its resilience through mitigation, adaptation, and disaster risk reduction actions, including through **nature-based solution** and/or ecosystem-based approaches, while minimizing negative and fostering positive impacts of climate action on biodiversity.

(Target 11)[8], and indirectly in other targets. For example, NBS can be used for targets associated with restoration of degraded areas (Target 2), conservation of important areas (Target 3), and management and use of wild species (Target 9), to name a few. As such, they are expected to be an integral part of NBSAPs that are currently being developed. As with climate, the evidence base for NBS benefits for biodiversity remains limited, and improved measurement approaches will be important to help to quantify and compare biodiversity gains (Petorelli et al., 2021).

There is momentum and great interest in the application of NBS in Africa. This is demonstrated by several significant investments: a review by WRI identified 85 NBS projects financed by the World Bank and African Development Bank for climate and water-resilience objectives in Sub-Saharan African over a 10-year period (2012–21), with investments estimated at $12 billion. Additionally, investments for components that integrate NBS amounted to approximately $4.5 billion. Common types of World Bank-led NBSs being implemented include enabling or restoring urban green spaces, forests, rivers and floodplains, and vegetation (GWSP et al., 2023). The magnitude of these investments demonstrates that there is high interest in NBS for climate resilience among African countries.

NBS have widespread global support as a framework to design and deliver solutions that bridge climate, biodiversity and development goals, and there is enormous potential for NCA to contribute to NDCs, NBSAPs and SDGs, but that remains an underdeveloped avenue. Despite these recent developments and widespread adoption of NBS, the ability to properly design, implement and monitor NBS with measurable targets can be better bolstered with natural capital data.

Enhanced by NCA and related natural capital assessments, NBS offers a pragmatic and potentially transformative opportunity to make progress towards the green growth aspiration of the Agenda 2063.

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[8] GBF Target 11: Restore, maintain and enhance nature's contributions to people, including ecosystem functions and services, such as the regulation of air, water and climate, soil health, pollination and reduction of disease risk, as well as protection from natural hazards and disasters, through **nature-based solutions** and/or ecosystem-based approaches for the benefit of all people and nature.
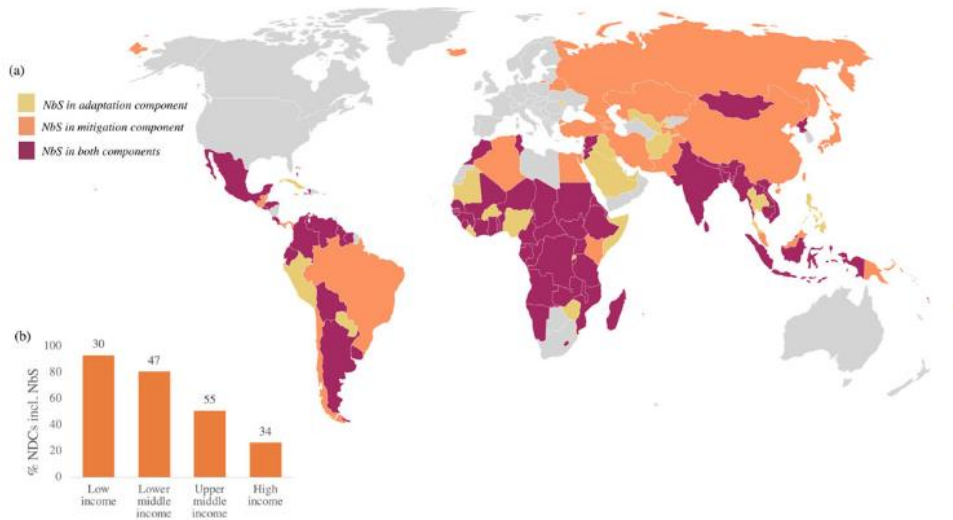
Figure 4. (a) NBS into NDCs (adaptation, mitigation, mitigation and adaptation); (b) NBS into NDCs distributed by income groups where the top of bars represent the number of countries (Source: Seddon et al, 2020).

So how might we begin planning for NBS to help bridge climate, biodiversity and development using NCA as inputs? The IUCN Global Standard for Nature-based Solutions offers one example (IUCN, 2021). The Standard lays out stepwise guidance, with **eight criteria** as a starting point for designing and deploying NBS options (Figure 5). Good natural capital information would clearly be an asset for assessing NBS options. Taking the first 5 design criteria as a brief example:

For **Criterion 1: NbS effectively address societal challenges**. This is the initial step to identify objectives, and most natural capital data can help identify issues and opportunities for intersectoral planning and priorities to address those challenges. Data which covers the interdependencies between nature, land and people sharpens the articulation of objectives that might then be addressed through coordinated ecosystem-based approaches such as biodiversity and climate change, in addition to other societal challenges such as disaster risk reduction, food security, human health, social and economic development and water security

Natural capital data can lend coherence to designing a NBS program or policy at the appropriate national to subnational scales in **Criterion 2: Design of NBS is informed by scale**, recognizing interactions from a geographic perspective but also economic systems, policies and cultural perspectives. Analysis that uses Natural Capital Accounting data, particularly spatial data on ecosystem extent and change, ecosystem condition, and ecosystem service flows and beneficiaries, helps facilitate multiple objective environment/climate/development planning for NBS interventions at different scales.

Overall, NBS encourages attention to the goal of 'net gain to biodiversity' as expressed in **Criterion 3: Biodiversity Net Gain**. This can be aided by SEEA ecosystem extent, condition and thematic biodiversity accounts, coupled with scenario models. That information can be used to project potential impact and benefits as well as the potential sustainability of an NBS investment to inform **Criterion 4: Economic Feasibility**.

Criterion 5: Inclusive Governance merits consideration in that the call of "whole of government" needed to achieve success could take advantage of the institutional arrangements that governments have used to structure the coordination and delivery of SEEA accounts since there are parallel and complimentary aims. In short, a range of NCA data and analyses including extent, condition, and spatial scenario models projecting these based on trends from SEEA accounts, CBA and other macroeconomic analyses, etc., have the potential to enhance the efficacy of NBS planning.

Figure 5. The criteria of the Global Standard for Nature Based Solutions to help plan, design and implement the core principles and safeguards of NBS. (Source: IUCN 2020)

These are only rudimentary examples, and we propose conversation about deploying existing natural capital data and initiating design steps like the Global Standard to formulate integrated strategies and responses to address climate, nature and development.

5.1 Case Studies of Solutions in Africa: Natural Capital Approaches for Climate, Nature and Development

Table 1 showcases the potential role of an NC approach to the design of NBS to meet climate change, biodiversity, and other societal challenges in Africa based on a few illustrative projects. Showcased NBS are based on four broad examples: (i) NBS1: **Protection** of marine and terrestrial ecosystems; (ii) NBS2: Sustainable **management** of agro-ecosystems, natural or semi-natural ecosystems, and of coastal/ marine areas; (iii) NBS3: **Restoration** of agroecosystem, natural or semi-natural ecosystems, and of coastal areas; and (iv) NBS4: Issue Specific: **Habitat Creation**. We note that in practice there may also be a mix of NBS interventions (e.g., combining restoration with protection) (Chausson et al., 2021), which we did not lay out in the table for simplicity.

These examples from Africa encompass a range of NBS-related interventions, including (i) improved management effectiveness of targeted protected areas in **Mozambique** (NBS1); ii. management of Strategic Water Source Areas (SWASAs) in **South Africa (**NBS2) – detailed
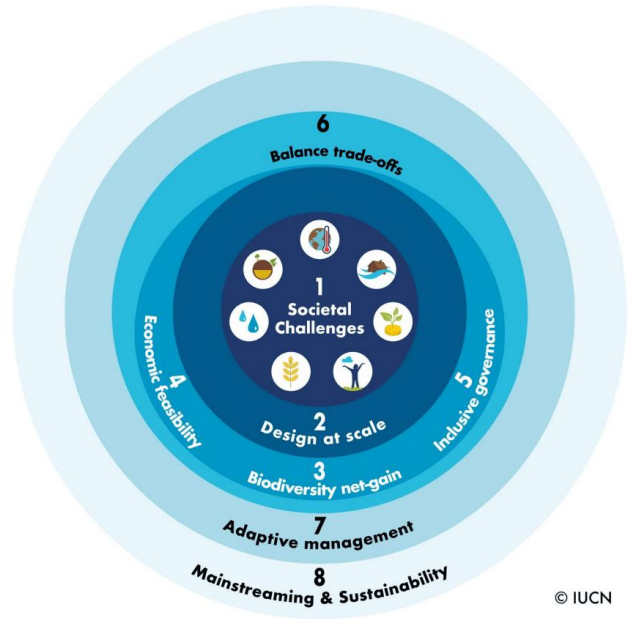
below; (iii) improved cost-effectiveness of restoring mangroves in **Guinea** (NBS3); and (iv) restoration of canopy cover in **Sierra Leone** (NBS4).

Guinea
Determination of the economic feasibility of reforestation/afforestation of mangroves based on their provision of ecosystem services

Mozambique
Identification of financial mechanisms in support of the financial sustainability of Protected Areas based on their provision of ecosystem services

Sierra Leone
Spatial planning of canopy cover expansion for climate adaptation to mitigate floods, landslides and threats to water supply

South Africa
Spatial prioritization of improved management/restoration interventions in Strategic Water Source Areas (SWSAs)
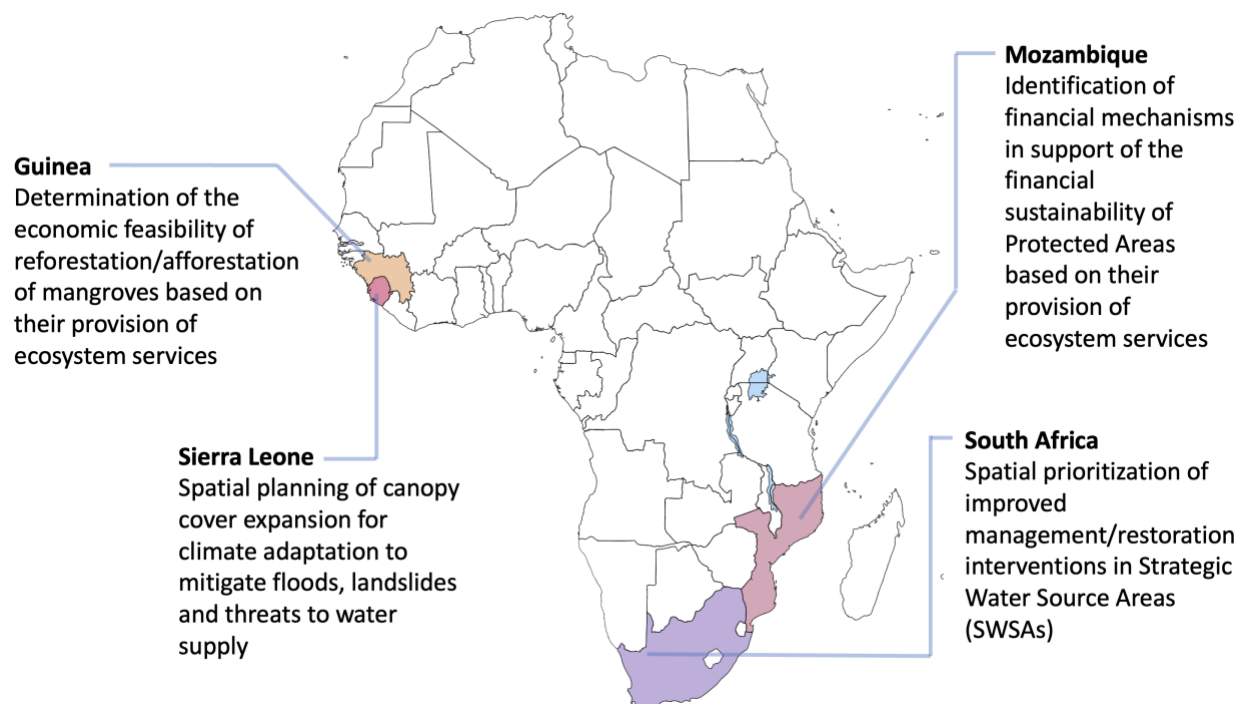
Figure 5. Four examples of interventions related to nature and climate change where Natural Capital Accounting or related analysis is being effectively deployed.

These examples showcase how using Natural Capital Accounting and analysis that relies on such data can lead to better outcomes, uncovering options which not only favourably enhance both climate and biodiversity, but further support development goals. We note that natural capital approach proposed in Table 1 (i.e., data, selected EA account, analysis and the suggested policy application) are illustrative only and not necessarily a reflection of activities within the scope of selected examples.

For these projects, commonly-inputted natural capital data are broadly categorized as:
- Indicators on the **ecosystem extent** in an area (hectares, maps), as well as their changes over time;
- Indicators of **ecosystem condition** (e.g., which might include indicators of integrity such as composition, structure, functioning);
- Indicators on **ecosystem services**, i.e., the **biophysical and/or monetary value of a given ecosystem and/or its contribution to other benefits** (e.g., climate regulation, water supply (including flow regulation, purification), erosion control, coastal protection, fisheries, crop provisioning services, etc.).

Table 1. Case studies illustrating how NC approaches can integrate climate and nature goals in Africa

Example NBS Interventions	Types of activities	Climate and biodiversity objectives	Illustrative NC Approaches			Case Study in Africa
			NC Assessment Data/ SEEA EA Accounts	Analysis that rely on NC data to inform Policies	Policy applications	
NBS1: Protection of marine and terrestrial ecosystems	Establishment/ Improved management of terrestrial, coastal and marine protected areas	Biodiversity goals[1] [NBSAPs] Climate mitigation goals[2] and adaptation goals[3] [NDCs] Co-benefits: Nature Contribution to People (NCP)[4]	Ecosystems extent in an area and changes over time[5] [Extent accounts] [6] Ecosystems condition [Condition Accounts] [7] Ecosystem services [Ecosystem services accounts] [8] Thematic accounts[9]	Assessment of cost-effectiveness/Return on Investments (ROI) of interventions in support of the financial sustainability of Protected Areas (PAs)	Protection, Conservation and Sustainable Use of Biodiversity	Improvement of management of conservation area and livelihoods in **Mozambique** (World Bank, 2018)
NBS2: Sustainable **management** of agro-ecosystems, natural or semi-natural ecosystems, and of coastal/ marine areas	Sustainable mixed natural and agroecosystems management Coastal zone management Rewilding of large herbivore species	Biodiversity goals[1] [NBSAPs] Climate mitigation goals[2] and adaptation goals[3] [NDCs] Co-benefits: Nature Contribution to People (NCP)[4]	Ecosystems extent in an area and changes over time[5] [Extent accounts] [6] Ecosystems condition [Condition Accounts] [7] Ecosystem services [Ecosystem services accounts] [8] Thematic accounts[9]	Spatial prioritization of strategic water source areas for improved management/ restoration interventions based on based on BAU/alternative scenarios of service provisioning	Territorial planning that considers impacts of sectoral policies on Land Use / Land Cover (LULC)	**South Africa**'s Strategic Water Source Areas (SWASAs): National ecological infrastructure assets for water security climate change adaptation (SANBI, 2023) [See Box 2]
NBS3: Restoration of natural or semi-natural ecosystems of coastal areas, and agroecosystems	Reforestation and/or restoration of degraded ecosystems	Biodiversity goals[1] [NBSAPs] Climate mitigation goals[2]	Ecosystems extent in an area and changes over time[5] [Extent accounts] [6]	Cost-benefit analyses of reforestation and afforestation of selected ecosystems based on private and	Land Degradation Neutrality (LDN) that supports food, water security, and support livelihoods	Assessing the cost-effectiveness of restoring mangroves in **Guinea** and its implication for improved coastal

		and adaptation goals[3] [NDCs] Co-benefits: Nature Contribution to People (NCP)[4]	Ecosystems condition [Condition Accounts] [7] Ecosystem services [Ecosystem services accounts] [8] Thematic accounts[9]	social benefits of mangrove areas		management policies and strategies (World Bank, 2023)
NBS4: Issue Specific: Habitat creation	Urban green zones and spaces, artificial coastal structures/habitats	Biodiversity goals[1] [NBSAPs] Climate mitigation goals[2] and adaptation goals[3] [NDCs] Co-benefits: Nature Contribution to People (NCP)[4]	Ecosystems extent in an area and changes over time[5] [Extent accounts] [6] Ecosystems condition [Condition Accounts] [7] Ecosystem services [Ecosystem services accounts] [8] Thematic accounts[9]	Assessment of Business as Usual (BAU)/alternative scenarios of expansion of tree cover in urban area to mitigate flood risk, landslide and threats to water supply	Integrating disaster and climate change considerations into territorial planning and infrastructure design in urban areas	Restoration of Free Town, **Sierra Leone** canopy cover through community-based reforestation (World Bank, 2019)

1. Biodiversity goals achieved with interventions to avoid ecosystems conversion, degradation, and biodiversity loss (e.g., though protection), or enhancement of biodiversity, ecosystem functions, ecological integrity (e.g., through restoration or improved management)
2. Climate mitigation goals achieve through C sequestration, storage, avoided emissions
3. Climate adaptation through Ecosystem-based Adaptation (EbA), such as relying on regulation of water flows/quality coastal protection.
4. Nature Contribution to People a.k.a. ecosystem services such as eco-tourism, water flow, fisheries, rice, carbon sequestration, protection from coastal flooding, water purification.
5. Includes maps of ecosystems distribution in an area based on a chosen ecosystem typology (e.g., IUCN Global Ecosystem Typology). Data in extent accounts is typically obtained with ground and earth observation (e.g., changes in land and land use) and documents the changes of ecosystems as a result of changes in Land Use / Land Cover (LULC)
6. Condition accounts include biotic and abiotic indicators that inform physical, chemical, compositional, structural, functioning or landscape/seascape characteristics. Data for these accounts is derived from in-situ measurements (or secondary data) and their extrapolation are commonly used on condition accounts.
7. Ecosystem services accounts include a range of services, services such as eco-tourism, water flow, fisheries, rice, carbon sequestration, protection from coastal flooding, water purification. Data for these accounts can be obtained through numerous approaches, including in-situ measurements (e.g., water meters), surveys (e.g., firewood consumption) or modelling approaches (e.g., sediment retention); their monetary values are estimated through various market and non-market-based valuation approaches.
8. Thematic accounts focus on data specific policy-relevant environmental themes, such as biodiversity, climate change, oceans and urban areas.

- Indicators on **other important thematic accounts, such as biodiversity** (e.g., species richness/diversity/distribution).

The combination of these (and other) data can be used for various analyses to inform intervention options e.g., assessment for spatial prioritization of interventions, trade-offs and synergies, cost-effectiveness vis-à-vis alternative interventions, Return on Investment (RoI), and co-benefits.

Table 1 also illustrates how natural capital data can inform various analytical approaches and applications of NBS, and can contribute to various nature, climate, and development policies linked to the selected case studies, including (i) the identification of **resource mobilization** to support improved management of Protected Areas (PA) (Mozambique); (ii) **territorial planning** for improved water security (South Africa) – further described below; (iii) **land degradation** (Guinea); and (iv) **mainstreaming of disaster and climate change** into planning in urban areas (Sierra Leone).

5.1.1. SEEA Accounts for Strategic Water Source Areas (SWASA) in South Africa

The case of South Africa's Strategic Water Source Areas (SWSAs) is one clear and compelling example of how Natural Capital Accounting and related analysis can inform territorial planning that integrates climate, biodiversity, and development goals. South Africa has long grappled with water shortages, compounded by the effects of climate change. Water insecurity in this semi-arid country is attributed to numerous reasons, including insufficient and unreliable rainfall, uneven distribution of water resources, poorly maintained infrastructure for distribution, and increasing water demand.

Only a few natural source areas for water in South Africa provide much of the water supply to the country. The SWSAs are considered to be 'ecological infrastructure', i.e., naturally functioning ecosystems that provide valuable services and benefits to people, such as water-related services. Seeking to identify ways to ensure SWSAs continue to provide water resources, the South African National Biodiversity Institute (SANBI) developed a series of SEEA EA thematic accounts for SWSAs for 1990-2020, with support from other agencies and implemented through the Ecological Infrastructure for Water Security (EI4WS) project (2018 to 2025) (SANBI, 2023).

The SWSAs accounts, drawing from previously implemented Land and Terrestrial Ecosystem Accounts (1990-2014) , and accounts for Protected Areas (1990-2020) show that 22 SWSAs are spread across the country, encompassing several biomes and covering about 10 million ha, or 8% of the national territory. They are economically important areas that generate 50% of water to South Africa, Lesotho and Eswatini (ibid).

The SWSAs accounts generated a number of indicators that are now being incorporated into various policies, including e.g., the National Spatial Development Framework (NSDF), shedding

light on the need to manage and restore SWSAs for the important socio-economic benefits they provide related to water supply. They are also informing the Medium-Term Strategic Framework (MTSF) of the Department of Environment, Forestry and Fisheries (DFFE), which set a target to secure eleven of the twenty-two SWSAs by 2024; and the National Water Resource Strategy 3 (NWRS 3) of the Department of Water and Sanitation (DWS), which has prioritized action around SWSAs (SANBI, 2023).

This case study illustrates the role of accounts in providing an evidence base for various policies, and for a range of NBS interventions – from protection, management and restoration in SWSAs areas. Its set of indicators in this case enhanced design, coordination, and planning of interventions.

6. Conclusions

UN Secretary-General António Guterres has described the triple planetary crisis as "our number one existential threat" that needs "an urgent, all-out effort to turn things around" (Guterres, 2021). We know that ecosystems provide multiple benefits to humanity including fuel, food, and other materials, climate regulation, carbon capture, and help us adapt to climate change impacts. Correspondingly, biodiversity loss and degradation of ecosystems contributes to climate change and can undermine climate gains. At the far end of the spectrum of inaction, climate and nature risks compound and can trigger irreversible systemic changes which will have a profound impact on the development trajectory of African countries. With these interlinkages of nature and climate in mind, addressing nature loss that is often more immediate and locally relevant in many countries must be a key component in a country's livelihood strategies and low carbon development aspirations.

With the Paris Agreement and the Global Biodiversity Framework in place, the time is now upon us to translate these global commitments into national action via the NBSAPs and NDCs. However, siloed efforts in climate and biodiversity still remain a challenge at this critical juncture in history, and the world seeks better examples of multifunctional interventions that integrate and innovate across scales.

Nature Based Solutions, tools to address biodiversity loss, climate, and related development issues, offer a range of practical approaches that address climate-nature interlinkages. NBS is specifically called out in the GBF and the Paris Agreement because of its great potential to integrate – aligning interventions to both agreements and effectively meeting the targets of both.

Natural capital data inform a range of applications, decisions and policy. **Natural Capital Accounting** is our most aspirational and systematic expression of the effort to capture the mispriced and undervalued contributions of nature and embed its true value in our economic

decision making process.[9] NCA can in and of itself, shed light on interlinked goals such as climate, biodiversity and human well-being, and the effectiveness of policy responses. Through structured information on nature's contributions to people and the economy, NCA and related natural capital approaches offers a compelling toolkit to help design, monitor and evaluate the benefits of NBS interventions but – amid the growing urgency to implement effective solutions – it remains both an underdeveloped area and a tremendous opportunity. Fostering the regional cooperation and capacity building needed to generate and capitalize on natural capital data, accounts and analysis to inform nature and climate policies remains a critical challenge. Fora like the Africa NCA Community of Practice, and a range of exemplary national efforts supported by the World Bank and others, are important models to draw from.

We posit that the question before us in this Forum, is not simply how we as the Africa Natural Capital Accounting Community of Practice, follow current movements and trends in how we use these NCA data effectively to address the nature-climate interface and correspondingly, develop nature-positive and climate-friendly solutions to sustain our people and our economies. The question before us is how we might lead and provide that guiding light to inform and make nature count in the decisions made by policy makers and private sector investors.   As the world strives to align their climate commitments with conservation objectives, this group is well positioned to provide the innovation for the integration of NCA with decision-making on policy, plans and NBS that will reshape our approach to sustainable development, and pave that transformative pathway to greener, healthier development by and for the people of Africa.

7. Acknowledgments

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[9] On the adoption of the SEEA as the new economic and environmental framework to integrate natural capital in economic reporting in 2021, the UN Secretary-General António Guterres remarked: "This is a historic step forward towards transforming how we view and value nature. We will no longer be heedlessly allowing environmental destruction and degradation to be considered economic progress."

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