Growing resilience

Unlocking the potential of nature-based solutions for climate resilience in sub-Saharan Africa

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Lizzie Marsters, Boris van Zanten, Brenden Jongman, Innocent Onah, and Todd Gartner conceived this report and secured the funding for its production. Natalie von Turkovich, Lizzie Marsters, Natasha Collins, and Gabriela Vidad led project data collection and analysis. Laura Jungman and Boris van Zanten led project data collection for the World Bank's portfolio. Innocent Onah led project data collection for the African Development Bank's portfolio. Rory Hunter, Lizzie Marsters, and Natasha Collins conducted and analyzed stakeholder interviews. Data interpretation and writing of the manuscript was conducted by Natasha Collins and Lizzie Marsters, Boris van Zanten, Laura Jungman, James Anderson, Natalie von Turkovich, Rory Hunter, and Gabriela Vidad. Brenden Jongman, Innocent Onah, and Todd Gartner provided reviews and comments that were crucial to finalizing the manuscript.

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Foreword

Sub-Saharan Africa is at a crossroads, facing escalating climate and nature threats while striving for economic growth. Despite contributing little to global greenhouse gas emissions, the region faces increasing vulnerability to the consequences of climate change. Its rapidly urbanizing population is expected to double by 2050, placing pressure on governments to expand access to basic services while building resilience to climate impacts. Yet with Africa facing an annual infrastructure financing gap of more than $100 billion, urgent investment and action are needed to secure a sustainable future.

Communities, governments, civil society, and donors across the continent are increasingly embracing nature-based solutions (NBS) to enhance climate resilience. From integrating trees into farmlands, restoring wetlands, protecting coral reefs, and restoring nature in urban areas, these projects address critical infrastructure gaps for water quality, flood mitigation, and erosion control. They simultaneously create jobs, safeguard public health, and protect and enhance biodiversity. In some cases, NBS can be integrated with traditional gray infrastructure to draw on the complementary strengths of each approach.

This report is one of the most extensive assessments of NBS projects for climate resilience in the region to date. It leverages data from WRI, the World Bank, and the African Development Bank, to analyze nearly 300 NBS projects in Sub-Saharan Africa from over the past decade. We determine progress to date, and what is needed to scale implementation and investment. The findings reveal momentum — NBS project initiation grew by roughly 15 percent annually from 2012-2022, with more than $12 billion in funding raised in aggregate during the same period. Yet, this is only a fraction of what's needed to safeguard the region and its people.

Unlocking the full potential of NBS requires systemic change. Jointly, we must provide governments with the tools and support to integrate NBS into policies, budgets and planned infrastructure projects. Multilateral organizations, donors, and civil society must increase investment in early project preparation, technical capacity, and monitoring. To scale financing, the public and private sector must expand innovative tools like green bonds, dedicated national funds and risk sharing mechanisms. Since private markets do not yet fully recognize the economic value of NBS, governments have an opportunity to make near-term, foundational investments and create new markets for NBS private finance that deliver long-term benefits for their citizens and the planet.

Our findings also emphasize the importance of community involvement and ownership. Projects tailoring to local needs, incorporating gender equity, and leveraging Indigenous Knowledge can address persistent social challenges. Strengthening impact tracking and evaluation will build confidence and demonstrate NBS's value to communities.

The stakes are immense, but the opportunities are even greater. Sub-Saharan Africa's unique challenges position it as a critical proving ground for scaling resilient climate solutions. By embracing NBS, the region can not only adapt to climate change and reduce biodiversity loss but also create jobs and increase the quality of life for hundreds of millions of people. Let this report inspire bold action, collaborative efforts, and a shared commitment to a resilient and equitable future for Africa and beyond.

ANI DASGUPTA

President & CEO

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MING ZHANG

Global Director Urban, Resilience and Land

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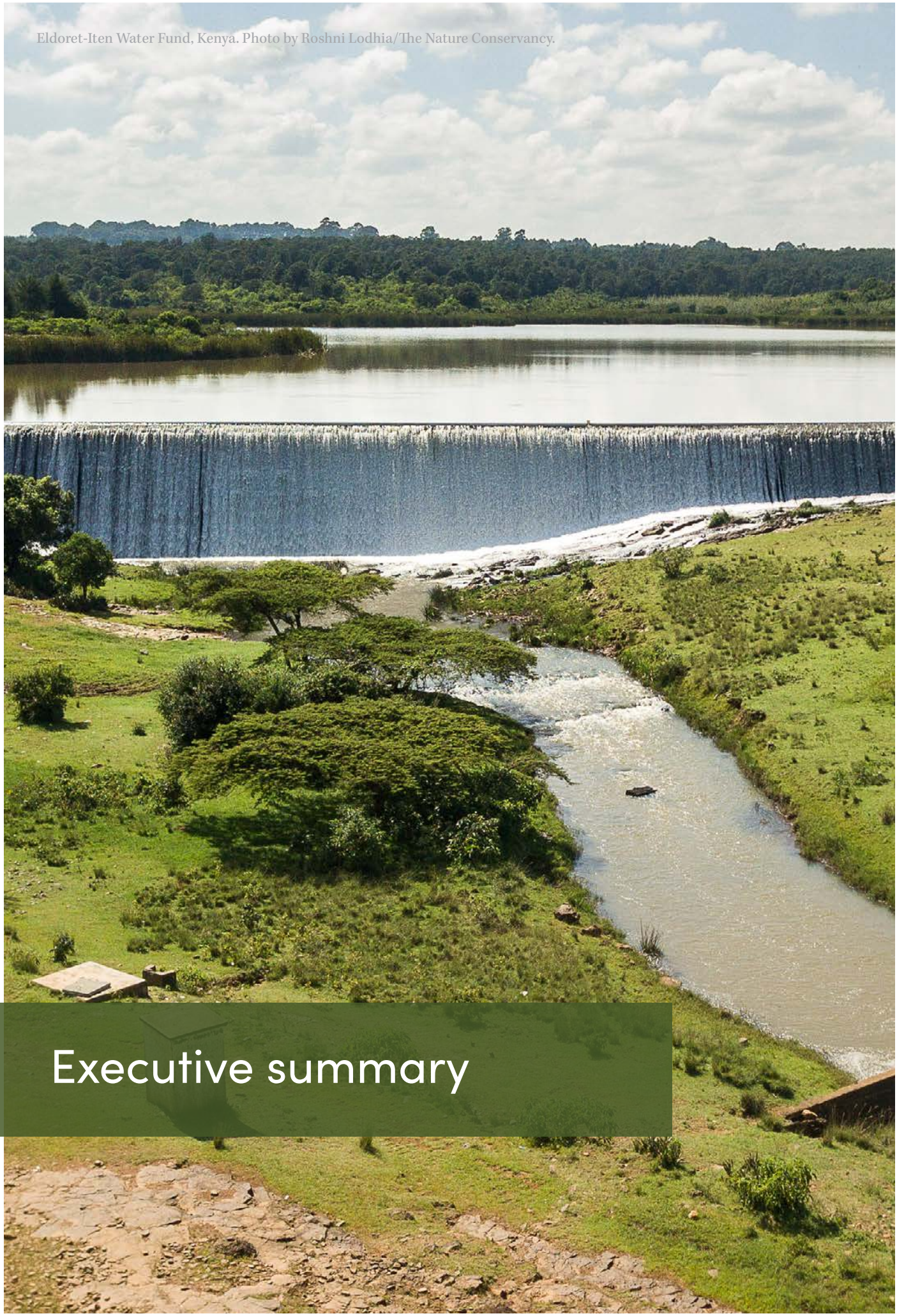


Eldoret-Iten Water Fund, Kenya. Photo by Roshni Lodhia/The Nature Conservancy.

Executive summary

Sub-Saharan Africa faces the intersecting challenges of climate change, rapid population growth, and nature loss

Africa is one of the most vulnerable regions to climate change in the world. The continent is experiencing faster increases in surface temperature than the global average alongside increasingly erratic weather patterns (IPCC 2022a). In sub-Saharan Africa, which makes up most of the continent's land mass and population, extreme weather events including heat waves, droughts, floods, and cyclones have increasingly impacted the region in recent years, resulting in the loss of thousands of lives and billions of dollars in economic damages (WMO 2022). Africans in SSA are also disproportionately employed in climate-exposed sectors like agriculture (IPCC 2022a), contributing to a heightened socioeconomic vulnerability of residents to climate change.

Over the next decades, population growth, urbanization, fragility, and conflict will likely exacerbate climate vulnerability across the region. Rapid urban growth intensifies infrastructure challenges, as existing systems are already unable to support essential services such as electricity, water supply, and sanitation for SSA's growing population (Hallegatte et al. 2019; ICA 2022). As urban areas expand faster than governments can provide adequate housing and services, a substantial portion of the urban population has resorted to living in informal settlements (Mahendra and Seto 2019; World Bank 2021b), often located in areas that are highly exposed to natural hazards and climate change impacts, such as in floodplains, on drained wetlands, or along coastlines. Over half of the countries in SSA were designated as fragile, conflict-affected, and violent (FCV) by the World Bank at some point between 2012 and 2023 (Baah and Lakner 2023), characterized by weak institutional capacity, poor governance, and the presence of violent conflict. These conditions elevate climate and disaster risk, and as a result an average of three times more people in these countries are affected by natural disasters compared with those living in non-FCV settings (Jaramillo et al. 2023).

Ecosystem degradation and biodiversity loss further exacerbate the challenges SSA countries face in achieving economic stability and resilience to climate change. The rapid deterioration of natural ecosystems has led to widespread loss of biodiversity and forest cover, increased flooding, and intensified heat island effects (Güneralp et al. 2017; TNC 2021a). Approximately 65 percent of arable land in SSA is affected by degradation, leading to an estimated annual gross domestic product loss of up to 9 percent in some countries (Iseman and Miralles-Wilhelm 2021). Over 62 percent of the population relies on goods and services from natural ecosystems, and biodiversity loss impacts key economic sectors like agriculture, fisheries, forestry, and tourism (IPBES 2018). Desertification affects nearly half of Africa's landmass, reducing agricultural yields, increasing food and water scarcity, and displacing millions (IPCC 2022a).

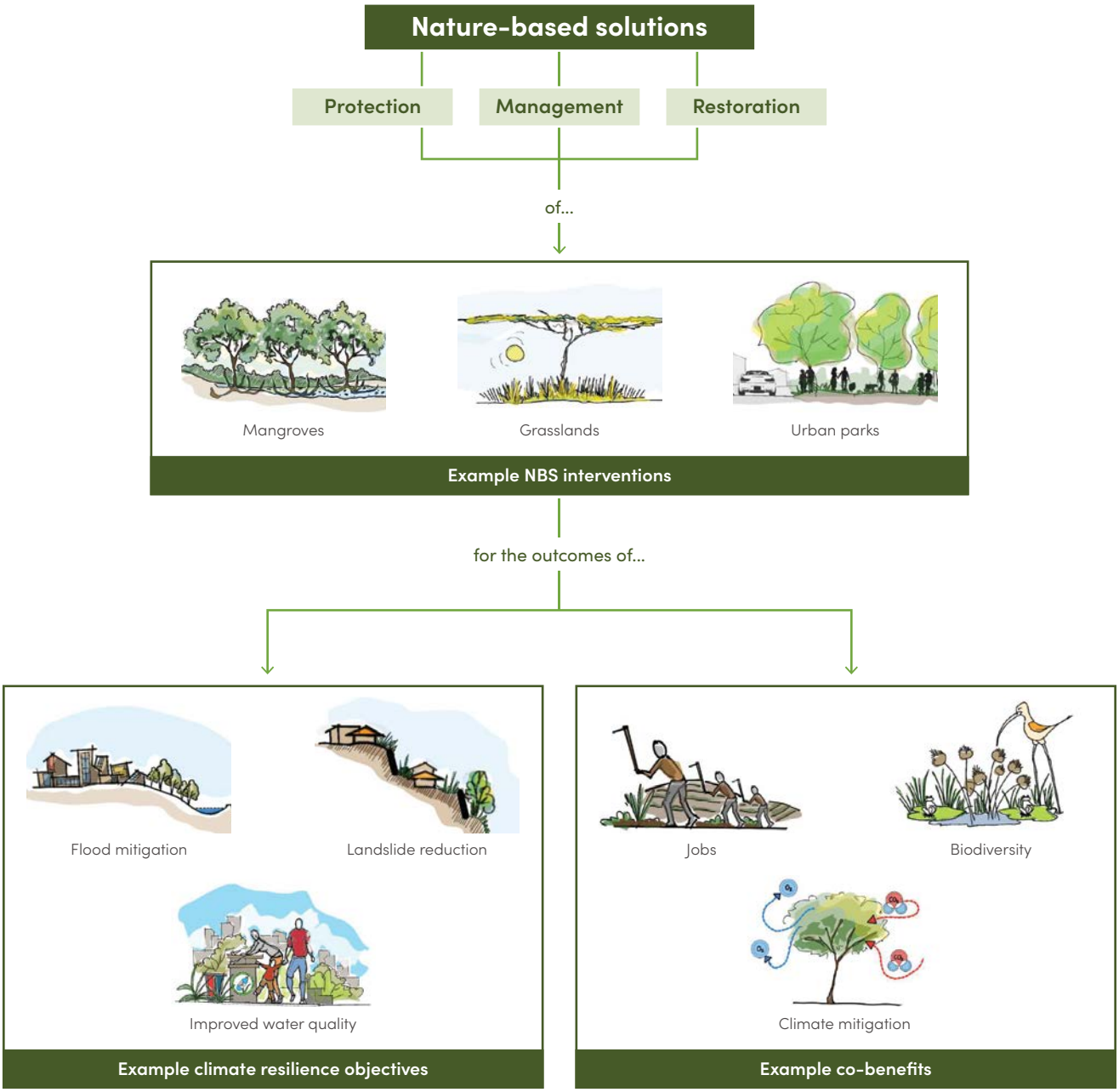
Highlights

- As sub-Saharan Africa (SSA) faces increasing climate vulnerability and a rapidly growing population, nature-based solutions (NBS) can help the region build climate resilience, meet its infrastructure gap, and protect the livelihoods of its population.
- This report identifies 297 NBS projects initiated between 2012 and 2023 that used NBS as an alternative to or in combination with traditional gray infrastructure for climate resilience objectives. Most projects were designed to meet multiple objectives, most commonly water quality improvements, water supply enhancements, flood mitigation, and erosion and landslide control.
- National governments drove project development, funded by multilateral development banks, international donors and funds, and domestic budgets.
- While these projects collectively secured over $21 billion in funding, this figure represents only a fraction of the climate adaptation finance needed to address SSA's vulnerabilities.
- Project developers can improve access to funding for NBS by tapping into infrastructure finance, showcasing nature and resilience benefits to attract biodiversity and climate finance, and increasing domestic budgets through dedicated funding mechanisms.
- Advancing NBS can be enabled by integrating NBS into policies and planning frameworks, improving early project preparation and technical capacity, better quantifying and tracking the benefits of NBS, and ensuring projects are responsive to community needs.

Nature-based solutions for climate resilience in sub-Saharan Africa

Nature-based solutions are increasingly recognized as effective interventions for strengthening climate resilience, enhancing ecosystem services and biodiversity, and addressing infrastructure needs. NBS are "actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits" (IUCN 2020; UNEP EA 2022). These solutions can be applied across different spatial scales and landscapes, ranging from upstream forests to coastal or urban areas (World Bank 2021b). NBS interventions, such as protecting or restoring forests, floodplains, wetlands, or coral reefs, can help bolster biodiversity and make ecosystems and societies more resilient to climate change (Figure ES-1). For example, restoring forests can increase soil retention, thus reducing erosion and landslides and improving water quality. Hybrid green-gray interventions, such as combining mangroves with gray infrastructure (engineered structures like concrete seawalls), offer solutions that can achieve optimal disaster risk and storm protection by balancing the durability of hard infrastructure with the adaptability and long-term resilience of NBS (World Bank 2023).

Figure ES-1 | **Nature-based solutions for climate resilience and co-benefits**



Note: The figure illustrates examples of NBS interventions, risk reduction, and co-benefits identified in the report and is not exhaustive. See Appendix A for the full lists.

Source: Authors, adapted from van Zanten et al. 2021.

About this report

This report aims to identify strategic actions to increase investment in NBS for climate resilience in SSA by evaluating over a decade of NBS project investment and assessing a range of policy, financial, institutional, social, and technical barriers to adoption. We examined historical and projected data for climate hazards in the region to provide background on the challenges SSA faces. To establish a baseline of the status of NBS in the region and evaluate the types of projects being implemented, this report presents an inventory of NBS projects from across the region that were initiated between 2012 and 2023. In addition, we conducted over 50 interviews with project developers, funders, and investors of NBS projects in SSA to gain insights on the key barriers to NBS project investment and implementation. This report synthesizes results from the analysis and interviews to offer targeted recommendations for how actors such as governments and multilateral organizations can effectively scale up NBS in the region.

Key findings from the report

The number of NBS projects and funding rose from 2012 to 2023

The number of projects investing in NBS for climate resilience rose steadily in the region with the number of new projects initiated each year increasing by an average of 15 percent annually from 2012 to 2021. Project initiation from the World Bank and African Development Bank (AfDB) portfolios grew at a similar rate during this period but had a sharp increase in 2022–23, where the number of new projects doubled from 2021 to 2022. Overall, the study identified 246 NBS projects from across the region with a project start date between 2012 and 2021, and an additional 51 projects from the World Bank and AfDB approved between 2022 and 2023, for a total of 297 projects (Figure ES-2). The study focused on SSA because unique socioeconomic conditions, rapid urbanization, regional governance structures, and climate and environmental challenges present significant opportunities for impactful NBS implementation. To be included in the analysis, projects had to be located in SSA, secure at least US$50,000 in funding, be initiated or approved between 2012 and 2023, and aim to address at least one of the following climate resilience objectives: flood mitigation, improved water quality, improved water quantity, erosion or landslide mitigation, urban heat mitigation, or fire risk mitigation.

Funding secured for new projects increased by an average of 23 percent annually between 2012 and 2021. Total funding for this period amounted to $12.5 billion with about $5.3 billion (42 percent) allocated specifically to NBS implementation. Total funding included costs for gray infrastructure components of hybrid projects and other activities included in project funding packages that are not specifically tied to NBS implementation, such as capacity training. The average funding secured per project was $74.7 million, and of this, NBS implementation accounted for $33.6 million. From 2022 to 2023, in which our analysis included only World Bank and AfDB projects, projects received $8.7 billion in funding, of which $2.9 billion (23 percent) was for NBS implementation.

NBS projects were often designed to deliver multiple climate-resilience and disaster-risk-reduction objectives with several co-benefits. Most projects focused on a combination of improving water quality, increasing water supply, and mitigating flood risk. In addition to the climate resilience objectives, projects listed intended co-benefits, some of the most common being job creation, biodiversity enhancements, public health improvements, and community cohesion. Projects were implemented in diverse contexts, including in rural, coastal, and urban settings, with rural settings as the most common.

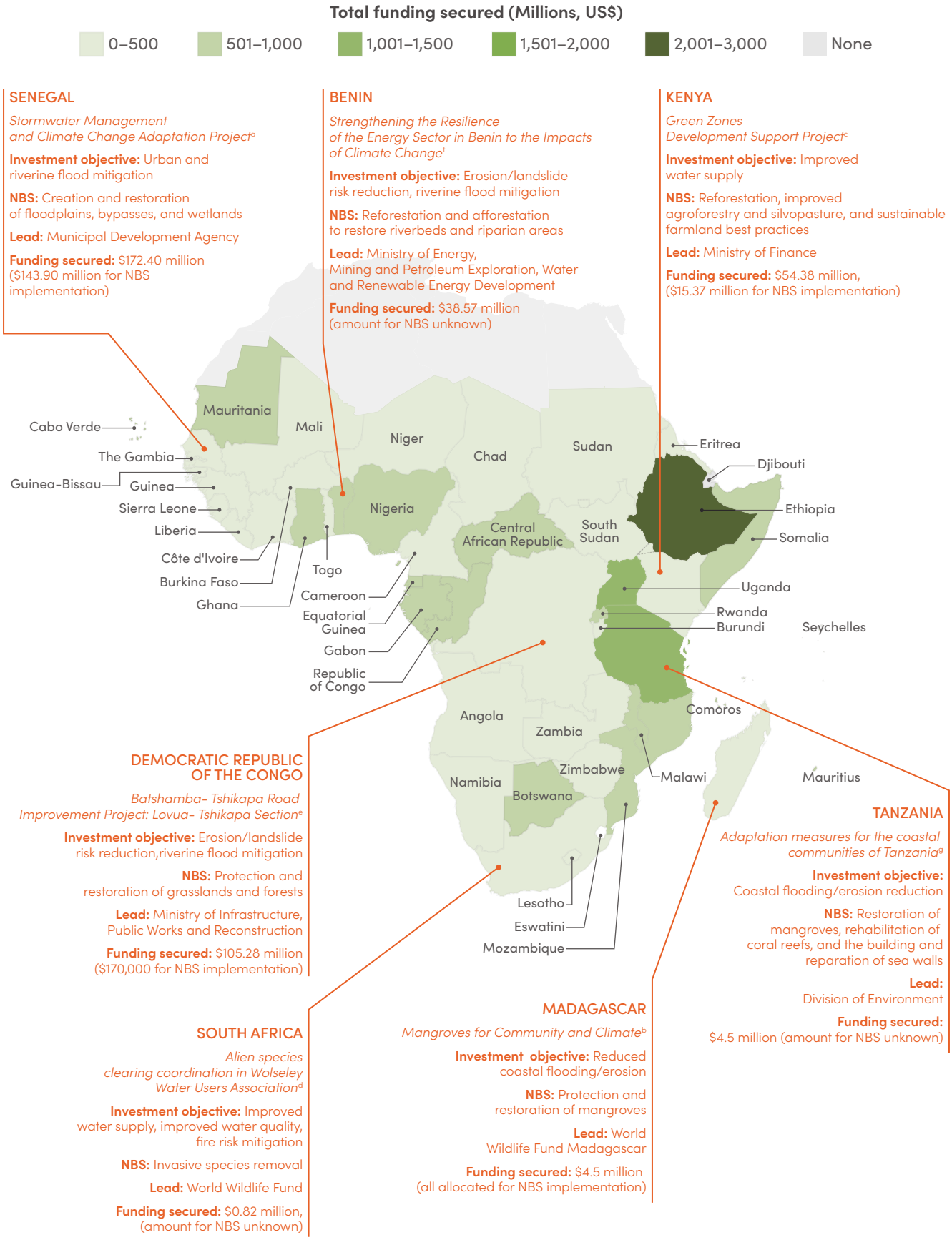
These NBS projects were initiated across SSA with the highest levels of investment made for projects in Eastern Africa (49 percent of the total investment from 2012 to 2021), followed by Western (30 percent), Southern (15 percent), and Central Africa (6 percent) (Figure ES-3). Ethiopia alone captured 43 percent of Eastern Africa's share and 20 percent of SSA's overall NBS project funding. Investment from World Bank and AfDB projects shifted primarily to Western Africa in 2022–23. A small portion, about 1 percent, of projects were cross-regional.

Figure ES-2 | Project initiation by year for NBS for climate resilience projects in SSA, 2012–23

Notes: We excluded 48 small-scale projects that received funding from the African Forest Landscape Restoration Initiative's TerraMatch in 2021 from the figure. The project count for 2022 and 2023 represents projects from only the World Bank and the African Development Bank as data from these institutions were provided for analysis (overall numbers of NBS projects are likely higher). NBS = nature-based solutions. SSA = sub-Saharan Africa. WB = World Bank. AfDB = African Development Bank.

Source: Authors.

Figure ES-3 | **Geographic distribution of funding secured for NBS climate resilience projects in SSA, 2012–21, with illustrative examples**



Notes: Countries in northern Africa were not included in this analysis and are shaded in gray. NBS = nature-based solutions. SSA = sub-Saharan Africa.
Source: Authors; a World Bank 2022a; b WWF n.d.; c AfDB 2023a; d Lephaila 2021; e AfDB 2023b; f GEF n.d.; g UNEP 2019.

To distinguish between the range of project types and investment sizes, we categorized projects into three groups: green-gray, green, and small scale (Figure ES-4). These categories were defined to account for each project type's unique requirements for project planning, design, and implementation, including technical expertise, resource allocation, stakeholder engagement, and impact assessment. Small-scale projects are typically community driven, whereas large-scale green-gray and green projects demand complex stakeholder coordination, substantial investment, and comprehensive planning and management due to their size and impact.

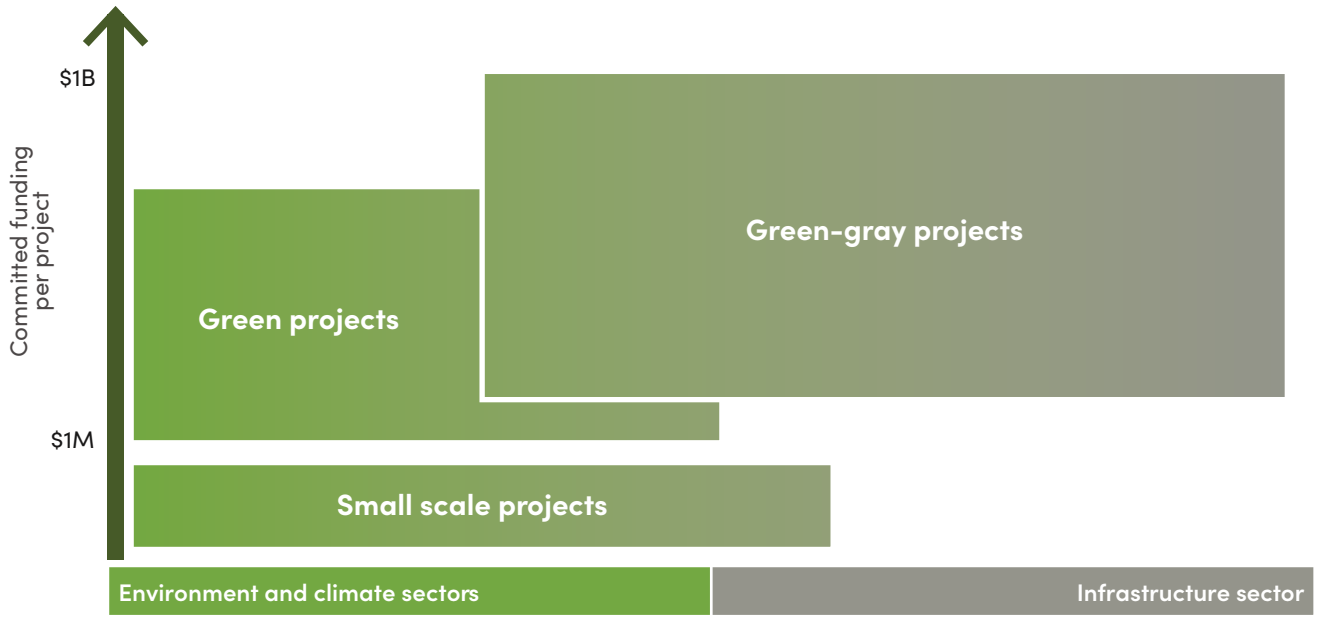
Green-gray projects represented the largest group with 95 projects initiated between 2012 and 2021. The total committed funding and financing to these projects was $8.8 billion, with $3.5 billion reserved for NBS implementation. These projects used NBS interventions—such as green (e.g., restoring forests to mitigate landslides) or blue (e.g., coral reef management or restoration to reduce erosion) NBS—together with gray infrastructure, and secured over $1 million per project. Funding secured for such projects ranged from $1 million to $909 million, with an average project size of $108 million including gray components. Over half of these projects were led by the infrastructure sectors of national governments. Green-gray projects were often funded by multilateral development banks (MDBs) and designed to deliver a range of co-benefits, including job creation and improvements to public health.

Green projects represented the second-largest group with 83 projects between 2012 and 2021. The total committed funding and financing to these projects was $3.7 billion, with $1.8 billion reserved for NBS implementation. These projects used green or blue NBS interventions without gray infrastructure to achieve their climate resilience objectives. Green projects secured between $1 million and $500 million with an average of $54 million per project. They were generally developed by national governments' environment and natural resource departments and funded by multilateral donors and funds. They were most frequently designed to enhance biodiversity and support job creation co-benefits.

Photo by Rob Barnes/GRID-Arendal.

Small-scale projects were the third group with 67 projects initiated between 2012 and 2021. Twenty-one small-scale projects disclosed funding for a total of $6.7 million. Funding secured for those projects ranged from $50,000 to $910,000 per project with the average project receiving $370,000. Funding for NBS could not be calculated as projects did not differentiate between project totals and NBS implementation. These projects mostly used green or blue components, with few using green-gray interventions. These projects were funded by multilateral donors, multilateral funds, and nongovernmental organizations (NGOs); developed by NGOs; and focused on job creation and biodiversity enhancement co-benefits.

Figure ES-4 | Graphical representation of the NBS project typology



Note: NBS = nature-based solutions. B = billion. M = million.
Source: Authors.

Projects aimed to address multiple climate resilience objectives and co-benefits

Most of the 246 projects identified from 2012 to 2021 had multiple climate resilience objectives with improved water quality and water supply as the most common (Figure ES-5). Flood mitigation and erosion and landslide risk reduction followed. For World Bank and AfDB projects from 2022 to 2023, erosion and landslide risk reduction were the most common objectives for both green and green-gray projects. Projects also aimed to address a variety of co-benefits in addition to their climate resilience objectives. For projects initiated between 2012 and 2023, job creation was the top socioeconomic co-benefit. Improved biodiversity and food security were also leading co-benefits for green and small-scale projects, while public health enhancements and community cohesion were more common co-benefits for green-gray projects.

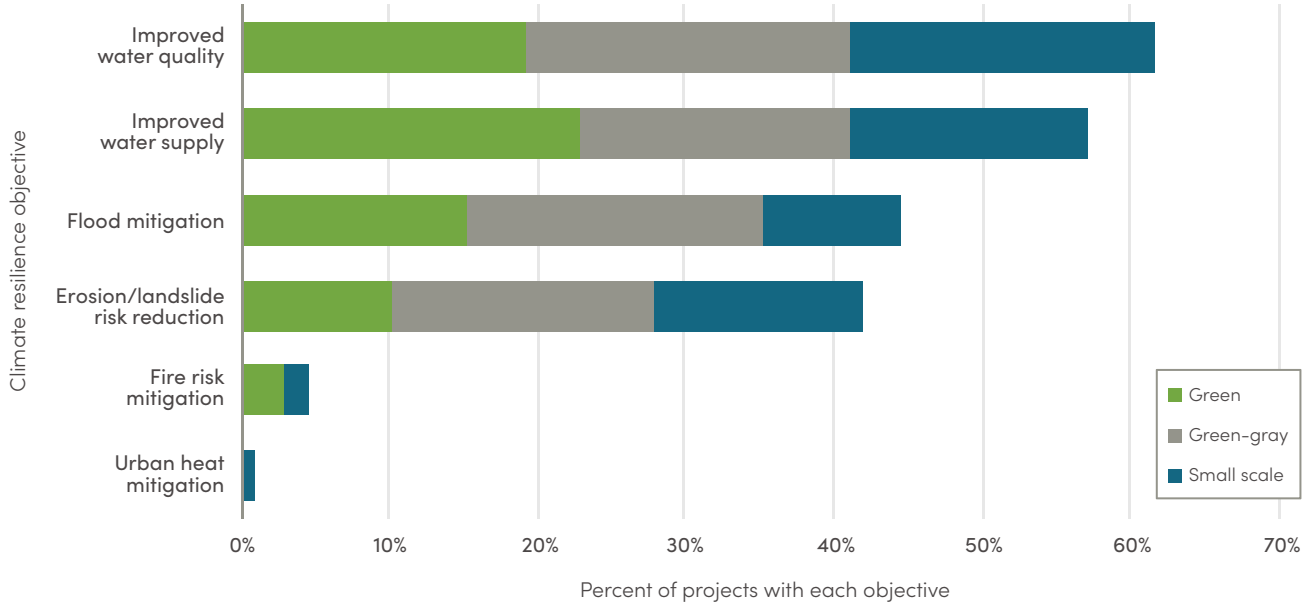
Urban projects gained momentum amid predominantly rural forest management projects

Rural landscapes were the primary focus of all NBS projects. Of projects initiated from 2012 to 2021, nearly 70 percent targeted rural areas like upper watersheds, agricultural zones, forests, and natural grasslands. These projects often used sustainable forest management (63 percent) and improved agriculture (46 percent) to enhance water resources and mitigate erosion and flooding. About 10 percent of projects were coastal, predominantly focusing on mangrove restoration to reduce coastal flooding, with other interventions like coral reefs and salt marshes used less frequently. Urban NBS projects were less common (15 percent of the portfolio for 2012–21), but grew in 2022–23, comprising 50 percent of recent World Bank and AfDB portfolios. These urban projects primarily used urban parks, constructed wetlands, and rain gardens for flood control and water quality improvements. Additionally, 15 percent of projects spanned multiple landscapes, benefiting both rural and urban residents, such as watershed projects where implementation occurred upland to deliver improved climate resilience downstream to urban residents.

National governments led project development

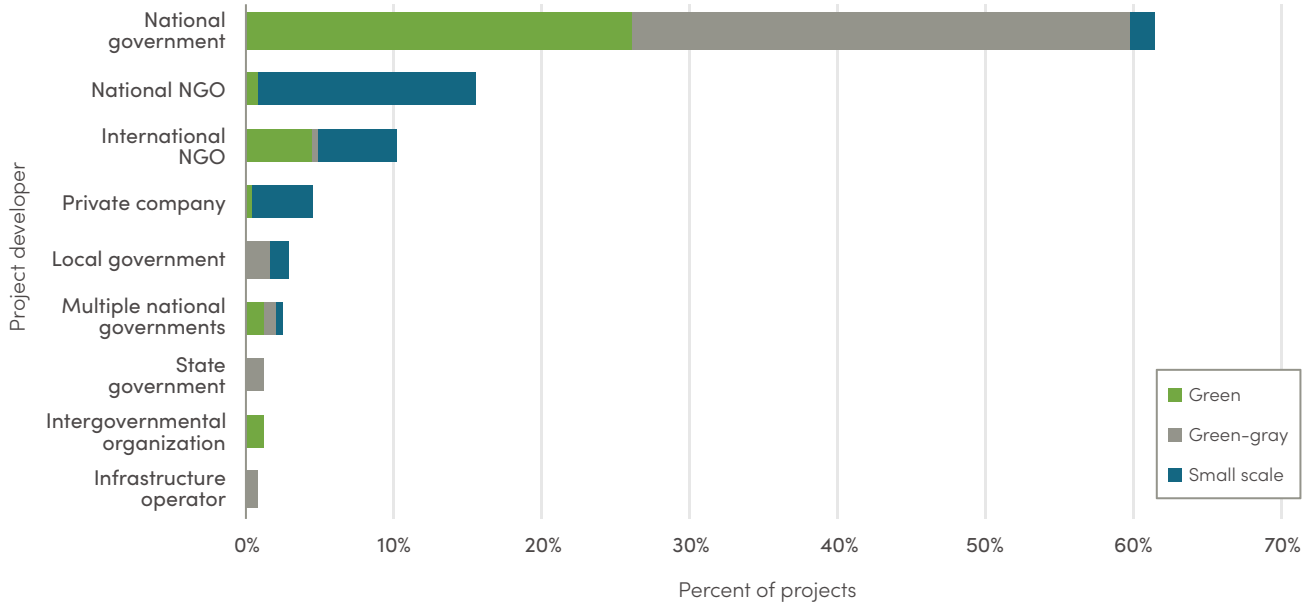
National governments were the lead project developers for 62 percent of projects, highlighting their pivotal role in driving implementation and ensuring project goals are achieved (Figure ES-6). While they frequently acted as the primary liaison with funders, national governments collaborated extensively with local and state authorities to execute site-specific NBS. For green and green-gray projects, national governments typically took the lead in project development, while small-scale projects were often spearheaded by national or international NGOs.

Figure ES-5 | Climate resilience objective by project type, 2012–21



Note: Flood mitigation includes coastal, riverine, pluvial, and urban flood mitigation; erosion includes both coastal and terrestrial erosion risk reduction.
Source: Authors.

Figure ES-6 | **Types of lead project developers, 2012–21**



Note: NGO = nongovernmental organization.
Source: Authors.

Projects were co-funded by multilateral organizations and national governments

Projects were often co-funded by MDBs, multilateral donors and funds, and national governments. MDBs were the primary funder of 70 percent of projects, with national governments and multilateral donors & funds—including international organizations like the United Nations Environment Programme (UNEP) and United Nations Development Programme (UNDP) and multilateral funds such as the Global Environment Facility (GEF) and Green Climate Fund—often co-funding these projects. Multilateral donors and funds funded 43 percent of green projects and 28 percent of small-scale projects. In contrast, MDBs predominately provided financial support for green-gray projects (61 percent). Few projects were primarily funded by the private sector, revealing an area for greater engagement as this sector can provide capital at scale.

Grants, concessional loans, and government contributions were the primary sources of funding for projects. Fifty percent of projects relied solely on grants, while concessional loans alone or in combination with grants or government contributions funded 25 percent of projects. Grants were the most common funding instrument, especially for small-scale projects. They were involved in funding 51 percent of green projects, 32 percent of green-gray projects, and 81 percent of small-scale projects. Concessional loans, used alone or in combination with other instruments, were used in 25 percent of projects but contributed over 73 percent of the total funding across all initiatives. Large-scale green-gray projects primarily used concessional loans combined with grants to fund projects, while green projects relied more on grants alone or in combination with government contributions. Market-rate loans, in-kind

Northern Congo Agroforestry Project, Republic of Congo. Photo by the World Bank.

contributions, private equity, and carbon offsets were far less common, but demonstrated a diverse funding landscape for NBS projects.

Social equity in NBS projects can be enhanced by integrating gender inclusion, Indigenous and traditional knowledge, and context-sensitive approaches in fragile regions

Most NBS projects cited gender equity components, but few referenced using Indigenous and traditional knowledge. Gender equity integration was referenced in 68 percent of project plans from 2012 to 2021, yet using Indigenous knowledge was identified in only 13 percent of projects. For World Bank and AfDB projects from 2022 to 2023, gender equity inclusion increased to 98 percent of projects and Indigenous knowledge to 24 percent. The high reference of gender equity could be a result of the inclusion requirements for MDBs, showing how formal requirements can increase integration.

Lower NBS project investment was found in countries with a fragility and conflict status. Fifty-five percent of projects were implemented in countries that were not designated by the World Bank as FCV (affected by fragility, conflict, and violence) from 2012 to 2021 compared with 22 percent of projects that were implemented in countries that had been on the FCV list over five times. Small-scale projects were more common in countries often listed as FCV, while green and green-gray projects were mostly found in non-FCV countries. In fragile countries, NBS projects relied on a mix of government and in-kind contributions, along with market-rate and concessional loans. While high-FCV nations co-funded more projects through government contributions, their limited access to alternative financing could lead to a dependence on loans, which in turn can create high debt burdens and compromise a borrower's long-term financial stability.

Key implementation barriers

A lack of policy integration, lack of institutional coordination, limited technical knowledge, and an underdeveloped business case are among the known implementation barriers of NBS for climate resilience, according to over 50 project developers, funders, and investors interviewed for this report (Table ES-1). Interviewees mentioned that national and local policies in SSA often incentivize building with traditional gray infrastructure rather than green or green-gray hybrid solutions, making it difficult to incorporate NBS into planning and funding frameworks. Interviewees also highlighted institutional barriers such as constrained government budgets and insufficient understanding of NBS as hindering national support or buy-in. Project developers, funders, and investors interviewed cited gaps in technical capacity, including insufficient NBS-specific knowledge and training, which can impede successful implementation and long-term project outcomes. In addition, social challenges, such as land tenure conflicts and inadequate community involvement, weaken project outcomes and damage NBS credibility. Another recurring theme was funding challenges, with project developers emphasizing the need to strengthen the business case for NBS to secure more public funding and attract private investment. Securing long-term funding remains a key obstacle, as many projects struggle to sustain themselves over time. Addressing these interconnected barriers will be crucial to scaling up NBS and realizing their full potential to build climate resilience in SSA.

Table ES-1 | Key implementation barriers identified in interviews with project developers, funders, and investors

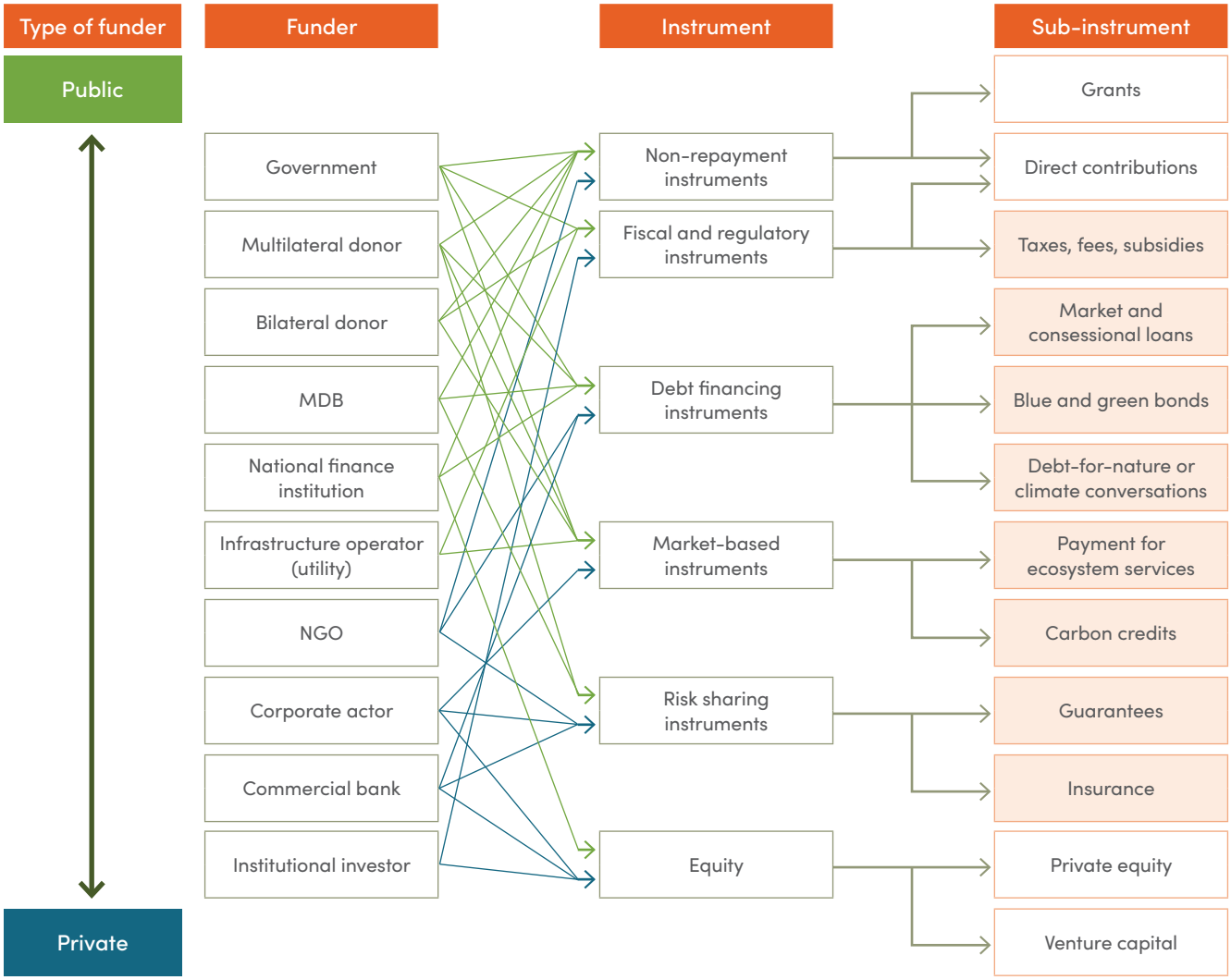
BARRIERS TO IMPLEMENTATION OF NBS FOR CLIMATE RESILIENCE	
Policy	• Lack of incentives or supportive national policies to consider NBS • Policy preference for gray infrastructure
Institutional	• Limited budgets and resources for multisectoral collaboration • Lack of institutional buy-in for NBS
Technical	• Limited technical capacity to design, implement, and maintain NBS projects • Insufficient scientific data to inform effective project design and resources for MEL
Social	• Lack of incentives and resources to build trust and community support for NBS • Social conflict and insecure land tenure
Financial	• Business cases and revenue streams are not developed for NBS • Funding covers implementation alone and not longer-term NBS maintenance and monitoring

Note: NBS = nature-based solutions. MEL = monitoring, evaluation, and learning.
Source: Authors.

Funding and financing pathways for NBS in SSA

NBS projects often rely on grants; however, diversifying funding instruments can ensure the long-term sustainability of projects and secure additional capital to achieve scale (Figure ES-7). Debt-financing options, like certified green bonds or debt-for-nature swaps or climate conversions, offer pathways to secure substantial up-front capital, while market-based tools, such as payments for ecosystem services and carbon credits, can provide a consistent revenue stream over time, making projects more financially sustainable. Risk-mitigation instruments, like guarantees and insurance, can lower investment risks for lenders or borrowers, enhancing the attractiveness of NBS for investors and facilitating broader financial support. These instruments are already in use in the region, but increasing their application to finance NBS projects will be critical to accessing new and additional sources of capital. Multilateral development banks and other multilateral organizations will need to continue to play a foundational role by offering initial capital for projects, while national governments can create supportive policy, regulatory, and financial frameworks to facilitate further investment. New domestic sources from fees, taxes, utilities, or corporate contributions will be required to sustain projects for the long term.

Figure ES-7 | Overview of funders and financial instruments for NBS in SSA



Notes: This table integrates database findings and climate finance literature and does not represent an exhaustive list of the funders or financial instruments in use in the region. Sub-instruments with an orange outline are used by projects in the database and those marked by a gray box are covered in depth in section "Funding and financing strategies for scaling up NBS investments." Guarantees are used in sub-Saharan Africa (SSA) but have not yet been used for nature-based solutions (NBS). MDB = multilateral development bank. NGO = nongovernmental organization.

Source: Authors.

Recommendations for scaling up NBS implementation in the region

This report's analysis of NBS projects reveals positive trends in project initiation and funding over the past decade. However, current NBS investment and implementation remain insufficient given the scale of the challenges facing SSA including climate change, nature loss, and rapid population growth. To increase the scale of investment in NBS and unlock its potential to address climate resilience, key actors including national and subnational African governments, MDBs and other multilateral organizations, NGOs, private sector actors, and infrastructure operators will need to change business-as-usual policies and practices to address the barriers identified in this report.

We provide a set of strategic recommendations for these actors based on our analysis of current investment, assessment of implementation barriers and opportunities, and the expected climate resilience and development challenges across the region. Our key recommendations are the following:

1. **Better integrate NBS into relevant policies and plans across SSA to institutionalize their role in addressing climate and development challenges.**

   Integrate NBS commitments into strategic adaptation and resilience planning. Many countries in SSA promote NBS in their climate and biodiversity contributions toward multilateral environmental agreements. Further integration in national and subnational adaptation plans and policies can ensure NBS are a viable and cost-effective option for climate adaptation.

   Mainstream NBS in sectoral policy and planning. To integrate NBS in infrastructure portfolios or land-use planning, NBS should be enabled and incentivized by plans and policies for urban development, coastal management, housing, transport, water, and energy. Countries can incorporate natural capital accounting (the process of quantifying and valuing natural resources like forests, water, and biodiversity) to help promote the integration of NBS.

   Update policy and regulatory frameworks to remove barriers and unlock funding for NBS. Update existing regulations that hinder the adoption of NBS and reform policies to provide financial incentives for investment and maintenance of NBS, such as Rwanda's Green Growth and Climate Resilience Strategy, whose implementing agency, FONERWA, secured a portion of the national budget for NBS initiatives (RoR 2022).

2. **Improve NBS project preparation and NBS-specific technical capacity to develop a project pipeline.**

   Increase early-stage project preparation by project developers. Increasing access to NBS-specific technical capacity could improve the success and bankability of NBS projects, particularly in low-capacity and FCV environments. Project preparation facilities and accelerators provide a powerful approach to deliver this tailored support.

   Disseminate lessons and best practices through peer-to-peer learning, practitioner forums, and knowledge exchanges. To improve project development, NBS practitioners can share region-specific insights, tools, and real-world experiences related to the design, implementation, and monitoring of NBS projects.

3. **Enhance NBS project integrity and effectiveness by incorporating gender equity and Indigenous and traditional knowledge, increasing NBS responsiveness to community needs, and safeguarding biodiversity.**

   Actively involve local communities to ensure that projects are tailored to their specific needs and conditions, fostering a sense of ownership and responsibility, and creating socioeconomic benefits relevant to local needs. This can be achieved through participatory planning processes, regular consultations, and inclusive decision-making frameworks.

   Integrate gender equity and engage Indigenous Peoples and local communities (IPLCs) in project design, planning, implementation, and monitoring. This can enhance the relevance and effectiveness of projects. For gender equity, this can involve targeted training programs, support for women-led initiatives, and policies that promote gender balance in leadership roles. Collaborating with IPLCs and valuing their traditional knowledge systems can enhance the relevance and effectiveness of projects.

   NBS must deliver positive outcomes for biodiversity and ecosystem integrity and can do so by aligning with global conservation and climate resilience goals. Projects should enhance biodiversity, avoid harmful practices like introducing invasive species or monocultures, and adhere to safeguards that mitigate unintended harm.

4. **Diversify funders and funding sources by applying conventional and innovative financial mechanisms.**

   Continue to tap into conventional funding streams for green and green-gray projects from infrastructure funders, like MDBs and other multilateral organizations, using both market-rate and concessional loans, when fiscally appropriate.

   Market the climate and biodiversity benefits of NBS projects to unlock committed climate and biodiversity finance through the issuance of green, blue, and sustainability bonds or debt-for-nature swaps or climate conversions.

   Increase domestic sources of funding for NBS through fees, taxes, and subsidies, which can provide capital for project initiation, operations and maintenance, and ongoing monitoring, or serve as repayment sources for debt finance. Use these dedicated sources of capital to seed national climate funds, conservation trust funds, or water funds for operations and endowments, allowing them to pool multiple sources of capital.

   Deploy more risk-sharing instruments, such as guarantees and insurance, to address the perceived and real risk associated with investing in NBS projects in SSA.

5. **Apply country-level implementation strategies based on natural hazards, fragility, and climate impacts.**

   Establish national NBS investment priorities for climate resilience. Countries in SSA should prioritize NBS investments that directly address climate impacts and natural disaster risks tailored to specific regional needs to maximize positive outcomes. Targeted interventions in coastal cities can address pressing infrastructure needs and improve resilience to hazards such as coastal flooding, erosion, and storm surges.

   Tailor NBS strategies for fragile and conflict-affected regions. In FCV contexts, implementing NBS requires customized strategies that account for limited borrowing capacity, institutional constraints, and funding challenges. NBS projects can enhance resilience to climate hazards and provide co-benefits like job creation and community cohesion, making community-driven and locally beneficial projects especially impactful in these regions.

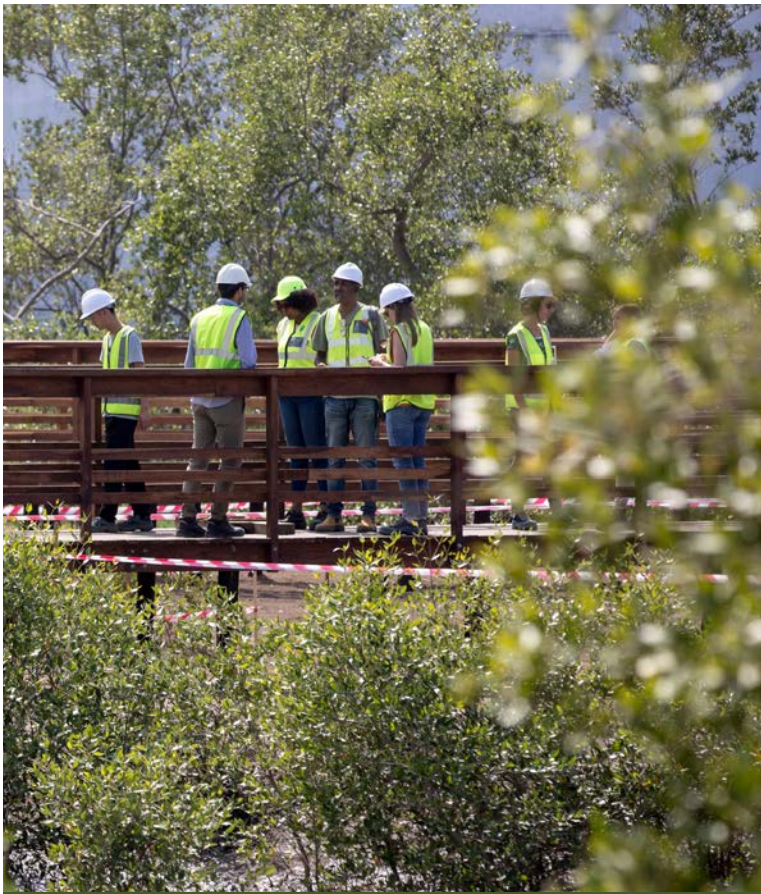
   Urban areas require increased investment and targeted approaches to address infrastructure demands and enhance resilience to hazards such as heat stress, flooding, and green space loss. Effective urban NBS must integrate natural systems into densely populated areas while addressing critical issues such as informal settlements and competing land uses to ensure equitable and sustainable outcomes. Contending with these challenges necessitates tailored approaches that consider the complex socioeconomic dynamics, spatial limitations, and local governance structures unique to cities.

6. **Improve monitoring, evaluation, and learning to ensure projects deliver intended climate impacts and co-benefits.**

   NBS project developers should significantly increase their investments in monitoring and evaluation to better gauge projects' effectiveness in delivering climate resilience and co-benefits. They can use the data to improve project design, and showcase the findings to build confidence with communities, governments, and investors.

   While this study did not evaluate the effectiveness of individual projects, future research should evaluate NBS projects by collecting data on key impacts such as climate risk reduction, economic savings, gender equity outcomes, and the delivery of co-benefits. This can help inform future design, enhance the robustness of available scientific data, and demonstrate the viability of NBS as a cost-effective tool for climate resilience.

As the world's fastest-growing region, and one of the most climate vulnerable, SSA presents a significant opportunity for investment and impact. Decision-makers can leverage the power of NBS to create a more resilient, equitable, and sustainable future for the region. We encourage readers to explore the full report to gain deeper insights into the opportunities and challenges surrounding NBS in SSA and gain inspiration to take bold action.



Mozambique Cities and Climate Change Project, Mozambique. Photo by the World Bank.

Rwanda Environmental Conservation Organization (RECOR) TerraFund for AFR100, Rwanda. Photo by Serrah Galos.

Introduction

Sub-Saharan Africa (SSA) faces escalating climate change impacts compounded by socioeconomic vulnerabilities, but nature-based solutions (NBS) offer a promising approach to enhance climate resilience, improve ecosystem services, and address infrastructure and economic challenges. This section provides background for this report's analysis of the potential of NBS to address SSA's interconnected challenges. It describes the region's climate and development context, defines NBS with examples, identifies key barriers to NBS adoption and implementation from existing literature, and reviews relevant international policies and financing frameworks for NBS.

Background

Africa is experiencing increases in surface temperature faster than the global average (IPCC 2022a) and is one the world's most vulnerable regions to climate change. Extreme weather events such as heat waves, droughts, floods, and cyclones have devastated countries in sub-Saharan Africa[1] in recent years, resulting in the loss of thousands of lives and inflicting billions of dollars in economic damages (WMO 2022). Across the region, infrastructure worth nearly US$200 million is at risk of flooding each year (World Bank 2022b), trapping SSA in a cycle of economic losses due to climate change.

Ecosystem degradation further exacerbates challenges countries face in achieving stable economic growth and resilience to climate change impacts. In SSA, where livelihoods are heavily dependent on natural resources and a large portion of the population works in climate-exposed sectors such as agriculture, the region's residents are particularly vulnerable to the impacts of climate change and biodiversity loss (IPCC 2022a; Archer et al. 2018). Land degradation affects roughly 65 percent of arable land in SSA, leading to an estimated annual income loss of up to 9 percent of gross domestic product (GDP) in some countries (Iseman and Miralles-Wilhelm 2021).

In addition to the growing adverse impacts of climate change and nature loss, SSA faces several socioeconomic and political challenges. Africa has one of the fastest growing and urbanizing populations in the world—the continent's population is expected to double by 2050, mainly in urban areas (UN 2022)—increasing demand for infrastructure and public services and jobs and economic security (AfDB 2020a). The region faces persistent political instability, with over half of the countries in SSA designated as fragile, conflict-affected, and violent (FCV) by the World Bank in the last 10 years (Baah and Lakner 2023). FCV countries also tend to be more vulnerable to natural disasters, with three times more people affected by natural disasters and twice the share of the population at risk of displacement when compared with non-FCV settings (Jaramillo et al. 2023).

Kigali, Rwanda. Photo by James Anderson.

With this complex setting, there is a significant need to invest in reducing disaster risk and increasing climate resilience in SSA, such as by promoting climate-resilient infrastructure to address pressing and interconnected vulnerabilities. Yet, the African Development Bank (AfDB) estimates that Africa faces a climate adaptation financing gap of $166-260 billion from international sources between 2020 and 2030, with an infrastructure financing gap of $68–$108 billion per year (AfDB 2018, 2022). Furthermore, adaptation funding is often fragmented, small scale, incremental, sector specific, and designed to respond to current impacts or near-term risks rather than necessary long-term investments (IPCC 2022a). Additional financing is needed to close these gaps and alter current trajectories to reduce disaster risk and build resilience to climate change impacts.

Box 1 | Key terms

Nature-based solutions: An umbrella term for "actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits."[a]

Gray infrastructure (also referred to as traditional infrastructure): Engineered structures such as dams, reservoirs, pipes, levees, roads, and water treatment plants that are designed to deliver key services such as transportation, energy, water supply, wastewater management, or natural hazard protection.

Green infrastructure (also referred to as natural infrastructure or nature-based infrastructure): A subset of NBS that uses natural systems such as forests, floodplains, riparian areas, and mangroves, among others, to provide key infrastructure services and additional benefits, such as improved biodiversity.

Green-gray infrastructure (also referred to as hybrid infrastructure): Combines green infrastructure or NBS with gray infrastructure to create more resilient and cost-effective systems.

Notes: a IUCN 2020; UNEP EA 2022.
Source: Authors, adapted from Box 1 in Browder et al. 2019.

Nature-based solutions for climate resilience

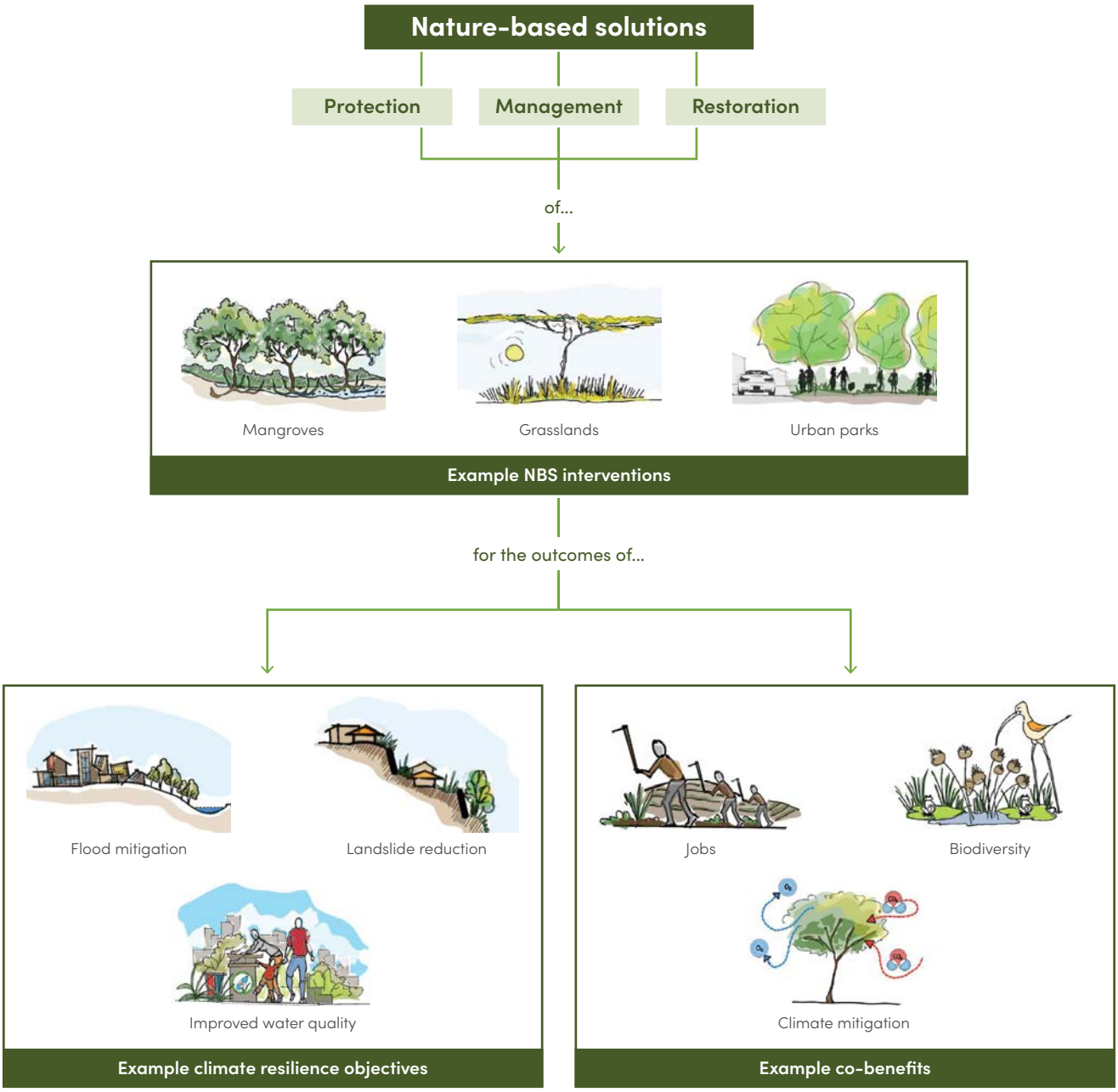
Nature-based solutions are increasingly being considered as effective interventions for strengthening climate resilience, enhancing ecosystem services, and meeting infrastructure gaps. NBS are often defined as "actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits" (IUCN 2020; UNEP EA 2022). As such, NBS principally should be designed to capitalize on their ability to respond to socioeconomic needs; use a systems approach to contribute to wider resilience and risk reduction objectives, including through the integration of hybrid green-gray approaches when these are deemed more efficient; consider a hierarchical set of interventions based on protection, restoration, and the creation of solutions; be implemented across different spatial scales; and adopt a multistakeholder and interdisciplinary approach for their implementation (World Bank 2021b).

NBS can increase the delivery of ecosystem services by improving ecosystem conditions, which can yield climate resilience and socioeconomic benefits. For example, restoring 350 million hectares of degraded terrestrial and aquatic ecosystems by 2030 could yield ecosystem services valued at approximately $9 trillion (UN Decade et al. n.d.). Healthy ecosystems, such as mangroves, forests, and grasslands, can reduce natural hazards like flooding or erosion. Crucially, NBS can also provide social and economic co-benefits, such as food security, new jobs and sustainable livelihoods, and improved public health, among others (Figure 1).

NBS can serve as an alternative or complement to traditional infrastructure, increasing the infrastructure's effectiveness and operable life (Browder et al. 2019; G-G CoP 2020). Projects effectively incorporating NBS generally have higher benefits than projects relying on gray infrastructure alone (van Zanten et al. 2023).[11] In many cases, NBS can be used to provide infrastructure-related services, either as an alternative (known as "green infrastructure") or as a complement (known as "green-gray infrastructure") to traditional infrastructure (see Box 1). One example is reducing the expenses associated with future road damage by pairing road enhancement with forest restoration to mitigate flooding and erosion.

Dhow negotiating mangroves at Kilwa Kisiwani on return voyage," Tanzania. Photo by Richard Mortel.

Figure 1 | Nature-based solutions for climate resilience and co-benefits



Note: The figure illustrates examples of NBS interventions, risk reduction, and co-benefits identified in the report and is not exhaustive. See Appendix A for the full lists.

Source: Authors, adapted from van Zanten et al. 2023.

While different definitions and intended outcomes may exist for NBS, this report focuses specifically on NBS aimed at increasing climate resilience, through their ability to regulate and manage specific climate hazards. The report looks at NBS to address flood mitigation, water quality, water supply, erosion and landslide risk mitigation, fire risk mitigation, and heat mitigation, as these are all climate-related hazards that severely affect SSA (see Figure 2). Solutions such as climate smart agriculture and other agricultural NBS are key to reducing greenhouse gas emissions while providing biodiversity and livelihood benefits; however, if their main objective is not to address a climate-related hazard, we excluded them from the report. This definition of NBS served as the foundation for the search protocol and informed the eligibility criteria we used to develop the NBS project database analyzed in section "Status of and trends in NBS for climate resilience in SSA." The project selection process included six complementary assessments to identify relevant projects. A comprehensive explanation of the methodology, including its limitations and a complete list of projects, is provided in Appendix A.

Figure 2 | **Example NBS interventions for climate resilience objectives**

Note: Examples are illustrative and not representative of all potential solutions for the objectives. Certain types of nature-based solutions (NBS), such as specific types of climate-smart agriculture, were not included as they do not directly address climate resilience as a main objective.
Source: Authors, adapted from World Bank 2021b.

The following are specific examples of how NBS, often integrated with gray infrastructure, can effectively address climate hazards and enhance resilience objectives:

- **Flood mitigation:** Restoring floodplains can mitigate riverine flooding by absorbing water and controlling seasonal volumes, while coastal mangroves act as natural barriers that can be coupled with sea walls to protect against storm surges and erosion (Narayan et al. 2016; Browder et al. 2019). Urban wetlands, green roofs, and parks enhance stormwater infiltration, reducing urban flood intensity (Soz et al. 2016; Gulati and Scholtz 2020).
- **Water quality:** Restoration of forests and wetlands can enhance water quality by filtering pollutants and controlling sediment. In urban areas, constructed wetlands play a similar role by mimicking natural filtration processes (Acreman et al. 2021; Hassan et al. 2021).
- **Water supply:** Removing invasive trees that consume excess water can enhance water supply by increasing water quantity and improving distribution. Restored floodplains and wetlands store water during wet periods and release it during dry times, while forest and wetland restoration upstream helps stabilize seasonal water flows (Hunink et al. 2017; Browder et al. 2019).
- **Erosion and landslide risk mitigation:** Vegetation management stabilizes slopes and reduces landslide risk and water runoff and helps improve drought conditions, while natural ecosystems like coral reefs and sand dunes mitigate coastal erosion and flooding (Smyth and Royle 2000; Ozment et al. 2018).
- **Fire risk mitigation:** Green firebreaks—strips of land planted with fire-resistant or low-flammability vegetation—coupled with traditional firebreaks, such as roads, can stop the spread of fire (Curran et al. 2017).
- **Heat mitigation:** Urban tree canopies, green spaces, and water bodies, combined with cool roofs and energy-efficient buildings, help reduce extreme heat in cities (Degefu et al. 2023; Garuma 2023).

Barriers to NBS implementation

Despite the potential for nature to increase resilience to natural hazards and climate change, there are several challenges to scaling up NBS in SSA, including a lack of financing and barriers to implementation that impede the development of investment-ready projects. From 2021 to 2022, climate finance covered only 23 percent of the estimated annual funding that African countries need to achieve their nationally determined contributions (NDCs) and fulfill 2030 climate goals (CPI 2024). Funding allocated to support NBS through climate adaptation finance or infrastructure finance is limited. Countries in SSA also face barriers in accessing finance due to complex application procedures, limited institutional capacity, and concerns over creditworthiness and political risk. While interest from investors for NBS is growing, uncertainty around financial returns often limits investment (UNEP 2021).

On the other hand, many governments and investors in SSA struggle to reach investment readiness for NBS projects due to data gaps, limited technical capacity, and insufficient policy support. The lack of reliable, comprehensive data in SSA hinders the ability to accurately assess risks, plan interventions, and track progress (White et al. 2017; Gulati and Scholtz 2020). Understanding priorities for NBS and the benefits they could generate is therefore often difficult, although recent developments using globally available information show that these hurdles can be overcome (World Bank 2024a). Low technical capacity for NBS limits the available expertise needed to develop, scale, and manage effective projects (Opperman et al. 2021; ANRMIC 2022). Existing policies often favor gray infra-

Freetown, Sierra Leone. Photo by UrbanShift.

structure over NBS (G-G CoP 2020; UNEP 2022b, 2022c), making it challenging for NBS to receive the funding, support, and integration into mainstream development plans that they need.

Social dynamics and structural challenges pose additional barriers to the successful implementation of NBS projects in SSA. A lack of community participation and mistrust can prevent successful NBS projects. Social inequalities may increase if vulnerable groups are not intentionally included (UNEP 2022c; Trivedi et al. 2020). The rapid urbanization and development of informal settlements in African cities reduce available land for NBS implementation, leading to land conflicts and inhibiting NBS adoption (UNEP 2022b; Gulati and Scholtz 2020). Additionally, inadequate safeguards can result in unintended social and environmental harm, further impacting community support and project success. There are no one-size-fits-all NBS projects, and these solutions need to be carefully tailored to specific contexts. Given the diversity of local conditions across regions, a singular NBS approach might thrive in one setting and flounder in another. These nuances make it challenging to scale NBS at the rate needed to increase the region's resilience to future climate hazards. Barriers to NBS implementation and related strategies are further discussed in section "Challenges to and strategies for advancing NBS in SSA."

Policy and funding commitments in SSA

Enabling policy and funding frameworks are key for NBS to be implemented in a sustainable way and upscaled country- and continent-wide. Policies include laws, subnational and national action plans, and international conventions, as well as operational, informational, and financial policy instruments (e.g., official operational guidelines, awareness campaigns, and tax incentives). Most African countries have adopted basic environmental protection laws (Mkandawire and Arku 2009), yet implementation has often been undermined by conflicting water, agriculture, and other sector laws, together with institutional and economic challenges regarding law enforcement. At the same time, many countries are increasingly emphasizing environmental objectives in their policies, integrating conservation and other NBS-enabling approaches (e.g., Integrated Water Resource Management; see Dirwai et al. 2021). This trend is strongly related to international conventions, which are becoming important legal instruments in SSA (Kotzé 2021). The following constitute the most relevant conventions for NBS in SSA:

- All 48 countries in SSA have signed the Paris Agreement and submitted **NDCs**, which outline national commitments to mitigating greenhouse gas emissions, climate adaptation plans, and funding/financing avenues to support these endeavors (UNFCCC n.d.). In 2022, 32 African countries explicitly referenced NBS in their NDCs (Kiribou et al. 2024).

- All 48 countries have crafted **National Biodiversity Strategies and Action Plans** (NBSAPs) to promote biodiversity conservation and management (CBD n.d.). Countries are in the process of harmonizing these with the new Kunming-Montreal Global Biodiversity Framework's goals for 2050 (CBD 2023).
- All 48 countries have accepted or ratified the **Convention on Biological Diversity** (CBD), which includes meeting 23 targets related to biodiversity under the Kunming-Montreal Global Biodiversity Framework by 2030 (CBD n.d.).
- Twenty countries in SSA have submitted **National Adaptation Plans** (NAPs), which aim to reduce climate vulnerabilities through adaptation plans and facilitate the integration of these plans into development policies and programs (UNFCCC 2023).
- Almost half of the **United Nations (UN) Decade on Ecosystem Restoration's global commitments** to halt, protect, and restore nature and ecosystems are from SSA countries (UNEP 2022a).
- Eleven countries are implementing a green belt of vegetation to combat desertification through the **Great Green Wall initiative**, with intervention activities that started in 2008 and a goal of restoring 100 million hectares of degraded land by 2030 (UNCCD 2020); 11 countries are committed to the new **Great Blue Wall initiative**, which taps into NBS to improve ocean conservation and accelerate the blue economy in coastal countries on the Western Indian Ocean (BFC 2023); and 31 countries have pledged to restore more than 100 million hectares of degraded landscapes across Africa through the **African Forest Landscape Restoration initiative** (AFR100), supported by the African Union and other partners (AFR100 n.d.).
- Public and private actors in SSA, such as national and local governments, nongovernmental organizations (NGOs), civil society organizations, academic institutions, and private companies, have submitted 15 voluntary commitments to the United Nations Office for Disaster Risk Reduction's **Sendai Framework for Disaster Risk Reduction** to substantially reduce disaster risk and the associated losses of life, livelihoods, and economic opportunities (UNDRR n.d.).
- Africa is a priority geography for donors, NGOs, and multilateral organizations pursuing the **Sustainable Development Goals** (SDGs), such as clean water (Goal 6), clean energy (Goal 7), infrastructure (Goal 9), sustainable cities and communities (Goal 11), and partnerships (Goal 17) (UNDP 2023). According to UNEP (2023b), nature-based infrastructure solutions can help achieve 79 percent of SDG targets across all 17 goals.
- The African Union has developed **Agenda 2063**, a 50-year plan initiated in 2013 that focuses on Africa's sustainable development and socioeconomic transformation, with a strong emphasis on environmental conservation and the sustainable use of resources (African Union n.d.). In addition, the **African Union Climate Change and Resilient Development Strategy and Action Plan (2022–2032)** and **Nairobi Declaration of 2023** support Agenda 2063's vision for a climate-resilient and prosperous Africa by building resilient capacities for adaptation, maximizing mitigation potential, and integrating climate risk management into sustainable development (AICCRA 2022).

Photo by Rob Barnes/GRID-Arendal.

To fund and support these initiatives, there are potentially new funding frameworks linked to climate resilience and nature that developing nations could access, including the following:

- The **Kunming-Montreal Global Biodiversity Framework** (GBF) was established by the CBD and adopted internationally during the 15th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP15) in 2022 (UNEP 2022e). Target 19 commits to mobilizing $200 billion annually for biodiversity by 2030, including $30 billion through international finance, with a near-term goal of $20 billion annually by 2025. Countries are tasked with creating National Biodiversity Finance Plans to identify and mobilize the financial resources required to achieve the GBF targets (CBD 2024). Additionally, Target 18 aims to repurpose $500 billion annually in harmful incentives by 2030 to sustain and safeguard biodiversity (UNEP 2022e).
- The operationalization of the **Loss and Damage Fund** was a significant outcome of COP28. Nearly $300 million was pledged toward adaptation strategies and recovery efforts in countries that often contribute the least to climate change but are most vulnerable to its impacts (UNEP 2022d, 2023).
- As laid out in this report, multilateral development banks (MDBs) are already important sources of financing for NBS. The **"MDB Joint Nature Statement"** advocates for further mainstreaming nature into MDB policies, analyses, assessments, investments, and operations (MDBs 2021). If strengthened with actual commitments, this framework could unlock more resources for nature-positive investments, including NBS.

Establishing and linking policy and financing frameworks at multiple scales and sectors will create a more supportive environment for scaling up NBS initiatives across the continent.

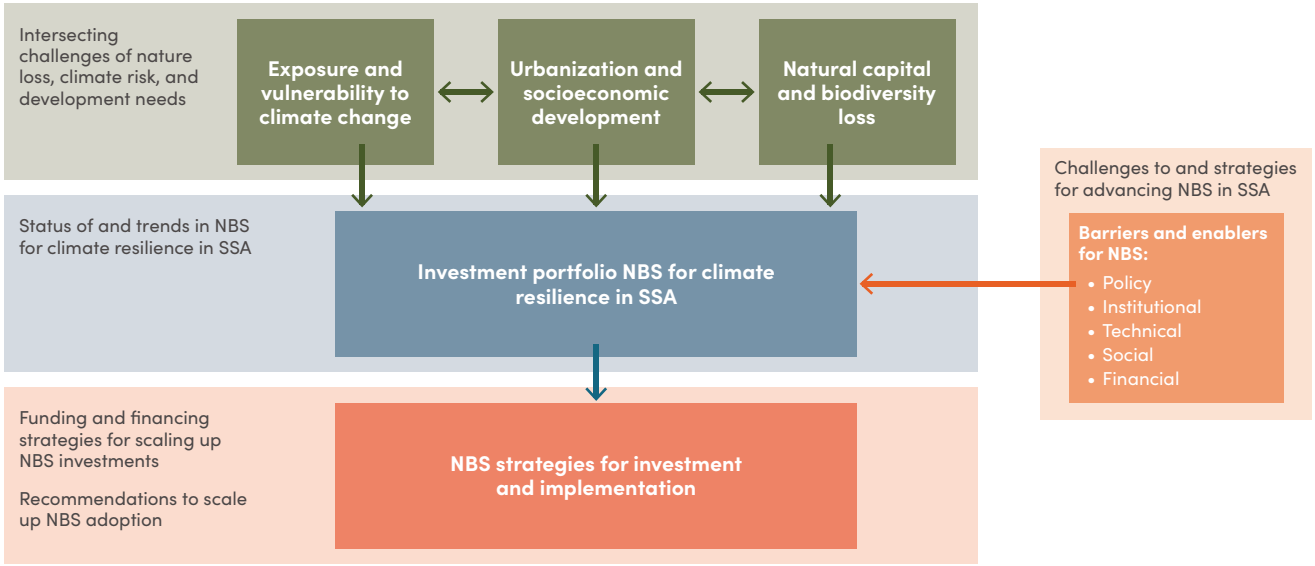
About this report

This report identifies recommendations to increase NBS implementation for climate resilience in SSA based on an analysis of prevalent natural hazards in the region that NBS can help address, a review of NBS projects from 2012 to 2023, and an analysis of the key barriers funders and project developers identified in interviews (Figure 3).

The report is structured as follows:

- The next section, **"Intersecting challenges of nature loss, climate risk, and development needs,"** describes natural hazards and climate change impacts, nature loss, and urbanization based on a literature review. We also used existing historical data and future projections to identify countries most impacted by natural hazards that NBS can help address.
- Then, **"Status of and trends in NBS for climate resilience in SSA"** outlines the current landscape of existing NBS projects in the region collected by the authors and identifies the types of NBS gaining traction. The section also identifies project developers, funders, and funding and financing instruments. It includes insights on trends in NBS investments from the World Bank and African Development Bank portfolios.
- **"Challenges to and strategies for advancing NBS in SSA"** describes barriers to NBS implementation according to interviews with project developers and investors in the region, and identifies what interviewees considered to be best practices for scaling up NBS adoption.
- **"Funding and financing strategies for scaling up NBS investments"** presents different funding and financing strategies utilized in the region, based on interviews and literature. It outlines opportunities for replication aimed at scaling available finance and long-term funding for NBS operations.
- Finally, **"Recommendations to scale up NBS adoption"** synthesizes recommendations informed by previous sections to scale up NBS implementation in the region. It provides recommendations tailored for key actors as each has a pivotal role to play in promoting NBS in SSA.

Figure 3 | Report structure



Source: Authors.

GEF Blue Forest Project, Gazi Bay, Kenya. Photo by Rob Barnes/GRID-Arendal.

Intersecting challenges of nature loss, climate risk, and development needs

Widespread ecosystem degradation, rapid population growth and urbanization, and accelerating climate risks present an interconnected set of challenges across SSA. Climate risk in SSA is characterized by socioeconomic vulnerability related to increasing inequality, limited access to capital and technology, a reliance on natural capital, and infrastructure challenges (IPCC 2022a; WMO 2022). This section describes the region's reliance on natural capital and biodiversity; highlights escalating threats posed by natural hazards; and presents how fragmented governance, fiscal constraints, and political fragility exacerbate vulnerabilities. To be effective, NBS must address these interconnected issues, and should be tailored to fit SSA's distinct ecological and developmental context.

Natural capital and biodiversity loss

Natural capital underpins the livelihoods of people in SSA, which holds nearly 20 percent of global natural wealth (World Bank 2021a). The region's diverse ecosystems—spanning drylands, savannas, grasslands, woodlands, forests, wetlands, and mountains—are essential to livelihoods (IPBES 2018). Over 70 percent of people in the region depend on forests for resources like timber, food, and fuel (UNEP 2016), while agriculture employs over 60 percent of the workforce, contributing significantly to GDPs, especially in West Africa. Smallholder farmers support the livelihoods of over 33 million households and contribute to 70 percent of the food supply in the region (Iseman and Miralles-Wilhelm 2021). Ecosystems like savannas and grasslands support megafauna and store carbon (IUCN ESARO 2020), and the tourism industry generates $29 billion annually and employs 3.6 million people. Water and marine ecosystems such as wetlands and rivers like the Nile support agriculture, provide drinking water, sustain hydropower, and underpin fisheries and tourism (UNEP-WCMC et al. 2018).

The degradation of these natural ecosystems' biodiversity is driven by land-use change, unsustainable resource use, invasive species, and climate hazards (IPCC 2022a; IPBES 2018; IISD 2021; Leisher et al. 2022). Rapid urbanization and deforestation destroy habitats, while mining, unsustainable fishing, hunting, and logging contribute to further biodiversity loss and environmental degradation (Güneralp 2017; OECD 2021; IPBES 2018; WWF 2017; Leisher et al. 2022). Climate hazards, such as floods, droughts, and rising temperatures, also damage habitats and wildlife, reduce the region's climate resilience, and impact economic stability. From 2010 to 2020, Africa experienced the highest rate of forest loss globally (FAO 2020). Deforestation and forest degradation affect roughly 65 percent of arable land, which could lead to an estimated annual income loss of up to 9 percent of GDP in some countries (Iseman and Miralles-Wilhelm 2021). Desertification affects 45 percent of Africa, impacting agriculture and leading to food insecurity and migration (ELD Initiative and UNEP 2015; WMO 2021), while biodiversity loss impacts key economic sectors such as agriculture, fisheries, forestry, and tourism. This ecosystem decline could cause an annual GDP contraction of 9.7 percent by 2030, amounting to a loss of $358 billion in annual income (Johnson et al. 2021).

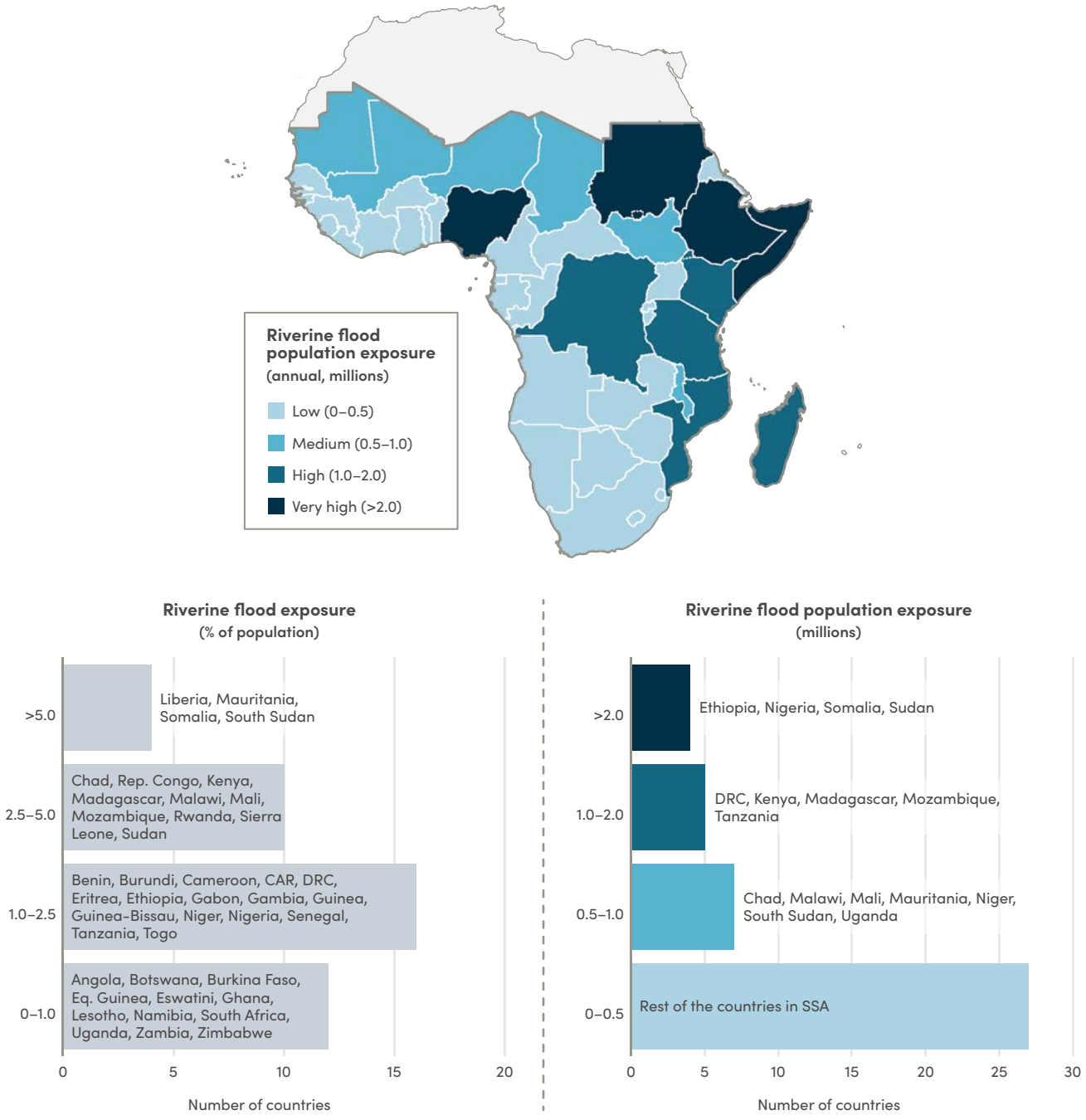
Consequently, nature loss exacerbates the exposure and vulnerability of populations to natural hazards and climate risks. Healthy ecosystems reduce climate risk and decrease the impact of natural disasters (IPBES 2018). For example, mangroves dissipate waves and storm surges (Enu et al. 2023) and forests can reduce runoff, increase infiltration and aquifer recharge, and lessen the likelihood of landslides. Ecosystem degradation reduces the ability of these NBS to protect residents against climate change impacts. In addition to the role of nature in regulating climate-related hazards, the region's economic dependence on natural resources for agriculture, livelihoods, and ecosystem services makes it particularly vulnerable to a changing climate (IPCC 2022a). For instance, rising global temperatures are projected to impact biodiversity and reduce agricultural yields by 13 percent in West and Central Africa and 8 percent in East and Southern Africa by 2050, which could have devastating consequences for food security and livelihoods in the region (WMO 2020).

Burkina Faso. Photo by Guido and Carrara family.

Natural hazards and climate change

Riverine flooding remains the most frequent and extensive natural hazard in SSA (Niang et al. 2014; Ekolu et al. 2024), affecting approximately 24 million people annually (Kuzma et al. 2023). As the impacts of climate change become more visible, riverine flood exposure becomes more prominent in the region, particularly in Eastern Africa (WMO 2021) and in urbanizing areas without proper planning throughout the continent. This region experiences seasonal flooding from overflowing rivers, which can devastate agricultural land and infrastructure, and displace communities. High and substantial exposure to riverine flooding is found in many other countries in SSA, including Tanzania, the Democratic Republic of the Congo, Kenya, South Sudan, and countries across the Sahel. Considering the number of people exposed annually relative to population size, countries like Mauritania, Somalia, Liberia, South Sudan (over 5 percent of the population in each is exposed annually) and the Republic of the Congo (3.4 percent annually) face high riverine flood exposure (Figure 4).

Figure 4 | **Projected annual population exposed to river flooding in SSA, 2030**

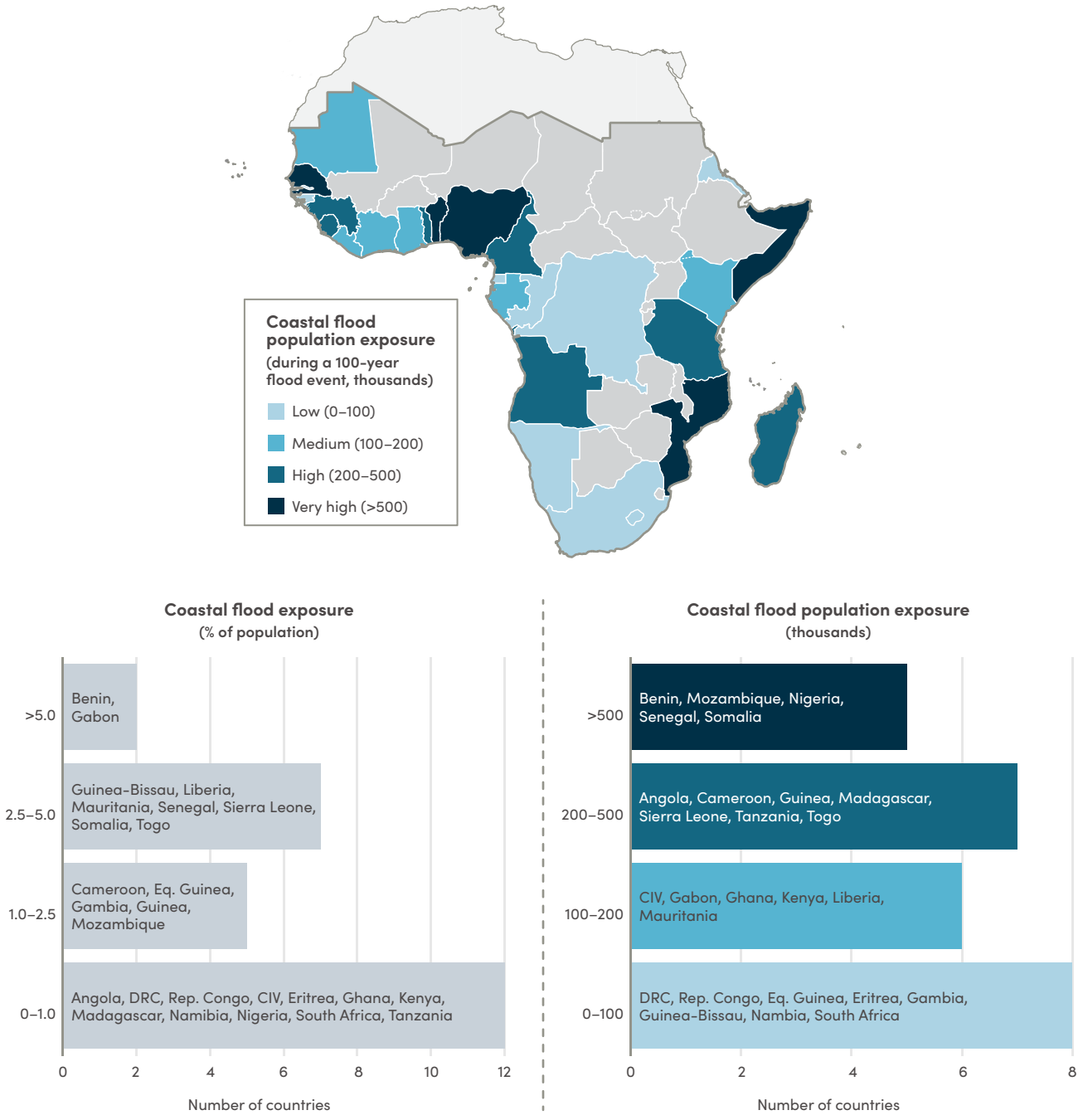


Notes: Bar graphs on the right show the annual exposure to riverine flooding based on the number of people exposed (top right) and percent of the total population exposed (bottom right). We used 2030 projections instead of historical data (1960–90) for a more accurate evaluation of current risk faced by countries. SSA = sub-Saharan Africa. DRC = Democratic Republic of the Congo. CAR = Central African Republic. Rep. Congo = Republic of the Congo. Eq. Guinea = Equatorial Guinea.

Source: Authors, using data from Kuzma et al. 2023.

As urban development rapidly expands along the coastlines of SSA, more people in low-lying cities are exposed to coastal flooding and erosion (WMO 2021). Since the 1970s, the urban footprint of coastal cities in SSA has grown by 58 percent and zones vulnerable to coastal flooding have expanded nearly five-fold (World Bank 2022b). Coastal degradation due to erosion, flooding, and pollution, particularly in West Africa, has led to significant economic losses, such as $9.7 billion in Nigeria in 2018—8.1 percent of its GDP (World Bank 2022b). Rising sea levels are expected to expose 108 to 116 million people in SSA to coastal flooding by 2030 (WMO 2022; Opperman et al. 2021) and 135 million people by 2050 (World Bank 2022b), with countries like Senegal, Mozambique, Benin, Nigeria, Somalia, and Gabon being the most affected (Figure 5). Warmer sea surface temperatures are also intensifying tropical cyclones, causing severe flooding, particularly impacting the eastern coast of SSA along the Indian Ocean. Events like Tropical Cyclone Eloise in 2021, which displaced over 3,000 people and damaged nearly 30,000 houses (ReliefWeb 2021), highlight this trend. Coastal flooding exposure is projected to increase by over 10 percent in

Figure 5 | **Exposure to coastal flooding during a 100-year flood event in 2015**

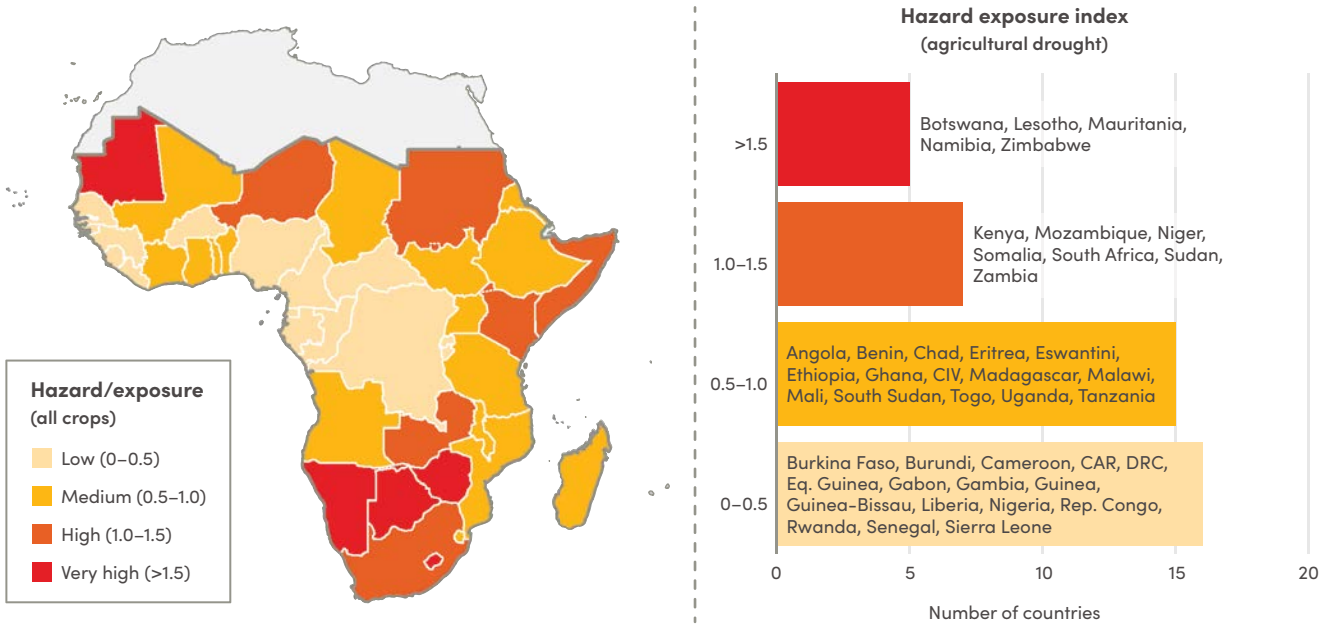


Notes: The bar graphs on the right show the population exposed based on the number of people exposed (upper right) and percent of the population exposed (bottom right). CIV = Côte d'Ivoire. DRC = Democratic Republic of the Congo. Rep. Congo = Republic of the Congo. Eq. Guinea = Equatorial Guinea.
Source: Authors, using data from World Bank 2022b.

certain countries due to climate change, and Benin and Gabon are among the most vulnerable to coastal impacts in terms of percentage of population affected.

Drought risk in SSA is severe, driven mainly by increasing temperatures and erratic rainfall patterns, which significantly impact agriculture, food security, and water security. Seven out of the 10 countries with the highest global drought risk globally are in Africa (Meza et al. 2020), and drought events over the past five decades have led to economic losses exceeding $70 billion (WMO 2022). With 95 percent of SSA's agriculture being rain fed (IPCC 2022a), drought undermines food security and jeopardizes livelihoods and income stability. East Africa, the Sahel, and the Horn of Africa are particularly vulnerable, experiencing prolonged droughts that have caused food insecurity, crop failures, livestock death, and displacement. For example, Lake Chad's water levels have decreased over 90 percent since the 1960s, worsening conflicts and causing displacement such as when over 30,000 people from North Cameroon fled to neighboring Chad in December 2021 (UNHCR 2021). Southern African countries, such as Namibia, Botswana, and Zimbabwe, as well as others like Mauritania, are expected to have agricultural systems highly exposed to drought (Figure 6).

Figure 6 | **Historical agricultural drought as a function of hazard and exposure, 1980–2016**



Notes: Hazard reflects mean drought conditions from 1980 to 2016, as assessed through the WaterGAP model and Global Crop Water Model. The exposure indicator evaluates elements that could be affected in drought-prone regions, incorporating the harvested area of irrigated and rainfed crops and using data from the MIRCA2000 dataset. Bar graphs on the right specify countries facing high hazard/exposure to agricultural drought. CIV = Côte D'Ivoire. CAR = Central African Republic. DRC = Democratic Republic of the Congo. Eq. Guinea = Equatorial Guinea. Rep. Congo = Republic of the Congo.
Source: Authors, using data from Meza et al. 2020.

In SSA's upland and rural areas, landslides and wildfires fueled by extreme weather patterns can damage infrastructure, displace people, and fragment livelihoods. Landslides are often triggered by heavy rainfall and are exacerbated by deforestation and unsustainable agriculture, and can destroy infrastructure and displace communities, as seen in Uganda's 2019 landslide, which claimed over 300 lives (ReliefWeb 2019). Unplanned settlements encroaching on steep hillsides further increase landslide risk, endangering the settlements and communities downhill (Redshaw et al. 2017). Erosion from landslides also deteriorates water quality by increasing sedimentation. Wildfires are worsened by high temperatures and prolonged droughts (Van Niekerk and Nemakonde 2017). Although wildfire is an important and natural part of some ecosystems in SSA, increasing temperatures heighten fire risk and the potential for larger and more catastrophic fires (Nieman et al. 2021). While not as deadly as other hazards, wildfires cause significant socioeconomic losses, damaging property and livestock (Mulugeta et al. 2007). For instance, in Mauritania, the increasing incidence of bushfires driven by rising temperatures presents a significant hazard to pastoralist refugees and surrounding communities, whose subsistence heavily depends on maintaining large herds of livestock (WMO 2021).

Climate impacts in urban areas—urbanization, flooding, heat, and loss of green spaces

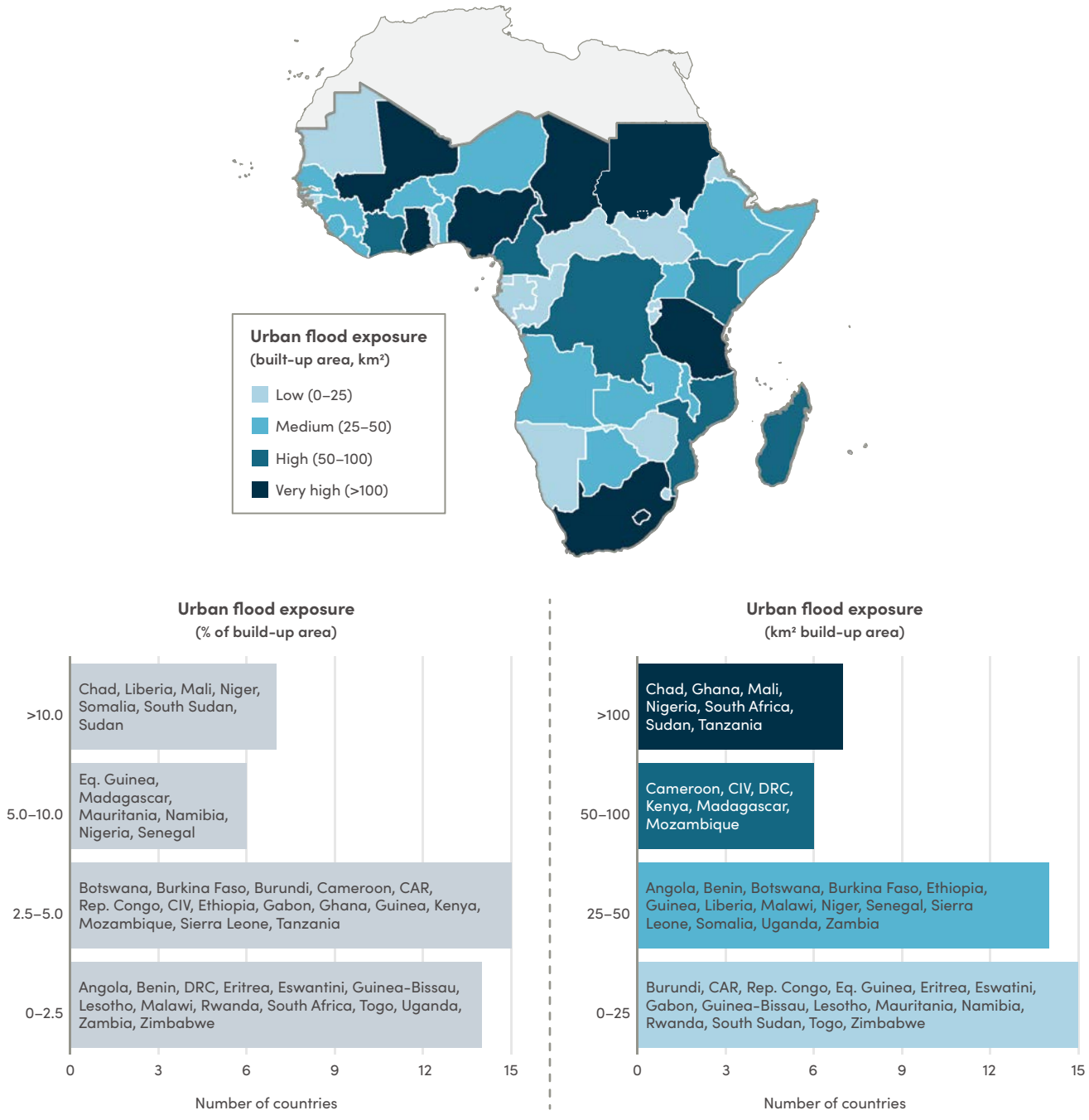
Urbanization in Africa started later than in other regions worldwide, yet it is accelerating rapidly, with the overall population expected to double by 2050, mainly in urban areas (UN 2022). This surge is driven by migration from rural to urban areas, as people seek better economic opportunities and escape climate impacts and conflicts (UN-Habitat 2019). This rapid growth presents challenges, as two-thirds of the urban infrastructure needed by 2050 does not yet exist (AfDB 2022). Existing and aging infrastructure is already under strain, with almost 600 million people lacking electricity, 400 million lacking access to basic drinking water, and nearly 800 million without basic sanitation services (Hallegatte et al. 2019; ICA 2022). As a result, many people live in informal settlements (World Bank 2021b), which are often overcrowded and poorly built with limited access to safe water and sanitation, and lacking secure land rights (UN-Habitat 2019). These settlements are often located in vulnerable areas highly exposed to natural hazards and climate change impacts, such as in floodplains, drained wetlands, or along coastlines (UNEP 2022b), and are excluded from official urban planning, perpetuating inadequate resource allocation and exposure to climate risks (AfDB 2020a).

Rapid urbanization without proper planning and infrastructure development has led to a significant increase in settlements in flood-prone areas (UNEP 2022b). Globally, the expansion of settlements in areas with high flood risk outpaces growth in safer areas, and SSA is outpacing regions like Latin America and central Asia in this trend (Rentschler et al. 2023). In coun-

tries like Chad, Mali, and Sudan, over 100 square kilometers of built-up area, equivalent to over 10 percent of built-up area in the country, are located within 100-year flood zones, exposing millions to severe flooding risks (Figure 7). As rainfall variability and intensity increases, and cities continue to expand into flood zones, flood risks are expected to rise further. Between 1985 and 2015, areas exposed to severe flood risk expanded dramatically, with built-up areas at risk of flooding over 1.5 meters deep increasing over 100 percent (Rentschler et al. 2023).

Combined with climate change, urbanization has intensified the urban heat island effect in SSA, where concrete and asphalt absorb and radiate heat, leading to higher temperatures. By the end of the century, heat exposure in African cities is anticipated to rise by 20 to 52 times (Rohat et al. 2019). Low-income neighborhoods are disproportionately affected due to a scarcity of green spaces, and limited infrastructure for shade and cooling (Venter et al. 2020) such as air conditioning or insulation (OECD 2020b). Informal settlements face heightened heat stress due to overcrowding, poor ventilation, and the high heat retention of low-quality building materials (Laue et al. 2022).

Figure 7 | **Estimated built-up area in urban areas exposed to 100-year flooding, 1985–2015**



Notes: Bar graphs on the right show built-up area exposed and area exposed relative to the total built-up area in the country. km2 = square kilometers. S. Africa = South Africa. CIV = Côte d'Ivoire. DRC = Democratic Republic of the Congo. CAR = Central African Republic. Rep. Congo = Republic of the Congo. Eq. Guinea = Equatorial Guinea.

Source: Authors, using data from Rentschler et al. 2023.

Between 2012 and 2016, over 200 million individuals were exposed to high heat stress conditions at least once per year in urban areas, with cities along the East and West African coasts and the Sahel—like Mali, Niger, Senegal, Nigeria, and Benin—facing particularly high exposure, in some cases exceeding 30 days of high heat stress annually (Figure 8). This trend is expected to worsen, posing significant challenges to both public health and economic productivity (Rohat et al. 2019).

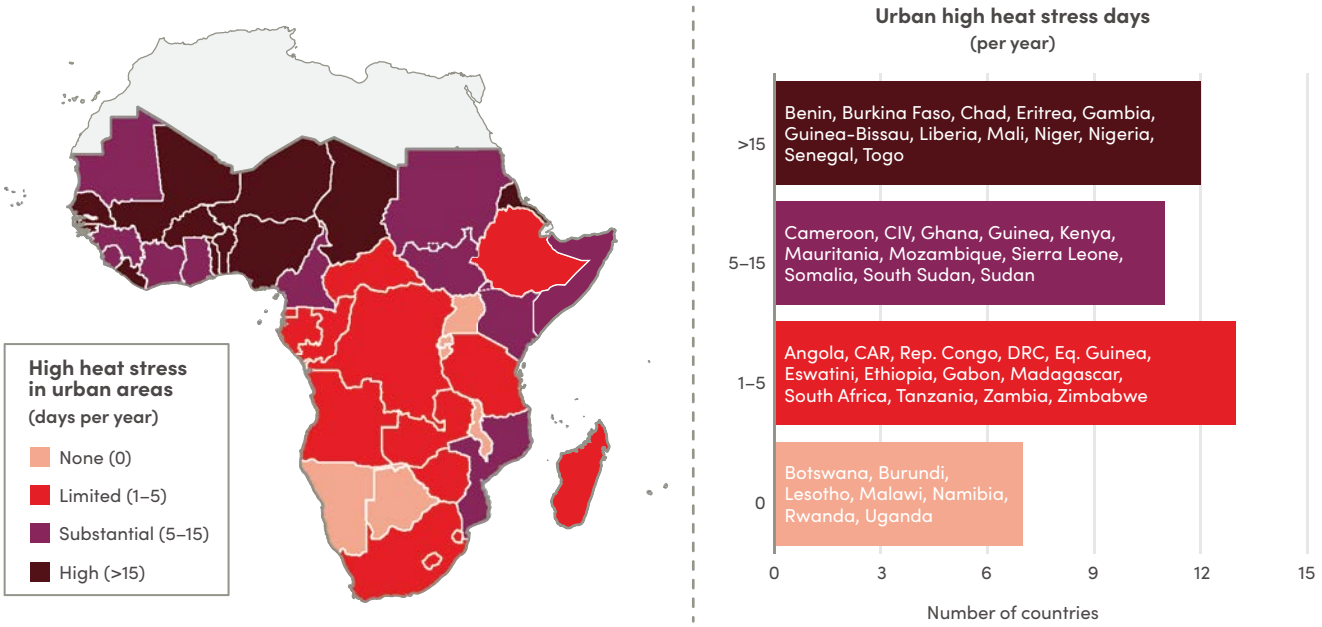
Over the past 20 years, vegetation in SSA cities has decreased by 1.1 percent annually, mainly due to rapid and unplanned urbanization, depriving urban residents of ecosystem services and biodiversity. The adverse effects of this growth are visible in areas with increasing deforestation surrounding urban centers and along transport corridors, leading to the fragmentation of natural habitats (Güneralp et al. 2017) (Figure 9). The loss of vegetation coverage also contributes to natural hazards and climate impacts such as the urban heat island effect and flooding (TNC 2021a). As a result, the preservation and enhancement of urban green spaces are critical for sustaining urban biodiversity and ensuring the resilience of cities to climate change (Seddon et al. 2020).

Fragility, institutions, policy barriers, and fiscal constraints

Political instability, policy barriers, weak governance structures, and limited implementation capacities, together with fiscal constraints, limit the ability of certain countries in SSA to adapt to climate risks (Sarkodie et al. 2022). The lack of enabling policies and legal and financial frameworks reduces the ability of countries to plan and implement adaptation measures country-wide. This includes upscaling NBS investments, which requires polycentric governance and policy coherence at multiple scales and sectors (e.g., environment and water) to be effective and sustainable (Martin et al. 2021).

The complex interplay of political instability, social fragility, and climate vulnerability in SSA creates significant challenges for sustainable development and disaster resilience. Many countries in SSA exist in unstable political landscapes, characterized by elevated levels of institutional and social fragility and violent conflict (TFP 2023). Between 2008 and 2022, the region experienced 29 coups, both successful and attempted (Duzor and Williamson 2023). These events, compounded by factors like food insecurity, poverty, drought, and floods, have intensified social tensions and displaced thousands (UNEP 2022a). States characterized by fragility are disproportionately impacted by

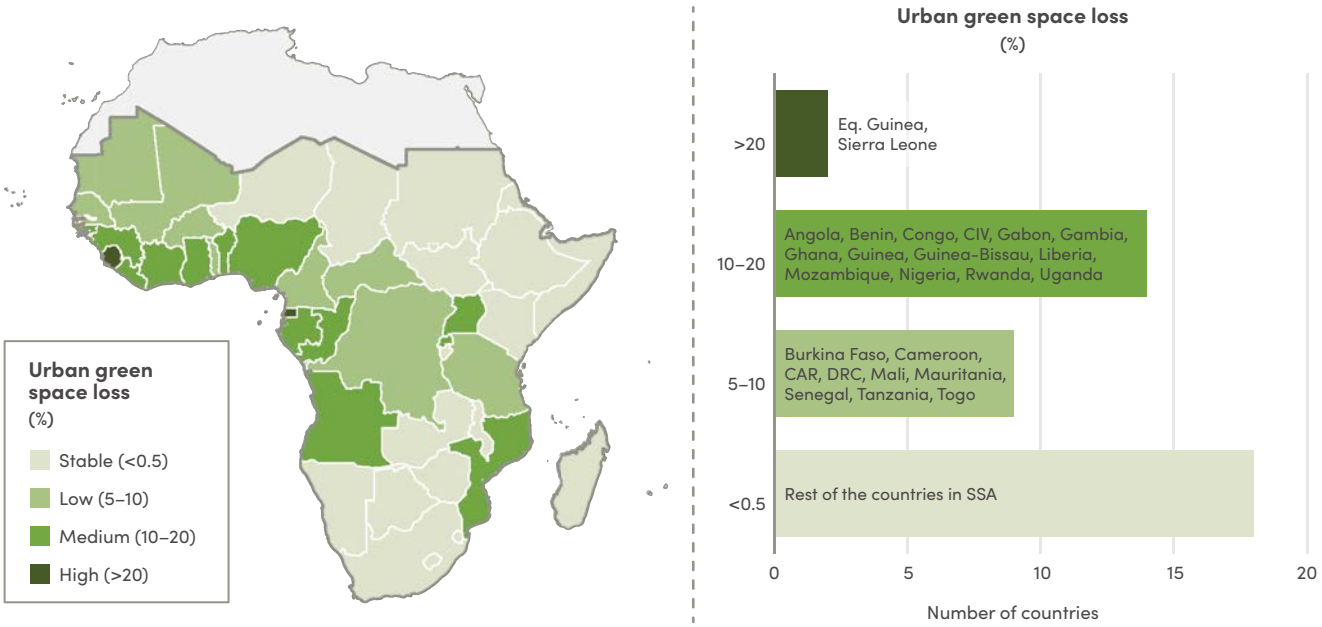
Figure 8 | **Estimated number of high heat stress days per year in urban areas aggregated to the country level, 2012–16**



Notes: High heat stress days are defined as days with a wet bulb globe temperature of over 30 degrees Celsius between 2012 and 2016. The graph on the right shows the number of heat stress days in urban areas by country. CIV = Côte d'Ivoire. CAR = Central African Republic. Rep. Congo = Republic of the Congo. DRC = Democratic Republic of the Congo. Eq. Guinea = Equatorial Guinea.

Source: Authors, using data from Williams et al. 2024.

Figure 9 | **Urban green space loss at the country level, 2000–20**



Notes: Data came from the annual Enhanced Vegetation Index (EVI) from the Moderate Resolution Imaging Spectroradiometer (MODIS) extracted for urban settlements from the Global Human Settlement Layer. Eq. Guinea = Equatorial Guinea. CIV = Côte d'Ivoire. CAR = Central African Republic. DRC = Democratic Republic of the Congo.

Source: Authors, using data from NASA n.d.; European Commission 2023.

climate-induced disasters, despite their minimal contributions to the underlying problem of climate change. In fact, three times more people are affected by natural disasters in fragile states than in other countries and disasters in fragile states also displace more than twice the share of the population (Jaramillo et al. 2023). As a result, fragile states, facing heightened challenges from climate vulnerability, conflict, and population displacement, are in critical need of robust governance and institutional structures to effectively address these issues. Unclear land tenure and property rights, common in SSA, often lead to conflicts and delay or deter infrastructure development due to disputes over ownership. These conflicts can result in population displacement and political instability, adversely affecting social and economic stability. Urban land conflicts can delay or complicate infrastructure projects, posing difficulties for land acquisition for construction (Gulati and Scholtz 2020).

The region's political instability exacerbates fiscal challenges like high borrowing costs and elevated debt levels, further impeding the implementation of development projects and heightening climate vulnerability. SSA requires an estimated $130–$170 billion annually from 2020 to 2030 to address critical infrastructure needs in water, sanitation, energy, transportation, and urban development (Haas et al. 2023). However, perceived risks in the region have made funders and investors wary of deploying both grant and market-rate capital.

Investor concerns over corruption, weak legal and regulatory institutions, political instability, and ineffective enforcement mechanisms hinder substantial investments. Moreover, high debt burdens across SSA—where roughly a third of countries carry debt levels exceeding 70 percent of GDP (IMF 2022)—strain national budgets, reducing funds for infrastructure and climate adaptation. High debt levels reduce funds available for infrastructure projects and climate adaptation measures because they strain national budgets to pay for debt servicing and make it harder for countries to access additional financing on favorable terms, which is often needed for large-scale infrastructure projects and emergency climate responses. Further limiting financial autonomy, many government agencies and regional governments face restrictions on borrowing from financial institutions, curtailing their capacity to fund large-scale projects independently. Additionally, countries with higher climate vulnerability face a greater risk of default, which amplifies their economic instability and limits investment in resilient and adaptive infrastructure (IMF 2020).

The Albertine Rift Conservation Society (ARCOS) TerraFund for AFR100, Rwanda. Photo by Seraphin Nayituriki.

Status of and trends in NBS for climate resilience in SSA

To evaluate the status of and trends in NBS in SSA, we identified 297 NBS projects for climate resilience in the region that were initiated between 2012 and 2023. This included 246 projects initiated between 2012 and 2021 that were financed by MDBs, multilateral funds, governments, and the private sector, complemented by a set of 51 NBS projects for which the World Bank and AfDB approved financing in 2022 and 2023. By evaluating over a decade of NBS projects, this section highlights regions where NBS are gaining momentum, identifies key players in project development, examines funders and funding instruments, and pinpoints areas where additional resources and support are needed to unlock the full potential of NBS for climate resilience.

Overview and methods

We reviewed project databases, completed a literature review, and conducted a survey to compile projects that used NBS for climate resilience (see Box 2). For some portfolios, projects may be underrepresented in the database as additional projects were identified after the research phase (Appendix A provides additional details on the methodology and its limitations). We used database filters and keyword searches and reviewed project documents to identify projects that met the following four requirements:

1. Located in countries in SSA, following the World Bank's 2023 definition of the region[22]
2. Initiated between 2012 and 2021 (except for the 2022–23 World Bank and AfDB projects); this is the year the project began and/or secured first financing; for MDBs, this correlates with "approval year"
3. Secured at least $50,000 in funding
4. Used NBS as a tool to achieve climate resilience objectives

Based on an analysis of the projects, three categories of NBS projects emerged, referred to herein as *project types*:

- **Green-gray:** Large-scale (over $1 million secured) hybrid projects that include green elements integrated into infrastructure projects with gray or human-built elements and with explicit mention of climate resilience objectives (e.g., mangrove restoration integrated with a system of sea walls for coastal flood protection)
- **Green:** Large-scale (over $1 million secured) nature protection, enhancement, or restoration projects with explicit mention of climate resilience objectives (e.g., mangrove restoration for coastal flood protection)
- **Small scale:** Both green or green-gray projects that secured over $50,000 but less than $1 million with explicit mention of climate resilience objectives

The distinctions among project types have implications for project planning, resource allocation, stakeholder engagement, and impact assessment. Large-scale projects often involve coordination among multiple stakeholders, require extensive planning and management, and have broader socioeconomic and environmental impacts. In contrast, small-scale projects tend to be more focused, nimble, and community driven, with a primary emphasis on addressing specific challenges within a localized context. Green versus green-gray projects may attract different funders, target different landscapes, or utilize different NBS interventions for climate resilience.

For each project, we scanned project documents qualitatively to collect data on specific project attributes and analyzed them to compare trends. This included overall trends such as the temporal and geographic distribution of projects; attributes specific to NBS (such as climate resilience objectives, geographic context, and NBS interventions used); and trends regarding the amount of funding secured, funding and financing instruments, and key stakeholders involved (such as project developers and funders). In cases where there was more than one climate resilience objective or funder, up to three objectives or actors were listed per project. In addition, we examined social and political considerations, such as gender equity inclusion, the use of Indigenous and traditional knowledge, and countries' FCV statuses (see Table A-1 for the full list of NBS interventions and Table A-4 for the list of project attributes). The sections below include the main findings from this analysis, in which we highlight key implications for green, green-gray, and small-scale projects where they could be distinguished.

Box 2 | NBS project identification process, 2012–23

We conducted a multipronged approach to identify NBS projects for climate resilience in SSA that met the four selection criteria. The five assessments we conducted include the following:

Assessment 1—MDB project databases: World Resources Institute (WRI) partnered with the World Bank and AfDB to scan project portfolios using a keyword search. We identified 80 NBS projects that were approved between 2012 to 2021. We identified an additional 51 projects approved between 2022 and 2023.

Assessment 2—Project databases: WRI completed a desktop scan of databases in SSA and used database filters and a keyword search to identify 105 NBS projects launched between 2012 and 2021.

Assessment 3—TerraMatch: WRI reviewed projects funded by TerraMatch in 2021 using a keyword search to identify 48 projects.

Assessment 4—Literature review: WRI reviewed global and SSA-specific publications and found six additional projects.

Assessment 5—Survey: WRI submitted a survey in 2021 to networks including AFR100 and identified seven more eligible projects.

Finding 1. Investment in NBS for climate resilience rose across the region

Project initiation

There was a steady increase in the number of NBS projects initiated in SSA per year between 2012 and 2023 (Figure 10). Project initiation increased with an annual average growth rate of 15 percent from 2012 to 2021. Projects from the World Bank and AfDB portfolios grew at a similar rate, but had a sharp increase in 2022–23, where the number of projects doubled from 2021 to 2022.

Funding secured

NBS for climate resilience projects in SSA from 2012 to 2021 secured approximately $12.5 billion. Funding information was available for only 200 projects, so total investment amounts were likely higher. Most small-scale projects received smaller investments (an average of $370,000 per project), while green projects garnered moderate-scale finance (an average of $54 million per project) and green-gray projects attracted the largest funding amounts (an average of $108 million per project). For the projects that listed funding information (200 projects), green-gray projects represented about 71 percent of the share of total funding, green projects represented about 29 percent, and small-scale projects comprised less than 1 percent.

About 42 percent of the total funding secured by these projects—equivalent to $5.3 billion—was allocated specifically to NBS implementation. The remaining 58 percent represented gray infrastructure, capacity building, and/or other activities included in project funding packages. For instance, the World Bank's Northern Congo Agroforestry Project approved in 2022 secured a total of $15.58 million in funding, but only $7.4 million was earmarked specifically for NBS activities related to agroforestry. The remaining funds supported other initiatives, such as strengthening agriculture value chains and piloting household payments. While some of these elements involve nature, these activities do not directly finance the implementation of NBS for climate resilience.

Below is a breakdown of total funding and NBS-specific funding by project type for 2012–21:

- **Green-gray projects** (95 projects between 2012 and 2021) secured $8.8 billion of total committed funding and financing, with $3.5 billion reserved for NBS implementation. These projects made up the largest share of NBS efforts in terms of project count and funding amounts, with projects often securing between $100 and $500 million.
- **Green projects** (83 projects between 2012 and 2021) secured $3.7 billion of total committed funding and financing, with $1.8 billion dedicated to NBS implementation. These projects accessed medium-scale funding amounts in comparison to green-gray projects, with projects most frequently securing between $25 and $50 million.

Figure 10 | Project initiation by year for NBS projects for climate resilience in SSA, 2012–23

Notes: We excluded 48 small-scale projects that received funding from the African Forest Landscape Restoration Initiative's TerraMatch in 2021 as we could not determine the project start year. Project counts for 2022 and 2023 represent projects from only the World Bank and the African Development Bank (overall number of NBS projects are likely higher). NBS = nature-based solutions. SSA = sub-Saharan Africa. WB = World Bank. AfDB = African Development Bank.
Source: Authors.

"Rice Bowl", Madagascar. Photo by Rod Waddington.

- **Small-scale projects** (21 projects out of the 67 small-scale projects between 2012 and 2021 disclosed total project funding) secured $6.7 million in total funding. Due to their relatively small size and lower profile, small-scale projects were more difficult to survey. These projects did not differentiate NBS-specific funding from total funding secured.

World Bank and AfDB projects from 2022 to 2023 committed an additional $8.7 billion with $2.9 billion dedicated to NBS specifically. Of the 51 projects approved during this period, 19 were green projects and 32 were green-gray projects (there were no small-scale projects). The average percent of total funding allocated to NBS was 40 percent for green projects and 33 percent for green-gray projects.

Geographic distribution

For projects initiated between 2012 and 2021, Eastern Africa had the greatest share of NBS project investment, followed by Western Africa, Southern Africa, and Central Africa. Eastern Africa represented 49 percent of total funding secured for NBS projects, concentrated in a few countries. For example, Ethiopia had 20 percent of total funding secured for SSA and 43 percent of funding for the eastern region. Western Africa followed at 30 percent of total funding, Southern Africa at 15 percent, and Central Africa at 6 percent (Figure 11). In contrast, from 2022 to 2023, 42 percent of investment from the World Bank and AfDB projects was in Western Africa.

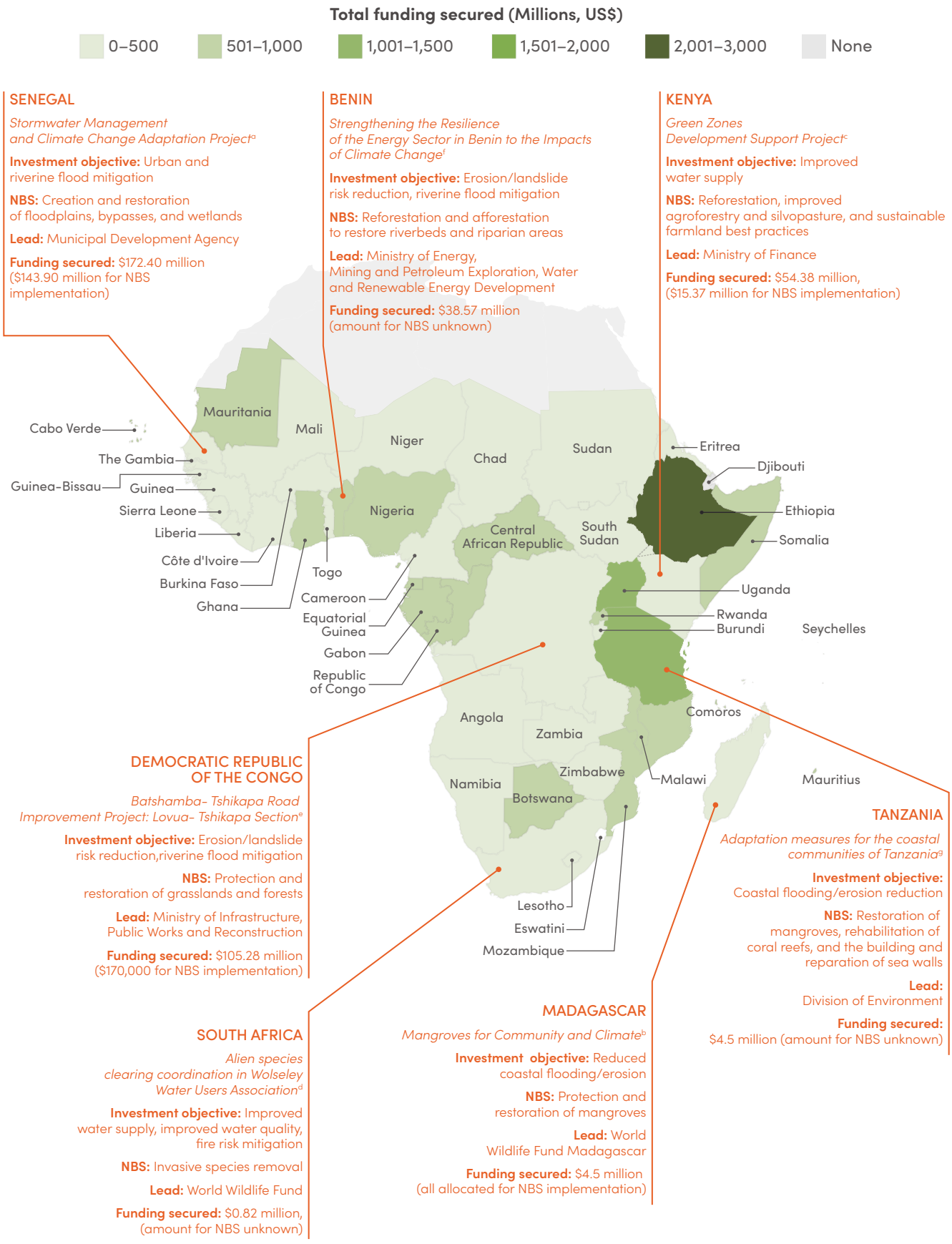
While this division may generally correspond to the sizes of these regional economies and their infrastructure investments, the relatively high investment in Eastern Africa is notable even when considering the size of its economies (IMF 2024). For instance, between 2019 and 2020, Eastern Africa allocated $20–$22 billion annually toward green-gray infrastructure and Western Africa spent $15 billion (ICA 2020). In contrast, Southern and Central Africa allocated about one-third the level of funding (ICA 2018).

Finding 2. NBS projects often had multiple climate resilience objectives

Most NBS projects simultaneously pursued multiple climate resilience objectives (83 percent addressed more than one objective). Many focused on improving water quality, enhancing water supply, and mitigating the risks of climate-related hazards like flooding, erosion, or landslides.

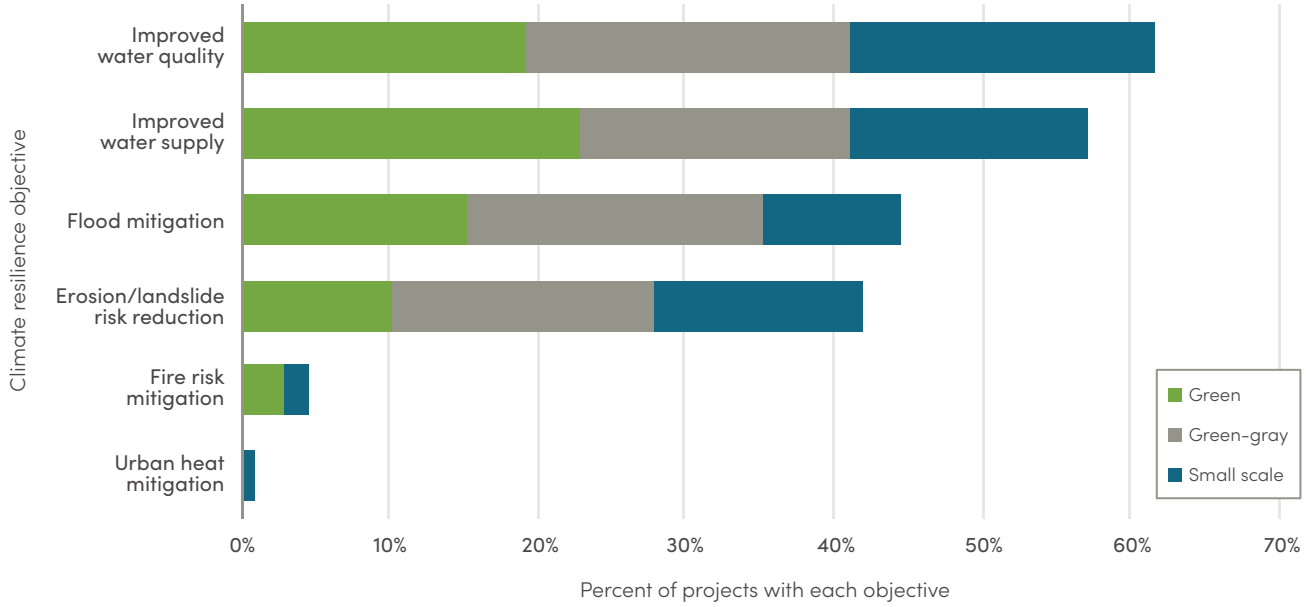
The most recurrent project objectives were enhancing water quality and improving water supply (Figure 12). These projects aimed to protect or enhance water quality by mitigating chemical pollutants, organic disturbances, and erosion's impact on water quality (61 percent). They also sought to safeguard or improve the water supply, including both temporal and spatial water distribution (57 percent). Although water supply was a common project objective, there was limited quantifiable evidence on the impact of NBS on water supply, highlighting the need for more investment in local research and data, and rigorous pre- and post-project monitoring (Acreman et al. 2021).

Figure 11 | Geographic distribution of funding secured for NBS climate resilience projects in SSA, 2012–21



Notes: Countries in northern Africa were not included in this analysis and are shaded in gray. NBS = nature-based solutions. SSA = sub-Saharan Africa.
Source: Authors; a World Bank 2022a; b WWF n.d. c AfDB 2023a; d Lephaila 2021; e AfDB 2023b; f GEF n.d.; g UNEP 2019.

Figure 12 | **Climate resilience objective by project type, 2012–21**



Note: Up to three climate resilience objectives were selected per project.
Source: Authors.

Most of the projects that aimed to enhance water quality or supply used forest restoration as their intervention (57 percent) and most of the work was concentrated in rural areas. Studies in SSA have shown that forest-related NBS interventions, such as native forest restoration or conservation, can consistently deliver positive impacts for water quality (Acreman et al. 2021).

Flood mitigation and erosion or landslide risk mitigation were the next most common objectives, present in 44 percent and 42 percent of the projects in the database, respectively. Slightly less than half (48 percent) of the flood mitigation projects also included erosion or landslide risk reduction as a co-objective. Most flood-related projects focused on reducing riverine flood risk (24 percent) compared with coastal flood risk (14 percent) and urban flood control (6 percent).

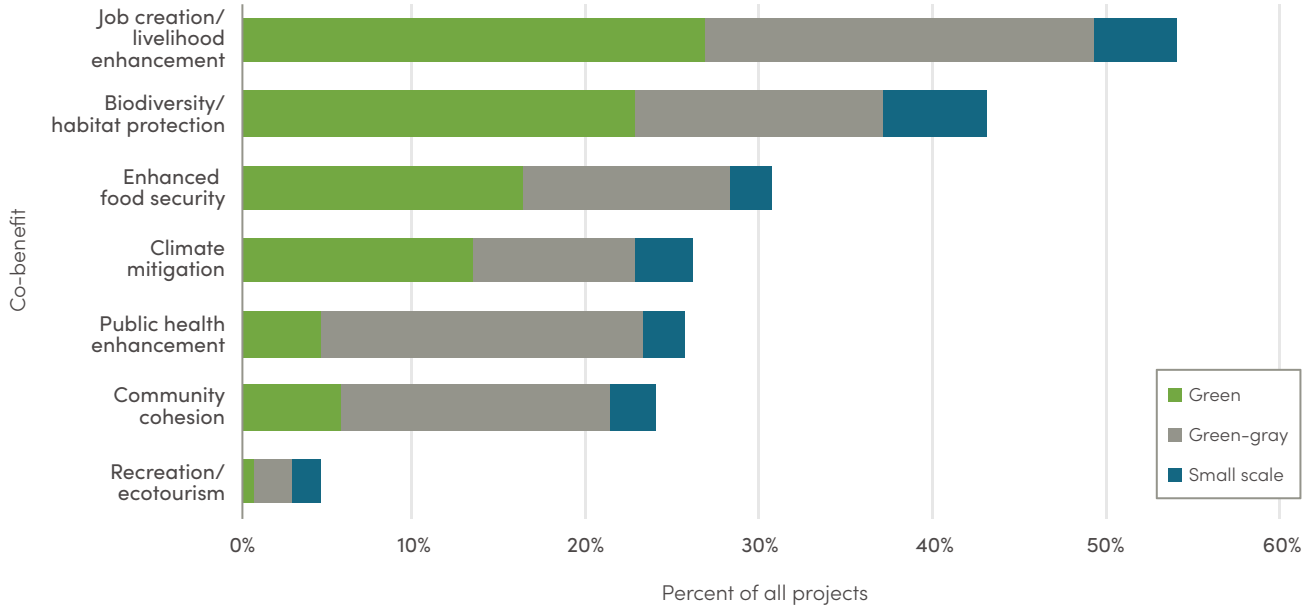
Few projects focused on fire risk mitigation and urban heat mitigation, indicating an underinvestment in these emerging threats. Despite growing evidence that increasing temperatures will impact local fire regimes (Lehmann et al. 2014), only 10 projects were designed to address this challenge. Fire risk will require greater planning and mitigation efforts in rural areas where higher fuel loads exist. Only two projects identified addressed urban heat, and both were small-scale projects that used expanding urban canopy cover, parks, and forests. Urban heat mitigation is an area needing more investment in SSA, as rapid urbanization and climate risks escalate. The lack of focus on this issue may stem from limited awareness, data gaps, resource constraints, and governance challenges (Enu et al. 2023). Urban heat stress will require new approaches to urban planning and investment to protect SSA's rapidly urbanizing populations.

In addition to their climate resilience objectives, NBS projects also identified desired co-benefits, including environmental, economic, and societal outcomes. Of the 246 projects from 2012 to 2021 reviewed, all identified at least one co-benefit, and 207 noted at least three (Figure 13). The most frequent co-benefits included job creation and biodiversity protection (see Box 3), underscoring the multifaceted impact of these initiatives. Job creation is an important factor in SSA due to high unemployment and population growth while biodiversity and habitat protection can help combat ecosystem degradation and green space loss faced by the region.

Additional co-benefits identified include enhanced food security and improved public health. Food security is of great concern in SSA, where climate disasters, global trade disruptions, and ecosystem degradation threaten agriculture and subsistence farmers. Public health improvements were common in green-gray projects, where NBS integrated into water and sanitation efforts helps filter water naturally, reducing disease risk and water treatment costs (Cross et al. 2021).

Community cohesion was another important co-benefit. This was particularly targeted in green-gray projects where it can mitigate conflict among local communities in large infrastructure projects, exemplified by the White Nile Corporation's project in Sudan, which used inclusive decision-making to resolve conflicts among farmers and pastoralists while improving water security and land productivity (see section "Challenges to and strategies for advancing NBS in SSA"). Despite the potential for revenue through recreation and ecotourism, few projects highlighted this as a co-benefit.

Figure 13 | Main project co-benefits, 2012–21



Source: Authors.

Box 3 | Biodiversity safeguards

With the growing biodiversity loss that SSA faces, outlined in section "Intersecting challenges of nature loss, climate risk, and development needs," it is crucial that NBS projects avoid exacerbating harmful practices, such as planting non-native species or disrupting native habitats. Adhering to strict biodiversity safeguards when designing and implementing projects is critical to ensuring ecological integrity and promoting the sustainable management of natural resources.

The AfDB's biodiversity safeguards suggest a mitigation hierarchy where projects should aim to first avoid biodiversity loss, then minimize loss, rehabilitate, and lastly offset impacts.[a] In addition to ecological benefits, biodiversity safeguards contribute to social resilience by supporting local livelihoods and inclusive economic development. Sustainable practices, for instance, can help preserve ecosystem services essential for community well-being, aligning conservation efforts with local development needs.

An example of this approach is Uganda's Biodiversity Trust Fund (UBF), established to address funding shortfalls for halting biodiversity loss and to provide alternative livelihoods for communities in Key Biodiversity Areas. With a seed grant from the US Agency for International Development (USAID), UBF was established as an independent entity capable of pooling funds from international, domestic, and private sources. It can invest this capital in an endowment and use the investment returns to provide grants for on-the-ground projects.[b] Currently, USAID and the European Union both directly contribute resources to UBF, which has redistributed funds to four projects that focus on conserving protected forest areas through community engagement and livelihood transitions. UBF supervises these projects to ensure that they uphold biodiversity safeguards, promoting ecological integrity and social resilience.

Notes: a AfDB 2023c. b UBF 2017.

Finding 3.
Most projects focused on rural landscapes. Forest restoration and improved agriculture were the most common interventions

Rural landscapes were the predominant geography for projects and often used forest management and improved agriculture to achieve climate resilience objectives. Almost 70 percent of projects occurred in rural landscapes, including upper watersheds, agricultural and forested landscapes, and natural grasslands and wetlands. Sustainable forest management and restoration, as well as improved agriculture, were used in 63 percent and 46 percent, respectively, of projects to improve the water supply and water quality and mitigate erosion and riverine flooding.

Sixteen percent of projects focused on urban landscapes from 2012 to 2021. For World Bank and AfDB portfolios, urban projects constituted 25 percent of projects (20 out of 80) during 2012–21, increasing to 50 percent (25 out of 51 projects) for 2022–23. Urban projects relied on constructed wetlands, rain gardens, and urban parks to address flooding and improve water quality. Green roofs and urban canopies were used less frequently (1 percent of total projects).

About 14 percent of projects were implemented in coastal landscapes, including mangroves, salt marshes, coral reefs, seagrasses, and sandy beaches and dunes. The most common intervention for projects in this landscape was the protection, restoration, or management of mangroves to reduce coastal flooding and erosion. Other coastal interventions included the use of coral reefs, salt marshes, seagrasses, and sand dunes to address the same resilience objectives. However, these were used in less than 6 percent of coastal projects.

Fifteen percent of projects were implemented across more than one landscape or were designed to benefit residents not located in the same geography. For example, the Landscape Restoration for Increase Resilience in Urban and Peri-urban Areas of Bujumbura project in Burundi aims to restore degraded land through tree planting and anti-erosion terraces in the upper watershed to reduce flooding, landslides, and erosion (GEF 2020). These interventions benefit both rural residents, living near the implementation sites, and the downstream urban communities in Bujumbura.

Finding 4.
National governments drove project development, often in partnership with MDBs

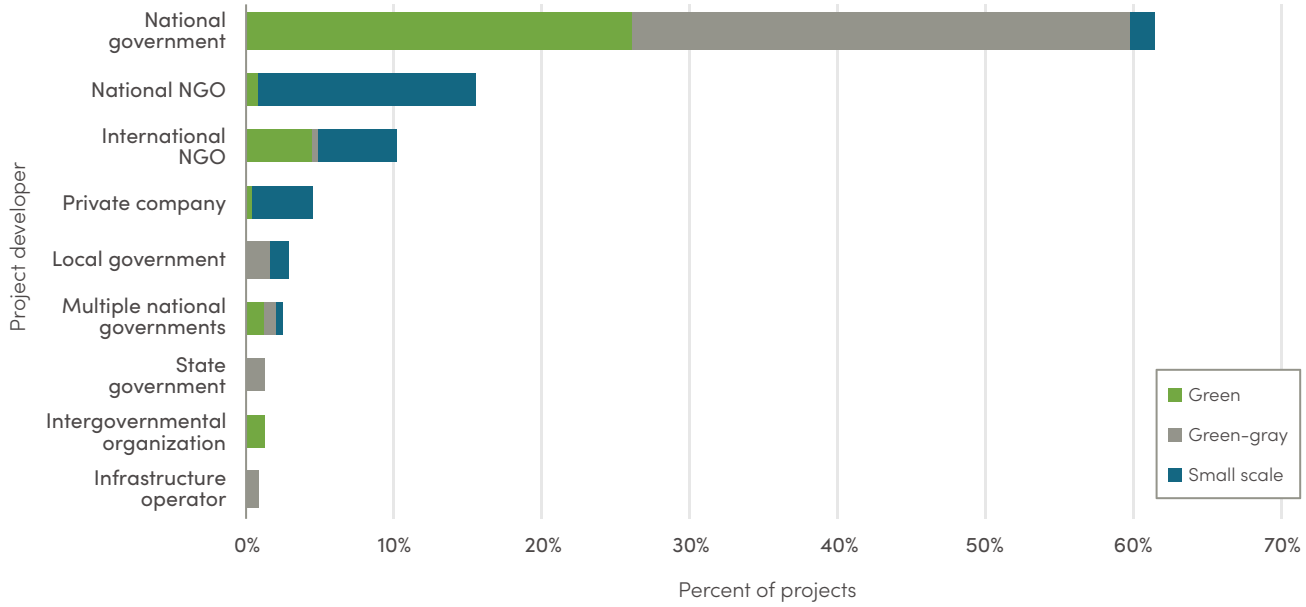
National governments were the primary developers of NBS projects, acting as the executive agency responsible for project implementation in 61 percent of projects (Figure 14). This central role likely stems from their responsibility for policy implementation and their position as key focal points for securing funding from multilateral donors, multilateral funds, and MDBs.[3] Beyond permitting and approvals, national governments also co-funded projects and contributed expertise for climate change, disaster risk management, and infrastructure planning.

Water tanks from the Freetown WASH and Aquatic Environment Revamping Project, Sierra Leone. Photo by AfDB.

The government agencies leading NBS projects in this study were mostly from the environment and natural resources sector with some participation from the infrastructure and development sectors, including energy, transportation, water and sanitation, public works, and sustainable development. The environment and natural resources agencies led most green projects and nearly half the green-gray projects. Infrastructure and development ministries led the other half of the green-gray projects. The participation of sectors beyond agencies that are directly engaged in environmental goals is notable and signals a promising political avenue for mainstreaming NBS.

While national governments were the main intermediaries with funders, they often collaborated with subnational governments, NGOs, and other organizations to implement projects. For these reasons, subnational actors may be underrepresented in the analysis as they were not the primary contact for MBDs and other funders. Subnational governments, with their local knowledge and contextual understanding, are crucial for effective NBS implementation, as they are well-placed to oversee implementation of projects, facilitate stakeholder and community engagement, and align activities with regulatory requirements.

Figure 14 | Types of lead project developers, 2012–2021



Note: NGO = nongovernmental organization.
Source: Authors.

Infrastructure operators, such as hydropower and water utilities, led two projects. However, they stand to benefit financially and socially from investing in NBS (see Box 4 and section "Challenges to and strategies for advancing NBS in SSA"). These investments have the potential to reduce costs for addressing water quality and supply challenges, while creating jobs and enhancing community cohesion for surrounding residents. Yet, many energy and water utility companies in SSA operate without national incentives to invest in NBS. Furthermore, many may lack the necessary NBS capabilities to support future planning, ongoing operations, and management, which can inform how best to obtain cost savings and invest in risk reduction activities. This challenge is exacerbated by issues such as limited asset data management, nonrevenue water, and uneven revenue collection (ICA 2022).

The landscape for small-scale NBS projects is distinct, with national NGOs leading 54 percent of initiatives, followed by international NGOs at 19 percent. NGOs bring valuable expertise in ecosystem restoration and disaster risk reduction, making them well-suited to spearhead these projects. Private companies led 15 percent of small-scale projects, indicating a growing business case for NBS and highlighting the potential for small and medium-sized enterprises to expand their role in scaling up NBS initiatives.

Box 4 | Water utility leading NBS project for climate resilience

The Guma Valley Water Company (GVWC) in Sierra Leone stands out among SSA utilities by actively leading the Freetown WASH and Aquatic Environment Revamping Project. This initiative addresses critical water security challenges in Sierra Leone's capital, Freetown, by restoring degraded lands and fostering community-led watershed protection.[a] GVWC's leadership in this project is driven by its mandate to ensure water security for Freetown's residents. By spearheading conservation efforts in the Western Area Peninsula, GVWC aims to protect the city's primary water source, thereby enhancing the reliability and quality of the water supply.

Note: a AfDB 2019.

Finding 5. MDBs, multilateral donors and funds, and national governments were the primary funders of projects, often using grants or loans

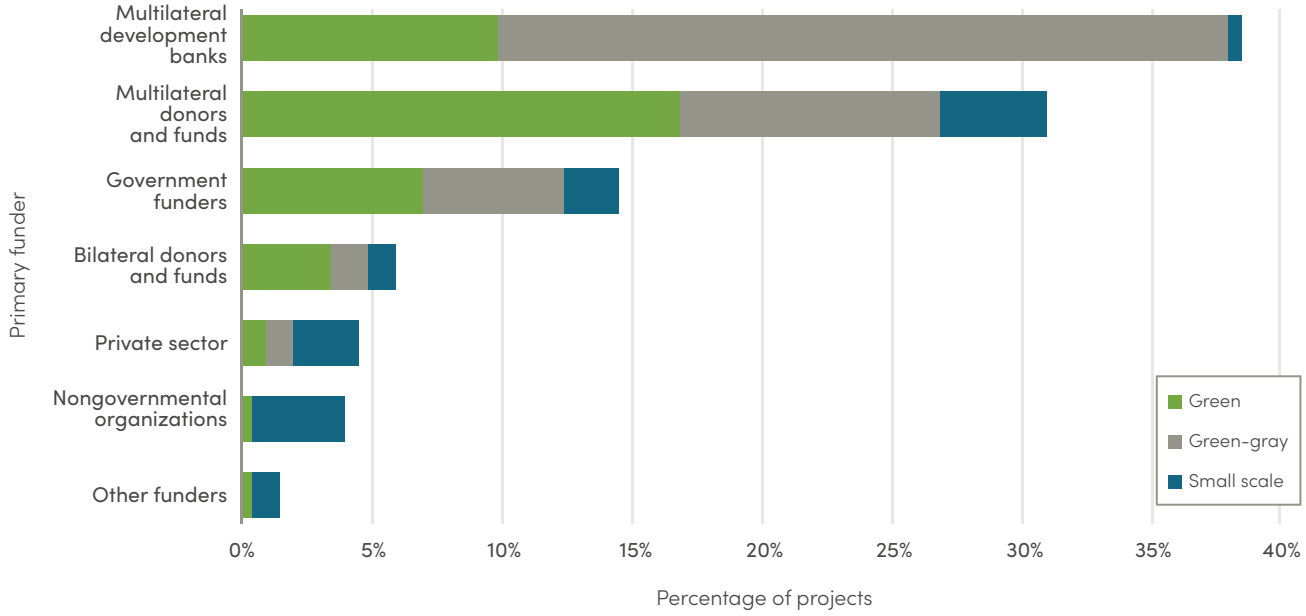
Funders

Seventy-four percent of projects secured funding from multiple organizations, with MDBs as the primary funder, followed by multilateral donors and funds, and then national governments (Figure 15). Notably, MDBs were involved in funding over 97 percent of green-gray projects, underscoring their key role in funding large-scale infrastructure projects. MDBs and multilateral donors and funds were the main source of funding for about 70 percent of NBS projects. This funding pattern aligns with Africa's broader climate adaptation funding landscape, where 70 percent of finance comes from multilateral organizations, and 19 percent from African governments, highlighting both substantial external funding support and a growing domestic commitment to tackling climate change (GCA 2023).

National governments primarily funded green and green-gray projects, while smaller projects were backed by national climate funds and intergovernmental bodies. In addition to frequently serving as the project developer, national governments were the primary funder for 15 percent of projects. Only 2 percent of projects (5 projects) were primarily funded by subnational governments, national climate funds, and intergovernmental organizations (organizations formed across multiple governments). Government funders were listed as co-funders (rather than the primary funder) for 36 percent of projects and multilateral donors and funds were co-funders for 32 percent.

MDBs underwrote 83 percent of loans with the World Bank and AfDB as the primary lenders. The World Bank provided $6.3 billion and AfDB contributed $2.3 billion for both green and green-gray projects from 2012 to 2021. This reliance on MDBs for loan financing reflects their regional role in funding the up-front capital for large-scale green-gray projects (see "Funding and financing strategies for scaling up NBS investments" for a loan example). A technical note (Oliver and Marsters 2022) discusses the methodology for tracking these NBS investments in MDB portfolios from 2012 to 2021. Box 5 provides an updated analysis of these project portfolios with data from 2022 to 2023.

Figure 15 | **Primary funders of nature-based solutions by project type**



Notes: We tagged the primary funder (the largest contributor) for each project and listed up to two additional funders (co-funders) when applicable. This figure shows the primary funders for projects using nature-based solutions. Since multilateral organizations were the most common funder type, we further divided them into multilateral development banks and multilateral donors and funds. The "multilateral donors and funds" category includes entities that provide financial aid pooled from various governments and organizations, such as international organizations like the United Nations Environment Programme and United Nations Development Programme, and funds that mobilize and allocate resources from multiple donor countries or organizations, such as the Global Environment Facility and Green Climate Fund. The "other funders" category includes conservation trust funds, community development financial institutions, research organizations, and religious organizations.

Source: Authors.

Box 5 | MDB key highlights from 2022–23 projects

We conducted an additional analysis of NBS projects from the World Bank and AfDB portfolios that were approved between 2022 and 2023. These MDBs supported a combined 51 projects in 2022–23 for a total of 131 projects approved since 2012. Most projects were green-gray (66 percent) and the remaining were green (34 percent). All projects secured over $1 million, and 51 percent of projects received above $100 million.

The following include key trends for 2022–23 compared with previous years:

- The annual average growth of project initiation tripled between 2022 and 2023 compared with the earlier decade.
- The percentage of urban projects initiated almost doubled, from 26 percent to 50 percent during 2022–23.
- More projects were designed to address erosion and landslide risk and urban heat mitigation in 2022–23 than in the previous decade.
- The percentage of coastal projects tripled from 4 percent for 2012–21 to 12 percent for 2022–23.
- There was a substantial increase in the number of projects incorporating gender equity strategies (incorporated into 98 percent of the 2022–23 projects), and although the inclusion of Indigenous and traditional knowledge increased from 8 percent to 25 percent, it remained underutilized.

The private sector, including companies and corporate foundations, were the primary funder for less than 5 percent of projects. These companies made financial commitments to projects operating near water basins that affected their operations, indicating interest in funding projects that ensure the operability of their businesses or help meet corporate environmental goals.

There was limited representation from subnational governments as the primary funder, reflecting the centralized nature of government funding in many African countries. Only 7 percent of the 57 government-funded projects were primarily funded by subnational governments, including financial contributions and in-kind assistance. This represents a potential barrier for local- and community-led disaster risk reduction, climate adaptation, and infrastructure projects. Strengthening the capacity of local authorities to raise funds via tax revenues and land-value capture tools could enable increased investment in effective, context-specific, and community-driven NBS to address growing climate risks.

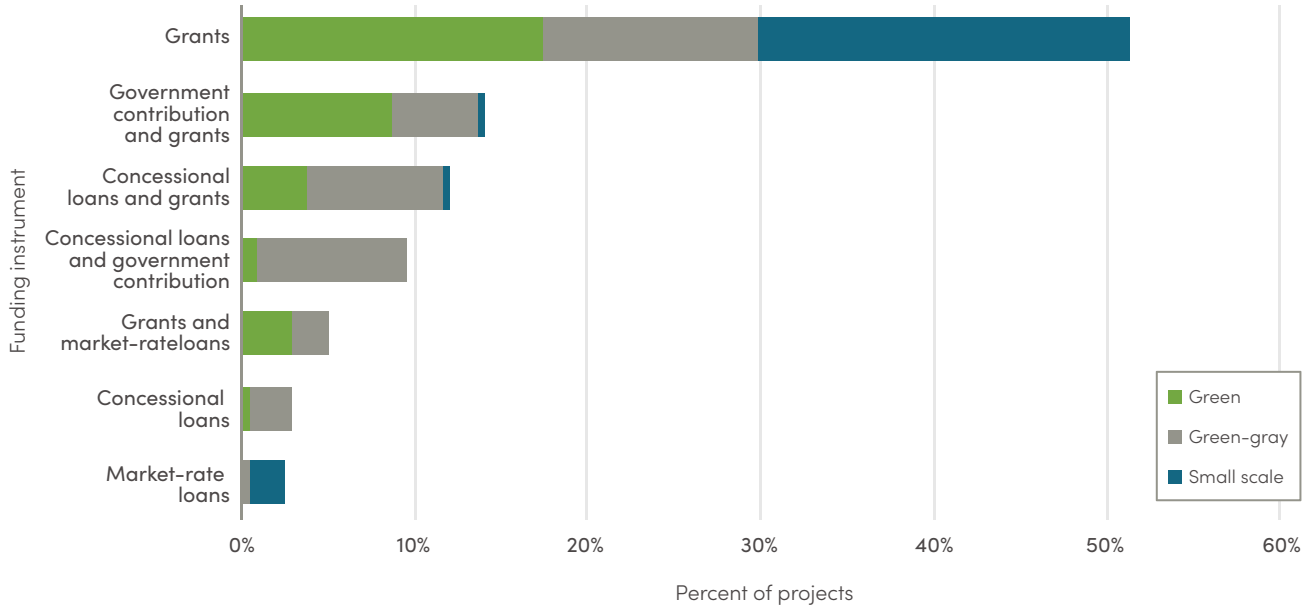
Funding instruments

Projects frequently used a combination of funding instruments, including grants, loans, and government contributions. Grants were the most common funding mechanism, used in 84 percent of projects, either alone or combined with other financial instruments (Figure 16). Most grants came from MDBs, multilateral donors and funds, and national governments. Grants were involved in 51 percent of green projects, 32 percent of green-gray projects, and 81 percent of small-scale projects, demonstrating their importance in funding NBS in SSA. While grants offer the advantage of not requiring repayment, they often do not cover the full cost of project implementation and are typically term limited (i.e., they have a set duration for which they can be utilized), leaving a funding gap for ongoing maintenance costs and long-term project sustainability.

Although loans were used in only 32 percent of projects, these projects accounted for over 73 percent of the total funding across all initiatives, highlighting the use of loans in mobilizing capital for large-scale projects (Figure 17). Most of these loans were concessional and used in combination with grants or government contributions for green-gray projects, emphasizing both the region's need for concessional capital and the effectiveness of integrating NBS with traditional infrastructure projects to secure up-front capital and unlock government repayment streams. While not generally publicly disclosed, loan repayments are often managed through national budgets with specific terms and repayment sources varying by transaction. In comparison, funding for green projects still heavily relies on grants in combination with other instruments rather than loans.

Despite the importance of grants and loans in funding projects, there is a need for greater diversification strategies: small-scale projects offer insights into new funding sources. Although these projects predominantly relied on grants, some also tapped into a broader range of supplementary funding instruments, including market-rate loans, private equity, and compensation and offsets. Five small-scale projects leveraged carbon credit sales as a revenue-generating tool, signaling the potential to better utilize the carbon development market given the prominence of forestry- and agroforestry-related efforts.

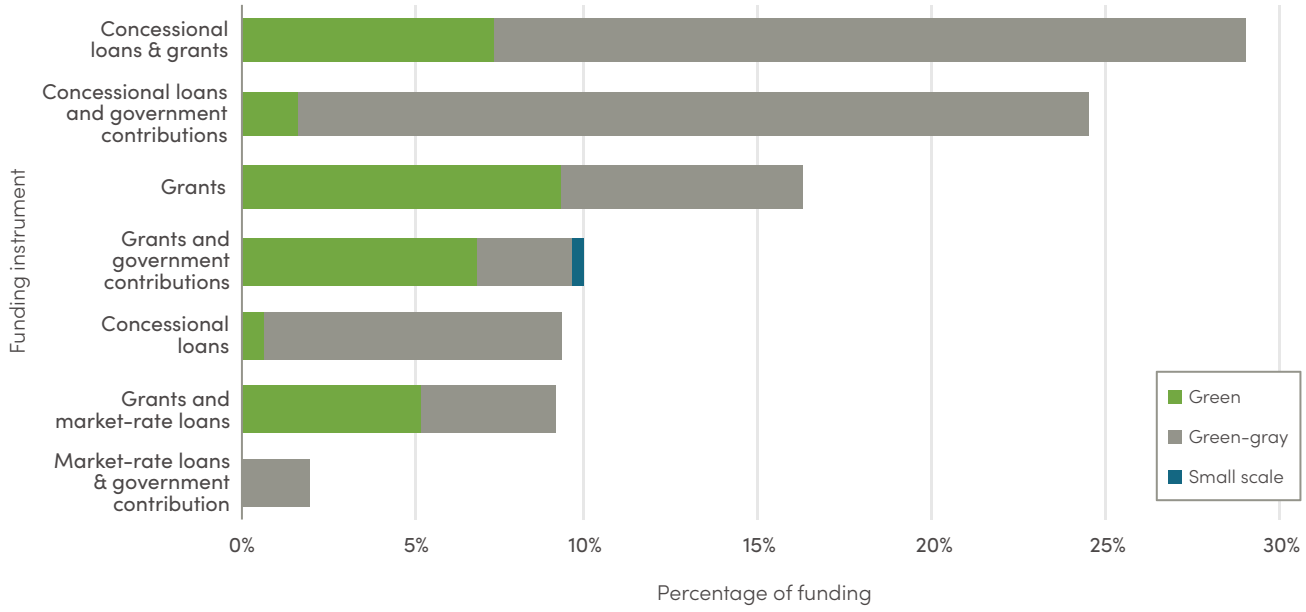
Figure 16 | Funding instruments by project count and NBS type, 2012–21



Notes: We tagged each project with up to two funding instruments, including grants (nonrepayable funds), market-rate loans (debt at market interest rates), concessional loans (low-interest, flexible term loans), and government contributions (including financial or in-kind support from African governments). Less than 1 percent of projects combined grants with offsets, endowments, private equity, or market-rate loans with government contributions, and we excluded these from the figure due to their limited use. NBS = nature-based solutions.

Source: Authors.

Figure 17 | Funding instruments by percentage of funding and NBS type, 2012–21



Notes: Less than 1 percent of projects used market-rate loans, compensation and credits, or grants in combination with endowments, private equity, or compensation and credits. We omitted these from the figure due to their limited use. NBS = nature-based solutions.

Source: Authors.

Finding 6.
Social equity in NBS projects can be enhanced by integrating gender inclusion, Indigenous and traditional knowledge, and context-sensitive approaches in fragile regions

Gender equity

Sixty-eight percent of projects explicitly referenced gender equity in their design and implementation. A gender-responsive approach to NBS takes into account gender-specific climate adaptation needs, vulnerabilities, participation in decision-making, and access to financial benefits from nature-based investments (GIZ 2021). In this study, gender equity was recorded as a simple yes/no variable, meaning we didn't measure the depth or quality of its incorporation. Of note, project documents did not track funding specifically allocated for gender equity initiatives, nor was it consistently clear if such components were mandatory in all project proposals—though more recent MDB projects must include these components. This points to a need for clearer metrics and more detailed reporting to assess how thoroughly gender equity is being integrated into projects.

Governments and multilateral organizations are incorporating gender equity into NBS projects, yet there is significant room for improvement, which could be achieved by enforcing inclusion requirements. MDBs showed an increase in the number of references to gender equity for projects, increasing from 60 percent of projects from 2012 to 2021 to 98 percent from 2022 to 2023. This is likely due to mandatory inclusion requirements according to their environmental and social standards. This approach could benefit other funding entities if they enforced similar standards to ensure gender equity is more consistently integrated into NBS projects across the board. Further, these considerations should be more deeply integrated into project design and implementation, which can be done by training project developers, implementers, and other funders and sharing good implementation practices (World Bank 2023). Expanding such requirements could lead to more equitable outcomes and improve the overall impact of these initiatives.

Scaling Urban Nature-based Solutions for Climate Adaptation in Sub-Saharan Africa (SUNCASA), Dire Dawa, Ethiopia. Photo by Cesar H. Arrais.

Indigenous and traditional knowledge

Indigenous or traditional knowledge are rarely referenced or integrated into projects, which may prevent projects from fully addressing local challenges or maximizing community benefits that could result from more meaningfully incorporating these elements. Only 13 percent of projects included information about incorporating or collaborating with Indigenous knowledge. As a key resource for local climate change adaptation and sustainable land management, Indigenous knowledge refers to context-specific understanding, skills, and philosophies developed by societies with long histories of interaction with their natural surroundings (IPCC 2022b). Similar to the evaluation of gender equity, the incorporation of Indigenous knowledge was evaluated as a yes/no variable through a qualitative scan of project documents. This limited integration may stem from a lack of formal requirements or enforcement mechanisms, unlike the mandated incorporation of gender equity in MDB-supported projects. The absence of specific guidelines or accountability for including Indigenous perspectives may lead project developers to undervalue or overlook the critical role of Indigenous knowledge in sustainable resource management or climate resilience. Additionally, many projects may lack the necessary frameworks or expertise to engage Indigenous communities effectively, further contributing to this gap.

Fragility, conflict, and violence

We assessed the level of fragility in countries with NBS projects by examining frequently used funding sources and financial instruments**.** The World Bank categorizes countries by FCV status each year, reflecting factors such as weak governance, political instability, conflict, and vulnerability to natural disasters. We grouped countries where NBS projects were found into four categories, based on the number of years they had received FCV designations from 2011 to 2021: FCV 0 (no fragility), FCV 1–4, FCV 5–7, and FCV 8–10. Table 1 compares the percentage of projects implemented in these categories and financial instruments.

Although fragile countries can use NBS as a tool to address the nexus between disaster management and FCV (World Bank 2024b), the majority of project financing was directed toward more stable countries, likely due to the more favorable enabling conditions. FCV 0 countries hosted the majority of NBS projects (55 percent). This trend reflects a broader bias in climate fund distribution toward countries with strong governance and regulatory frameworks, as highlighted in recent studies (Meattle et al. 2022). It underscores the critical role of strong governance, cross-sector collaboration, and stable land tenure in achieving NBS implementation.

The use of more diverse funding and financing instruments in low FCV countries highlights how stable environments can foster fiscal innovation. Countries with lower FCV classifications (FCV 0 and 1–4) showed broader use of instruments like endowments, compensation and credits, and private equity. Project funding sizes were nearly double in stable countries ($7.5 million and $9 million for FCV 0 and 1–4 countries, respectively, compared with $4.3 million and $4.8 million for FCV 5–7 and 8–10). However, grants in stable regions still funded nearly half of all projects, suggesting room for diversifying financial instruments.

In contrast, fragile states tended to favor low-risk, small-scale initiatives. In these fragile countries, small-scale projects were more common and projects relied on a mix of government and in-kind contributions, along with market-rate and concessional loans. While high-FCV nations co-funded more projects through government contributions, their limited access to alternative financing often led to a dependence on loans, which in turn can lead to high debt burdens and compromise a borrower's long-term financial stability.

Table 1 | FCV status and financing instruments, 2012–21

INSTRUMENT	FCV 0 YEARS	FCV 1–4 YEARS	FCV 5–7 YEARS	FCV 8–10 YEARS
Percent of total projects	55%	22%	5%	17%
Grants	51%	48%	75%	40%
Grants and government contributions	13%	4%	8%	37%
Grants and concessional loans	7%	25%	17%	9%

Notes: We grouped countries where NBS projects were found into four categories, based on the number of years they had received fragile, conflict-affected, and violent (FCV) designations from 2011 to 2021. We omitted other financing instruments that were infrequently used. Percentages may not sum to 100 percent evenly. Compensation and credits, endowments, and private equity alone or in combination with grants made up 4 percent of FCV 0 and 3 percent of FCV 1–4.

Source: Authors.

"Water towers project in Mau Forest", Kenya. Photo by Patrick Shepherd/CIFOR.

Challenges to and strategies for advancing NBS in SSA

Nature-based solutions hold significant potential for SSA, yet they have not achieved the investment and scale necessary to fully realize their benefits. This section explores the key barriers to NBS implementation, including the absence of enabling policies, limited resources and data, insecure land tenure, and financing challenges. It also identifies corresponding strategies—spanning policy, institutional, technical, social, and financial interventions—to address these obstacles and enhance the adoption of NBS.

Countries in SSA, like many others worldwide, encounter challenges in developing and implementing NBS, including needing better partnerships, governance, and funding and more robust policies (Marsters et al. 2021). Existing policy and planning frameworks often favor traditional gray infrastructure over NBS, and decision-making processes fail to recognize the disaster risk mitigation potential of combining NBS and gray infrastructure (G-G CoP 2020; Pérez-Cirera et al. 2021). The lack of coordination across sectors and levels of government further impedes the integration of NBS in planning, as does insufficient technical capacity and data availability to support landscape-scale assessments (WWAP and UN-Water 2018; UNEP 2022c).

In SSA, limited case studies and evidence on NBS successes make these challenges especially pronounced (Gulati and Scholtz 2020). The region also struggles with data gaps, inadequate technical capacity for NBS design, and rapid urbanization, which increases informal settlements and land conflicts, further reducing available space for NBS projects (UNEP 2022b; Opperman et al. 2021; White et al. 2017; Gulati and Scholtz 2020).

This section examines key barriers to increasing NBS adoption in SSA based on interviews with 50 project developers, funders, and investors, alongside insights from global and regional literature. It highlights the top 10 challenges to planning, implementing, and sustaining NBS, organized around five enabling factors (Table 2). This is not an exhaustive list of relevant challenges in SSA. Each barrier is described with strategies for mitigation, illustrated by regional examples. We identified interviewees through database contact information, literature reviews, and partnerships and did not include perspectives from community representatives or small landowners—an important addition for future research. Further details on the interviews can be found in Appendix B.

Table 2 | **Overview of barriers to and recommended strategies for scaling up NBS in SSA**

ENABLING FACTORS	BARRIERS	RESPONSE STRATEGIES	EXAMPLE
Policy	Lack of incentives or supportive national policies to consider NBS	Create or enhance NBS enabling policies and plans, aligning with NDCs, NAPs, and NBSAPs.	FONERWA, Green Climate Fund, Rwanda
	Policy preference for gray infrastructure	Integrate NBS as alternatives or complements to gray options in disaster risk reduction, infrastructure, or urban planning policies (e.g., standards, official guidelines, permits).	*Roadmap for Resilient Infrastructure*, Ghana
Institutional	Limited budgets and resources for multisectoral collaboration	Improve coordination frameworks and dedicate budget and resources to support engagement.	Building Resilient Communities, Wetland Ecosystems, and Associated Catchments, Uganda
	Lack of institutional buy-in for NBS	Increase awareness of NBS' economic and social benefits.	Green Roads for Water, Ethiopia
Technical	Limited technical capacity to design, implement, and maintain NBS projects	Improve workforce training and education.	Resilient Urban Sierra Leone Project, a component of the "Freetown the Treetown," Sierra Leone
	Insufficient scientific data to inform effective project design and resources for MEL	Develop and increase access to data and site-specific guidance to inform design, implementation, and replication strategies. Invest up front in MEL.	Ecosystem-based Adaptation for Rural Resilience Project, Tanzania
Social	Lack of incentives and resources to build trust and community support for NBS	Ensure safeguards are in place to include IPLC in all project stages, with adjustments to provide direct IPLC benefits and capacity building in territorial governance and NBS before project initiation. Foster a culture of co-design and collaboration to improve project outcomes.	White Nile Corporation, Sudan
	Social conflict and insecure land tenure	Increase clarity and transparency over land tenure and use. Create cooperatives and associations to increase negotiation power with governments.	Land associations, Ghana
Financial	Business cases and revenue streams are not developed for NBS	Increase valuation of natural capital and conduct cost-benefit analyses.	Greater Cape Town Water Fund, South Africa
	Funding covers implementation alone and not longer-term NBS maintenance and monitoring	Increase availability and use of long-term funding or financing mechanisms (e.g., domestic taxes, fees, and offsets) to maintain and monitor NBS.	Disaster Risk Management and Urban Development Project, Niger

Note: NBS = nature-based solutions. NDC = nationally determined contribution. NAP = national adaptation plan. NBSAP = National Biodiversity Strategy and Action Plan. MEL = monitoring, and evaluation, and learning. IPLC = Indigenous Peoples and local communities.

Source: Authors, adapted from Browder et al. 2019.

Policy barriers

National policies can promote NBS by providing a legal and financial framework and resources for integrating NBS into economic development and sectoral strategies and planning (UNEP 2022b). Such strategies can address the drivers of disaster risk and ecosystem degradation, as well as support the creation of climate-resilient infrastructure (G-G CoP 2020). Policies can also influence decision-making processes and procedures that traditionally favor the adoption of gray infrastructure over NBS (Browder et al. 2019; OECD 2020b). An enabling policy can impact financial frameworks which in turn can give priority to NBS in various sectors and country-wide as well as remove barriers that hinder NBS implementation (see Box 6). Multilevel governance structures further enhance policy effectiveness by aligning national priorities with local planning efforts.

Barrier: Lack of incentives and supportive policies to consider NBS. NBS often provide benefits over the long term, but political and budget cycles tend to focus on short-term gains. This mismatch makes it difficult to prioritize and incentivize NBS projects, which may not yield immediate, visible results.

Strategy: Aligning international commitments on climate change and biodiversity, such as NDCs, NAPs, and NBSAPs, with national policies, budgets, and planning processes can foster incentives and promote NBS enabling policies.

Example: Rwanda's Green Growth and Climate Resilience Strategy outlines climate resilience and low-carbon development pathways (RoR 2022). To fund these initiatives, 1 percent of Rwanda's annual national budget is dedicated to the Rwanda Green Fund (FONERWA), creating a dedicated source of capital for NBS and climate adaptation projects (RoR 2022). Strengthening the link between policy and finance, the fund's supported projects have also been incorporated into Rwanda's revised NDC, submitted in May 2020, which emphasizes investments in restoring degraded forests and wetlands, increasing sustainable land management practices, and constructing new terracing to reduce erosion (Africa NDC Hub 2022; WWF 2021).

Barrier: Policy preference for gray infrastructure. Many policies, technical standards, and permits prioritize gray infrastructure, leading to a reluctance among decision-makers to consider green or green-gray approaches. Additionally, gray infrastructure projects are often politically attractive due to their visibility and immediate impact, while there is limited awareness of the economic and environmental benefits of NBS—a challenge further explored under "Technical barriers."

Strategy: Integrate NBS as alternatives or complements to traditional gray infrastructure in disaster risk reduction, infrastructure, and urban planning policies, including standards, official guidelines, and permitting processes. Conducting a climate risk assessment of existing and planned infrastructure

Box 6 | NBS enabling policy and financing framework

To ensure NBS implementation and realize NBS' full potential, a supportive policy and funding framework is foundational. This requires cohesive policies across key sectors and levels, from high-level national development programs to national and subnational sector-specific policies (e.g., action plans, technical guidelines, or urban development plans), and should include dedicated funds to enact regulations and support implementation. An enabling policy and funding environment should do the following:

1. **Remove barriers** to NBS implementation and long-term viability (e.g., control pollution; reduce deforestation and green space loss; restrict construction permits on floodplains, coasts, and biodiversity hot spots; and remove the gray infrastructure preference in permits, guidelines, and technical standards)
2. **Enhance NBS uptake** and related sustainable practices (e.g., create protected areas, secure land tenure, promote integrated water resource management, and support sustainable agriculture)
3. **Allocate funding** to increase regulatory enforcement, protect existing NBS, and incentivize NBS implementation

Key actions for an enabling policy and funding framework include the following:

- Establish common definitions and a shared understanding of NBS across policies
- Adopt an integrated approach to issues and solutions across policy domains, with a focus on reducing environmental impact and leveraging NBS potential
- Encourage collaboration across stakeholders, multilevel and multidisciplinary governance, and engagement from environmentalists and local communities, enabling them to adopt NBS
- Ensure policy coherence by harmonizing instruments and using a blend of incentives and regulations
- Elevate nature's consideration within the hierarchy of laws, empowering enforcement and governance bodies accordingly
- Monitor and evaluate outcomes to refine and strengthen policies over time
- Dedicate funding and capacity to support policy implementation

can reveal vulnerabilities and opportunities where NBS can be effectively integrated with gray infrastructure to enhance resilience, reduce costs, and provide adaptation benefits.

Example: Ghana conducted a climate risk assessment for its transport, water, and energy sectors called the *Roadmap for Resilient Infrastructure in a Changing Climate* (Adshead et al. 2022). This was designed to align and inform Ghana's national strategic and development plans by identifying long-term climate risks and mitigation solutions. The assessment evaluated new green-gray infrastructure such as green-gray slope stabilization along highways to reduce erosion and revegetation along the Densu River to enhance flood resilience. It recommended how NBS can be incorporated into infrastructure planning and feasibility assessments and highlighted financial incentives to do so, like greater access to climate adaptation funding. Demonstrating the multi-benefits of integrating NBS into gray infrastructure projects led to government interest in incorporating NBS into national infrastructure plans and prioritizing them within climate adaptation strategies.

Institutional barriers

Institutional barriers arise from organizational structures, frameworks, and practices that hinder effective collaboration and implementation of NBS initiatives. NBS projects often demand coordination across sectors (e.g., infrastructure and environment) and scales (e.g., national and local), yet in SSA conflicting policies and regulations can make this difficult (Pérez-Cirera et al. 2021). Climate variability and extreme weather events further complicate planning, and limited political will, inconsistent policy enforcement, and bureaucratic delays also hinder progress. Clear roles and responsibilities, and access to the necessary financial and technical resources, are essential but often lacking in the SSA context.

Barrier: Lack of institutional buy-in for NBS. To secure the necessary budgets and resources to effectively execute NBS development, projects require institutional buy-in. Interviewees raised concerns about the lack of this buy-in for NBS projects, particularly from sector agencies, infrastructure funders, and subnational governments. Many noted the disconnect between public-facing policies and internal resource allocation and prioritization.

Strategy: Institutional buy-in for NBS can be boosted through increased understanding of the economic benefits of NBS, such as the cost savings associated with improved delivery or avoided losses of services for infrastructure operators, or other co-benefits, such as job creation and public health improvements. In SSA, these benefits are especially relevant given the region's challenging economic and labor markets.

Example: In Ethiopia, the Green Roads for Water (GR4W) program demonstrates significant economic benefits by using wetlands, floodplain restoration, and water harvesting systems to reduce flood risk, making the case for a national viable model (van Steenbergen et al. 2021). MetaMeta, a private developer, works with the government across agriculture, water, and transportation agencies to identify where green-gray infrastructure solutions could reduce flooding, minimize erosion risks, and enhance water access for farms and groundwater recharge (van Steenbergen et al. 2021). Implemented along 1,100 kilometers of rural roads, GR4W has improved transportation for six million people, generating a fourfold return on investment. This approach saves the government from costly repairs and has boosted agricultural productivity, offering $18,900 per kilometer in benefits compared with $1,800 per kilometer under traditional road repair (van Steenbergen et al. 2021; Yaron 2018). Due to its success, the program has been replicated in 12 other countries globally, including Kenya, Mozambique, Sudan, South Sudan, and Uganda (van Steenbergen and Deligianni 2023).

Barrier: Limited budgets and resources for multisectoral collaboration. Constraints in funding and capacity hinder coordination across public and private sectors, national and local actors, and rural and urban stakeholders and can affect all levels of NBS project development, including inter-agency planning.

Strategy: NBS projects require integrated, cross-sectoral approaches, along with decentralized planning and funding at every stage, to ensure long-term success. Beyond securing resources for initial coordination and stakeholder engagement, dedicated staff and sustainable funding are also needed for ongoing operations and maintenance (O&M).

Example: The Building Resilient Communities, Wetland Ecosystems and Associated Catchments project in Uganda highlights the significant impacts of insufficient coordination among stakeholders. The project aimed to rehabilitate watersheds degraded by unsustainable agricultural practices (Pers. Comm. 2022c). However, challenges arose when farmers were relocated from riparian zones before they received planned support for adopting sustainable practices. This premature relocation, due to poor coordination among national agencies, led to delayed project implementation and increased compensation costs, and required an extended community engagement process to regain trust and support (UNDP 2020). This example underscores the critical importance of integrated planning and early, consistent engagement among all stakeholders to align on project goals, timelines, and resource allocation.

Technical barriers

NBS require specific studies to be conducted to assess the feasibility of solutions, and these need to be tailored to different locations since NBS are highly contextual. This requires technical knowledge of different NBS, integrating them with and comparing them to other engineering solutions, but also community outreach, resource management, data gathering, and funding expertise. Addressing these needs can expand the technical and operational job opportunities in SSA, boosting job creation and enhancing economic productivity through a workforce with diverse skill levels. Furthermore, in SSA and globally, there is an underinvestment in monitoring, evaluation, and learning (MEL) practices, which provide data-driven insights, measured progress, and areas for improvement. These practices enhance accountability, support decision-making, and facilitate adaptive management, leading to better project outcomes.

Barrier: **Limited technical capacity to design, implement, and maintain NBS projects.** The successful implementation and assessment of NBS and green-gray infrastructure projects depend on the availability of technical capacity to prepare and manage these projects effectively. This entails an understanding of green and green-gray technical solutions, cost-benefit analyses of potential solutions, biodiversity and social and economic impact assessments, as well as studies to evaluate ongoing and long-term maintenance of NBS (Silva et al. 2020; UNEP 2022c).

Strategy: Technical capacity can be developed through project-based learning connected to NBS projects in the planning and operational stages as well as through formal training programs, such as engineering curricula. Moreover, improving the technical skills of local operators can spur green job creation, particularly for the agriculture and forestry sectors. Recognizing that countries in SSA are at different stages of NBS adoption, technical assistance can be tailored to meet the needs of national, city, or municipal governments to advance project preparation (see Box 7). Furthermore, integrating relevant content into professional training programs can provide more upstream, systemic capacity building beyond individual projects or enterprises. Knowledge exchanges and communities of practice can also be an effective way to scale the necessary capacity building (see Box 8).

Example: After severe flooding and mudslides in 2017, Freetown, Sierra Leone, committed to reforesting the city and surrounding areas to mitigate flooding and erosion in a campaign known as #FreetownTheTreeTown. One component of the campaign—the Resilient Urban Sierra Leone Project—trained youth to serve as project implementers, maintenance crews, and procurement providers. Using TreeTracker, a mobile application to monitor progress and pay for NBS maintenance, participants of the program photographed where they had planted a tree, verified growth, and received payments for its survival (Fisseha et al. 2021). Due to the up-front investment in training and MEL, the project had planted and monitored 557,000 trees as of 2022, generating 900 green jobs for youths, and restoring 578 hectares of land for flood protection (ILO et al. 2022; FCC 2022; Fisseha et al. 2021).

Barrier: **Insufficient scientific data to inform effective project design.** Given the highly contextual nature of NBS, local data are critical for the preparation of technical studies to identify suitable NBS in different locations. Interviewees highlighted the lack of Africa- and region-specific guidance on the types of NBS that can be applied in local ecosystems and urban areas, the importance of conducting climate risk and vulnerability assessments, and the need for guidance on native species selection to maintain biodiversity and ecological connectivity (Pers. Comm. 2022a).

Box 7 | Project preparation facilities

NBS project preparation facilities and accelerators can help developers advance through the stages of project preparation, from concept to implementation. They can provide early-stage NBS project developers with the data and analysis tools they need to optimize design and planning for appropriate NBS interventions; provide training on project management, as well as financial and business acumen; and support the development of NBS-generated revenue streams. Project accelerators and facilities can foster project pipeline creation, brokerage functions, and partnerships, offering a virtuous learning cycle for project developers, governments, MDBs, and private sector actors. These models can enable faster replication and scale for successes and help advanced projects secure traditional and new sources of funds.

The following are project accelerators already active in the region:

- The Urban Water Catalyst Fund, managed by WaterWorx, provides grants and technical assistance specific to water utilities.[a]
- The Nature Conservancy and Pegasys's Nature for Water Facility offers technical assistance in hydrological, mapping, and economic modeling in addition to finance, governance, and project management to evaluate and accelerate NBS project preparation.[b]
- The Green-Gray Infrastructure Accelerator, managed by WRI's Cities4Forests and Urban Water Resilience initiatives, is providing technical assistance to more than 11 cities in seven countries in SSA to accelerate urban water resilience and social equity using NBS and green-gray strategies.[c]
- The City Climate Finance Gap Fund, managed by the World Bank and European Investment Bank (EIB), supports early-stage project preparation for urban projects.[d]
- The Global Facility for Disaster Reduction and Recovery, housed within the World Bank, helps countries better understand and reduce their vulnerabilities to natural hazards and climate change. It supports the integration of NBS into disaster risk management and climate adaptation strategies, providing technical assistance, capacity building, and financial support for NBS projects.[e]
- The World Bank's Global Program on Nature-Based Solutions for Climate Resilience aims to integrate NBS into climate resilience efforts, offering guidance, tools, and funding to develop and implement NBS projects. This program uses natural systems to address climate risks, improve ecosystem services, and enhance the resilience of communities and infrastructure.[f]

Notes: a VEI 2022. b Nature for Water et al. 2024. c Authors. d World Bank et al. 2020. e GFDRR n.d.a. f GFDRR n.d.b.

Box 8 | Initiatives to build regional knowledge hubs

Several high-profile initiatives to support NBS exist in the region, including AFR100, the Great Green Wall initiative, the Great Blue Wall, and the West Africa Coastal Areas program. These initiatives aim to protect and restore forests, grasslands, and coastal and marine ecosystems for climate resilience, and present an opportunity to develop knowledge hubs among practitioners to share challenges and lessons learned. Table B8-1 summarizes these initiatives, the countries involved, and their progress to date.

TABLE B8-1 | Examples of regional initiatives for landscape and seascape restoration

INITIATIVE	COUNTRIES	OBJECTIVES	PROGRESS
AFR100	Malawi, Mozambique, Niger, Nigeria, Rwanda, Senegal, Somalia, South Sudan, Tanzania, Togo, Uganda, Zambia	Preserve 100 million hectares by 2030. The first phase of AFR100 exceeded expectations by garnering commitments from 32 countries to preserve almost 128 million hectares.	A preliminary assessment of forest and landscape restoration projects in 15 African countries from 2016 to 2021 estimated that there were 900,000 hectares under restoration. Recent estimates suggest over 5 million hectares of land are under restoration.[a]
Great Green Wall (GGW)	Burkina Faso, Chad, Djibouti, Eritrea, Ethiopia, Mali, Mauritania, Niger, Nigeria, Senegal, Sudan	GGW Sahel aims to restore 100 million hectares of degraded land, sequester 250 million tons of carbon, and create 10 million green jobs by 2030. The project was launched in 2007 with an initial focus on 11 countries.	GGW Sahel: By 2020, 18 million hectares of land had been restored (i.e., 18 percent of the initial target of 100 million hectares), 350,000 new jobs had been created, and $90 million in revenue had been generated.[b]
Great Blue Wall	Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, South Africa, Tanzania	Increase marine protected areas from 8 percent in 2021 to 30 percent by 2030 in the South Western Indian Ocean; conserve and restore 2 million hectares of critical blue ecosystems; sequester 100 million tons of CO_2; and create 1 million jobs in the blue economy by 2030.[c,d]	The Tanga-Pemba Seascape in Tanzania and Quirimbas Seascape in Mozambique have been officially designated for marine or coastal protection and restoration.[c,d]
West Africa Coastal Areas (WACA) Management Program	Benin, Côte d'Ivoire, Ghana, Guinea, Liberia, Mauritania, Nigeria, São Tomé and Príncipe, Senegal, Sierra Leone, Togo	Multicountry and regional action is used to strengthen the resilience of coastal communities and assets in 11 countries in West Africa vulnerable to erosion, flooding, and pollution.[e]	Several national projects, regional integration, and support activities are underway. The WACA platform was set up as a mechanism to scale up knowledge, dialogue, and funding for coastal resilience in West Africa.[e]

Note: CO_2 = carbon dioxide. AFR100 = African Forest Landscape Restoration initiative.

Sources: a FAO 2023. b Africa NDC Hub 2022. c IUCN 2022a. d IUCN 2022b. e World Bank 2018.

Strategy: Project developers can work with governments and technical experts to develop guidelines and standards for specific sectors and landscapes in SSA. Such guidance should emphasize scientifically sound decisions for regionally suitable NBS interventions and adaptive management. It should also establish MEL frameworks early in project planning, allocating dedicated funds to continuously self-assess and offer lessons learned for replication.

Example: Tanzania's Ecosystem-based Adaptation for Rural Resilience Project initially planted young, non-native seedlings across 2,000 hectares for water security (GEF 2016) due to a lack of scientific research and guidance. The seedlings were affected by drought conditions, resulting in low seedling survival rates in the first year of planting (Pers. Comm. 2022d). However, consultation with local communities inspired a collaboration with the Tanzania Forest Services Agency, which helped select indigenous tree species and suggested a shift toward planting more mature seedlings to improve survival. To boost success, the project engaged NGOs to train local communities on locally tested restoration techniques (Pers. Comm. 2022d). By adjusting the project design based on local input

and scientific data, the project improved its chances of success, demonstrating the importance of integrating adaptive management and region-specific guidelines from the outset.

Social barriers

Social barriers to NBS project development include a lack of participation and engagement by IPLCs,[4] women, and other typically underrepresented groups in decision-making processes and management, and perceived threats among local communities of NBS to livelihoods and resulting land use changes (UNEP 2022c). Interviewees identified that the challenge lies not just in the availability of resources, but in how the existing resources are prioritized and the baseline capacity of partners to effectively engage and collaborate with local communities. If NBS projects fail to recognize community uses and their role in managing ecosystems, NBS projects can impinge on the rights of communities (UNEP 2022c). These dynamics can lead to mistrust between NBS project developers and local communities, limiting opportunities to explore the benefits and potential trade-offs of more sustainable land management practices or investment in more resilient infrastructure.

Barrier: Lack of incentives and resources to build trust and community support for NBS. Projects often fail to properly engage impacted communities, whether due to budgetary restrictions or limited capacity. This is reflected in the project database presented in section "Status of and trends in NBS for climate resilience in SSA," where only 14 percent of projects reported incorporating Indigenous and traditional knowledge in NBS projects. Although challenging, effective IPLC engagement can uncover and amplify the multiple benefits of NBS projects while helping to mitigate potential negative impacts (World Bank 2023). Conversely, interviewees noted that project developers often assume that local communities will want to be involved in and become the long-term owners of NBS projects (Pers. Comm. 2022e). This is not always the case, and over time this expectation can lead to the failure of NBS projects and reduced trust in project developers. It is important that incentives and governance structures are in place before project implementation to facilitate long-term community ownership.

Strategy: Project developers must apply robust environmental and social safeguards to ensure that affected communities, especially IPLCs, including women and other vulnerable groups, are included throughout all stages of NBS project development and implementation. Participatory stakeholder mapping and consultations should be used to understand community needs; differential access to natural resources; prevalent gender and social norms dictating power dynamics; the sociopolitical context; and vulnerabilities to flooding, drought, and climate risks (Buckingham et al. 2018; Pers. Comm. 2022d; Pers. Comm. 2022j). Even better is the practice of including IPLCs in the co-design and creation of projects, which has been shown to improve project outcomes by ensuring that interventions are contextually appropriate and equitable. These community engagement and social safeguard processes can be established through national policies and standards, stipulations in grants or loans by project funders, and/or internal policies and procedures set by project developers.

Example: The White Nile Corporation's project in Sudan incorporated local farmers and pastoralists in planning and implementation on the restoration of wadis (channels that are dry except during the rainy season), which had been degrading due to unsustainable land management practices upstream. To increase water security, the project developed natural resource management committees that relied on the farmers and pastoralists to co-design improved strategies for rangeland, farmland, and other natural resources using green-gray infrastructure (Hou-Jones et al. 2021). The project not only reduced conflict, but also enhanced water resilience and improved the productivity of agriculture and grazing (Hou-Jones et al. 2021).

Barrier: Social conflict and insecure land tenure. Land tenure insecurity is a significant hurdle for NBS implementation in SSA due to a complexity of factors involving community reliance on natural resources, unplanned development, and limited land tenure records and management. The premise of land ownership as a requirement for certain types of NBS and insecure land tenure can delay project implementation, jeopardize funding avenues, and prevent NBS from being implemented at a scale that can deliver meaningful disaster risk reduction and ecosystem functionality. Consideration of informal uses of public lands is important for restoration or afforestation projects as they may inadvertently disrupt housing, livelihoods, or food sources for groups relying on non-timber forest products, even if they lack legal or formal land ownership. Addressing these equity issues can help ensure that NBS projects are inclusive and do not disadvantage vulnerable communities.

Strategy: Project developers must understand the rights to and uses of land and, where applicable, work with communities and governments to improve land tenure rights and design appropriate engagement strategies and compensation mechanisms for communities. Transparent land tenure can help protect the rights of IPLCs and enable swifter NBS implementation. At the community level, collectives and associations are increasingly important in securing land tenure.

Example: In Ghana, land managers—including agricultural producers and forest managers—formed a land management association to collectively advocate for more secure and transparent land tenure rights with the government (Pers. Comm. 2022g). Through this association, members were able to unify their efforts, amplifying their negotiating power and ensuring that government policies better recognize and protect their interests. Associations and cooperatives like this can be powerful tools for consolidating voices and promoting shared interests; however, it is essential to establish these groups with the full participation of IPLCs to prevent any potential infringement on their rights.

Financial barriers

The financial barriers to investing in NBS are often compounded by concerns about investing in SSA, including unclear regulations, a lack of transparency, and a history of poor performance, among others. Specific to NBS adoption, funders expressed concern about finding investment-ready projects with clear, reliable repayment streams—a challenge common to

NBS projects globally (Browder et al. 2019; Marsters et al. 2021). Two barriers that must be addressed to help projects advance to the next stage of maturity in project preparation and secure financial investment are the following: the challenge of developing a robust business case to quantify cost effectiveness and unlock public and private cash flows, and the lack of long-term funding mechanisms to pay for O&M and MEL to prove that projects can deliver on intended outcomes.

Barrier: Business cases and revenue streams are not developed for NBS. A sound business case clearly demonstrates the financial, social, and environmental benefits of a project that meet a funder's or investor's objectives, such as revenue generation, cost savings, reputational benefits, increased community resilience, or enhanced delivery of infrastructure services. NBS are often cost-effective compared with their alternatives, and the business case should make this clear. The interviewees noted difficulties in creating a compelling business case for NBS due to the correlated barriers of limited scientific data and access to technical expertise. Additionally, while the business case can be theoretically sound, there is a need for new financing and investment models to translate this potential into actual revenue streams.

Strategy: Business cases should be developed in partnership with potential payers and beneficiaries, such as governments, businesses, water and energy utilities, and development banks. This ensures projects are designed to deliver returns specific to the willing payer. For example, an NBS project designed to deliver cost-effective improvements in water quality can unlock funding from water utilities by adopting their water quality targets as the project's own. Designing projects to deliver specific outcomes or co-benefits can help unlock longer-term public and private funds. Conducting natural capital assessments and cost-benefit analyses can help demonstrate the economic value of nature and investment trade-offs for investing in NBS, respectively.

Example: The Greater Cape Town Water Fund (GCTWF) emerged from a coordinated effort involving government entities, businesses, utilities, and international development partners who sought to address Cape Town's severe water crisis from 2015 to 2018 (Holden et al. 2022). By uniting the interests of these diverse stakeholders, GCTWF presented a compelling case for investing in watershed restoration and invasive species removal as cost-effective solutions to improve water availability. The fund projected that a $25.5 million investment in NBS, such as removing invasive species, would generate over 55 billion liters of water annually within six years, whereas gray infrastructure solutions, including reservoirs and desalination, would cost $540 million and deliver 127–146 billion liters in nine years (Stafford et al. 2019). This cost-benefit approach successfully attracted investment from development banks and private partners, which saw a lower financial risk and a promising water security initiative. In 2019, the City of Cape Town, the largest beneficiary, pledged $4.3 million to match private and philanthropic funding, supporting restoration across 23,700 hectares and creating 570 green jobs (Benn 2022).

Barrier: Funding covers implementation and not longer-term NBS maintenance and monitoring. NBS projects need consistent, transparent, and certain cash flows to pay for the up-front costs of design, planning, and implementation; pay for ongoing O&M and MEL costs; or, if debt finance is utilized, repay investors. Unlike gray infrastructure, the up-front capital expenditures (CAPEX) for NBS projects is often relatively small, making them less attractive to institutional investors unless bundled with other projects. For MDBs, standalone NBS projects are typically too small or CAPEX is not large enough, resulting in financing being channeled through intermediated mechanisms or as part of larger infrastructure projects. Counterpart funders, like national governments, typically cover the operating expenditures for these large-scale projects, suggesting that NBS projects need more explicit budget allocations for upkeep and maintenance.

Eldoret-Iten Water Fund, Kenya. Photo by Roshni Lodhia/ The Nature Conservancy.

Strategy: There are several tactics to increase funding sources that can help sustain projects throughout their life cycles, and they should be established from the onset of project planning and preparation. These include creating a governance vehicle or financing vehicle such as a conservation trust fund or water fund that can pool multiple sources of capital, enabling projects to access more diverse funding sources and smooth funding gaps. Other strategies include investing up-front capital in endowments; employing payment for ecosystem services (PES) schemes where the project generates revenue based on the value of the ecosystem service provided; or securing dedicated fees, tariffs, or taxes that can contribute annual appropriations for O&M and MEL.

Example: The World Bank's Disaster Risk Management and Urban Development Project in Niger highlights the consequences of inadequate guidelines and safeguards for long-term funding and maintenance (Soto and Lorillou 2022). Launched in 2013 to expand and restore urban green spaces for flood and heat mitigation, the project lacked clear responsibilities for maintaining and monitoring these areas (Pers. Comm. 2022f). Project funders anticipated community-led maintenance, while the community assumed that project implementers would provide long-term support. This misalignment led to reduced vegetation coverage and diminished benefits. In the project's second phase, the municipality was required to allocate an annual budget, resources, and capacity for green space upkeep and monitoring (Soto and Lorillou 2022), thus course correcting its previous mistake.

GEF Blue Forest Project, Gazi Bay, Kenya. Photo by Rob Barnes/GRID-Arendal.

Funding and financing strategies for scaling up NBS investments

Nature-based solutions face a substantial funding and financing gap that must be addressed to achieve meaningful scale. This section examines opportunities to leverage diverse financial instruments, including green bonds, dedicated taxes, and debt-for-nature swaps, alongside market-based mechanisms like PES and carbon credits. Achieving scalable financing will require strengthened enabling conditions, such as robust policy support; transparent management systems; and enhanced collaboration among governments, private investors, and multilateral organizations.

Investments in NBS are critical for addressing the impacts of climate change, ecosystem degradation, and urbanization challenges in the region. However, current funding flows fall short. In 2021–22, climate finance covered only 23 percent of the estimated annual funding that African countries need to achieve their NDCs and fulfill 2030 climate goals (CPI 2024). This funding gap is particularly pressing in SSA, where scaling up NBS is essential to sustain biodiversity, achieve SDGs, and effectively manage climate impacts.

Although the economic and societal benefits of NBS—such as job creation, enhanced food security, and strengthened public health—are widely recognized, as demonstrated by their prominence in the project database, they remain challenging to quantify and convert into financial revenue streams in SSA (Pettinotti and Quevedo 2023). Project developers are increasingly tapping into different methods to compare and quantify the benefits of NBS, including through cost-benefit analysis, which often favors NBS against traditional gray infrastructure, to make the case to invest in NBS (van Zanten et al. 2023).

The database showed that most projects rely on grant funding either alone or in combination with other instruments, with multilateral organizations often serving as primary funders. Grants and government contributions are the backbone of NBS funding, typically paying for initial project costs, like design and planning, to advance projects toward bankability. However, these sources alone cannot bridge the funding gaps.

There are emerging opportunities to diversify funding sources and leverage a range of financial instruments for NBS in SSA. These include dedicated taxes, certified green bonds, debt-for-nature swaps or climate conversions, and payments for ecosystem services. Though applied with varying frequency, these instruments are already in use by regional actors (Figure 18), whose expertise can be leveraged to structure and support NBS projects. These instruments can be combined to maximize their effectiveness. This section examines eight sub-instruments that can be replicated and scaled, broaden capital access, and diversify funding sources for NBS projects (Table 3).

"Railway Town", Madagascar. Photo by Rod Waddington.

Fiscal and regulatory instruments

Fiscal and regulatory instruments, such as taxes, fees, and subsidies, can provide essential up-front and O&M funding for NBS in SSA. These domestic capital sources are particularly valuable for meeting national climate, biodiversity, and disaster risk reduction targets, as they operate independently of international donors and can be used to secure matching contributions.

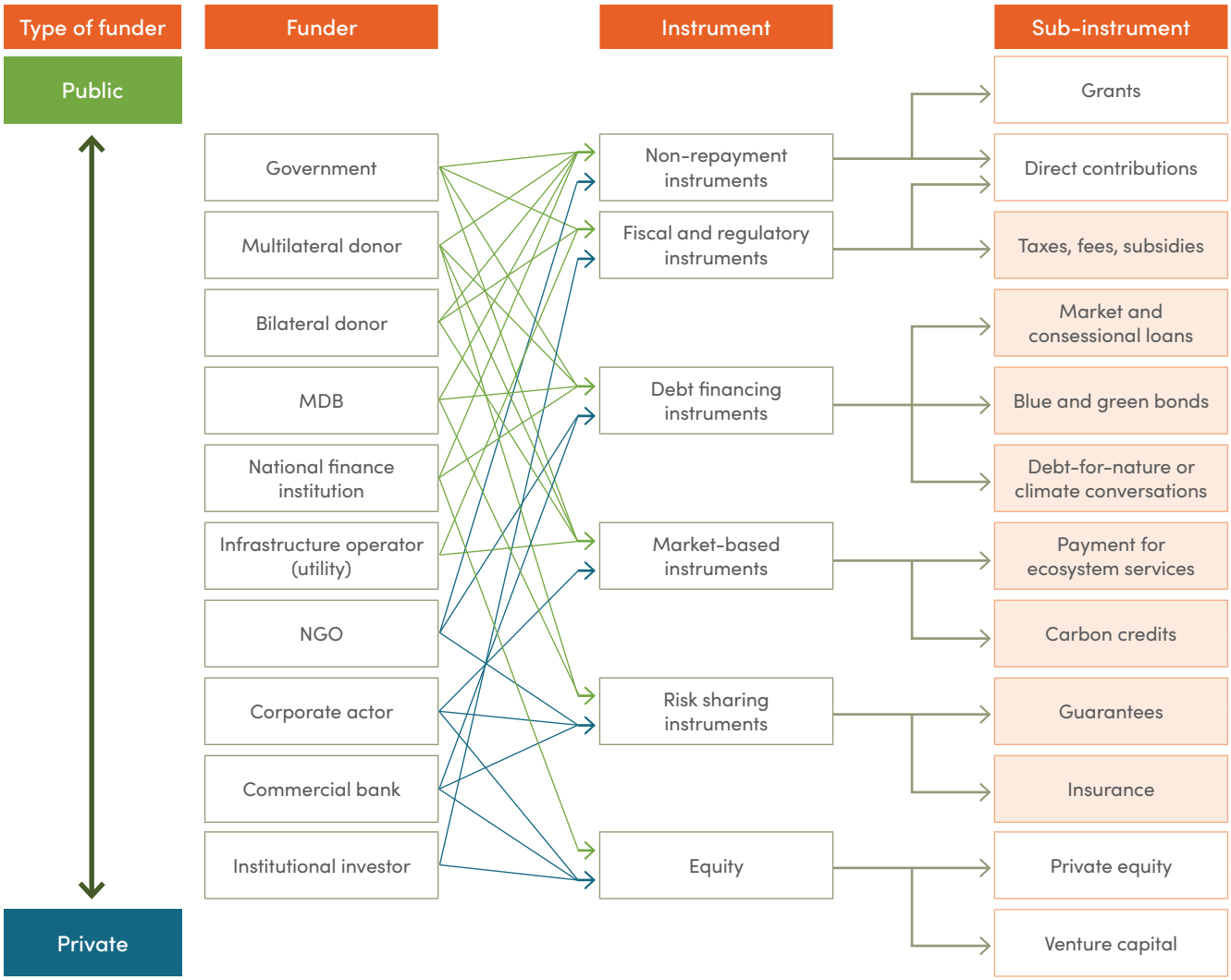
Dedicated taxes, fees, or fiscal policies

Description: Public sources like fees, tariffs, or taxes can serve as anchor funding for NBS projects, especially for ongoing operations and maintenance (Browder et al. 2019; Marsters et al. 2021). Across the region, several national climate funds rely on annual appropriations (funds allocated by a legislative body), such as Rwanda's FONERWA (see section "Challenges to and strategies for advancing NBS in SSA") or Benin's National Fund for the Environment and Climate, which is described below.

Example: Benin's National Fund for the Environment and Climate (Fonds National pour l'Environnement et le Climat; FNEC) is funded through a tax on the use of fossil fuels and greenhouse gas emissions (Pers. Comm. 2023). These dedicated contributions provide a reliable source of matching funds, helping to attract additional international and accredited climate financing, such as from the GCF, which the FNEC has utilized to co-finance adaptation and mitigation projects that align with Benin's NDCs and NAP. One $10 million GCF project required 10 percent co-financing from the FNEC and focused on climate resilience initiatives for rural farmers in northern Benin by building technical capacity and promoting sustainable agricultural practices (Pers. Comm. 2023; GCF 2019). The FNEC also funded green-gray interventions in the Ouémé River Basin to mitigate flood risks and improve agricultural productivity (World Bank 2022c). Currently, Benin is exploring the establishment of a carbon market to meet its NDC commitments and generate additional revenue for environmental and social projects (Pers. Comm. 2023).

Opportunity for replication: FNEC's example illustrates how taxes can be used to finance NBS projects at different scales. To be successful, countries will need to identify consistent sources of revenue and garner strong government support and policy backing.

Figure 18 | **Overview of funders and financial instruments for NBS in SSA**



Notes: This table integrates database findings and climate finance literature and does not represent an exhaustive list of the funders or financial instruments in use in the region. Public funders include multilateral development banks (MDBs), multilateral and bilateral donors (e.g., Global Environment Facility), governments (national or subnational), and national finance institutions (e.g., national development banks or national climate funds). Private funders range from corporate actors (such as a beverage company operating in a local watershed), nongovernmental organizations (NGOs) (e.g., conservation trust funds and corporate foundations), commercial banks, and institutional investors. Infrastructure operators (utilities) may operate as either public or private entities. While both government sources, direct contributions refer to general revenue from national budgets, and taxes, fees, and subsidies refer to the direct mechanism used to generate funding. Sub-instruments marked by a gray box are covered in depth in this section and those with an orange outline indicate that they were used by projects analyzed in this report. Guarantees are used in sub-Saharan Africa (SSA) but have not yet been used for nature-based solutions (NBS).

Source: Authors.

Table 3 | **Funding and financing instruments to increase capital for NBS in SSA**

INSTRUMENT AND DEFINITION	SUB-INSTRUMENT(S)	DESCRIPTION	EXAMPLE(S)	OPPORTUNITY FOR REPLICATION
Fiscal and regulatory instruments *Use taxation, subsidies, and public spending to influence economic behavior, raise revenue, or provide financial incentives to promote desired actions and policy outcomes*	Dedicated taxes, fees, or fiscal policies	Government-imposed financial mechanisms specifically designed to raise funds for environmental stewardship and conservation efforts	Benin's National Fund for Environment and Climate	Countries with strong governance structures
Debt-financing instruments *Raise substantial capital up front by borrowing against future revenue streams or specific project outcomes*	Market and concessional loans	Borrowing money up front with repayment terms and interest	The Restoration of Lake Guiers in Senegal	Countries that lack up-front capital but have high credit ratings
	Certified green, blue, forest, biodiversity, and sustainability bonds	Bonds (private capital) for projects that are earmarked for climate-focused or environmental benefits	Benin's sustainability bond	Countries that lack up-front capital but have high credit ratings
	Debt-for-nature or climate conversion	Financial arrangements where a portion of a nation's foreign debt is forgiven in exchange for commitments to environmental or climate-related projects	Seychelles' debt-for-nature swap	Countries with high debt and in need of conservation or climate-resilient industries
Market-based instruments *Leverage economic incentives and market signals by assigning monetary value to goods and services, encouraging behavior change through financial benefits or costs by market assigning monetary values to the benefits nature provides to humans*	Payments for ecosystem services	Market-based approach whereby beneficiaries of ecosystem services compensate those who manage these services sustainably (excludes carbon finance)	Upper Tana-Nairobi Water Fund	Countries with strong institutional frameworks and community interest
	Carbon credits	Market-based approach whereby reductions in carbon dioxide or other greenhouse gas emissions are achieved through projects such as reforestation, and are then sold as credits to individuals, companies, or governments to offset their own emissions	Kenya's Mikoko Pamoja project Rabobank's Acorn trading platform	Countries with strong institutional frameworks; forest, agricultural, and reforestation projects; and community interest
Risk-sharing instruments *Reduce financial exposure of lenders or borrowers by lowering the perceived risks*	Guarantees	Financial instruments that provide a backstop or assurance to lenders, reducing the risk associated with investing in environmentally focused projects	The Swedish International Development Cooperation Agency's guarantee	Countries with lower credit ratings or projects with higher perceived risk
	Insurance	Financial products designed to transfer and manage the risks associated with implementing and maintaining NBS, providing coverage for potential losses due to operational challenges, thereby ensuring financial stability and sustainability for these projects	R4 Rural Resilience Initiative	Countries with high climate risk, supportive policy environments, and community engagement

Note: NBS = nature-based solutions. SSA = sub-Saharan Africa.
Source: Authors.

Debt-financing instruments

Debt-financing instruments, such as bonds, loans, and debt-for-nature swaps or climate conversions, can be used to fund NBS projects. These instruments allow governments and organizations to raise substantial capital up front by borrowing against future revenue streams or specific project outcomes. While debt-financing instruments can provide critical capital for projects that might not otherwise have access, they can also increase debt burdens and limit future borrowing capacity.

Market and concessional loans

Description: Loans can provide countries in SSA with significant up-front capital to get large-scale projects—like infrastructure—off the ground and spread repayments over time, making it easier to manage large budgets and align costs with future income or benefits from the project. Concessional loans often offer lower interest rates and longer repayment periods compared with market-based loans, making them more accessible to countries with limited financial resources. Typical repayment sources for government loans include general revenue in national budgets.

Example: The AfDB provided a $14.8 million concessional loan to restore Lake Guiers in Senegal, aiming to enhance both ecological (water flow and quality through wetland restoration) and economic (support for agriculture, fisheries, and job creation) functions to benefit over four million people dependent on the lake for drinking, irrigation, and livelihoods. The Project to Restore the Ecological and Economic Functions of Lake Guiers was co-financed with a $1 million grant from the GEF and a $3.8 million contribution from the government of Senegal. The financing enabled the rehabilitation of existing canals and the construction of new channels and reservoirs, increasing the lake's flow capacity from 1.2 billion to 2.1 billion cubic meters per year. This expansion improved water retention and distribution for irrigation, drinking water supply, and ecosystem support. Community members noted that the project greatly increased drinking water availability in Dakar and other major Senegalese cities (AfDB 2020b). By project completion in 2019, AfDB had contributed 98.5 percent of its pledged loan (GEF IEO 2023).

Opportunity for replication: Loans are likely to continue to be a steady source of capital for infrastructure and large-scale green projects, offering avenues to scale up NBS in future financing packages. The participation of reputable lenders, like MDBs, can attract additional co-financing from other lenders or support a blend of grants, loans, and government contributions. Over half of the 297 projects relied on loans or a combination of loans and grants, primarily funded by multilateral organizations, demonstrating the current regional application of loans. Blending loans with grants could help attract new investors to NBS projects by reducing overall project risk.

Scaling Urban Nature-based Solutions for Climate Adaptation in Sub-Saharan Africa, Johannesburg, South Africa. Photo by Jenna Echakowitz.

Certified green, blue, and sustainability bonds

Description: A promising approach to finance NBS in SSA involves issuing certified green, blue, or sustainability bonds. These bonds function like traditional bonds by sourcing capital from private markets and have a mandate to allocate funds to quantifiable and measurable climate-focused or environmental objectives, such as biodiversity conservation or restoration. Green bonds are directed toward low-carbon initiatives, blue bonds finance marine-related efforts, and sustainability bonds combine both environmental and social outcomes. This method of financing allows countries to efficiently raise capital for green and green-gray projects that address environmental and/or socioeconomic challenges.

Example: In 2021, the government of Benin, in partnership with the investment bank Natixis and the UN Sustainable Development Solutions Network, issued a 12.5-year, €500 million ($560 million) sustainability bond at a low interest rate for the region (5.25 percent) and a 0.20 percent negative new issue premium, indicating high investor interest (Caumes and Merle 2021; Pers. Comm. 2023). The bond proposed supporting NBS interventions, including sustainable forest management, agroforestry and sustainable agriculture, urban green spaces and stormwater management, mangrove and wetland restoration, and capacity building and research in environmental sustainability (Caumes and Merle 2021; Pers. Comm. 2023). Benin's bond stands out from the debt-distress trends in SSA due to strong alignment with the SDGs, government backing, and effective market positioning, including participation in a joint International Monetary Fund–United Nations pilot program on SDG financing, which helped boost investor confidence and appeal to environmental, social, and governance–focused investors (Sustainabonds 2021).

Opportunity for replication: Certified green, blue, and sustainable bonds are best poised for large-scale projects, as smaller projects face barriers in covering the higher costs and risk premiums associated with bond issuance unless pooled with other projects. Investment-ready projects already included in national government budgets are particularly well-positioned for bond financing given that national governments are the traditional bond issuers in SSA, with limited access for subnational actors. Governments can leverage their NDCs, NBSAPs, NAPs, and SDGs to align policy priorities with bond proceeds, focusing on eligible and investable NBS projects. This supportive framework can be achieved through legal, financial, and institutional reforms. Transparency in how funds are used and the outcomes they achieve, combined with strategic marketing, is key to attracting local and international investors. Countries with higher credit ratings are generally more successful in securing investments at favorable rates, and MDBs can lend credibility and structuring support.

Debt swaps or conversions

Description: Debt-for-nature/climate conversions offer another innovative approach to allocate more capital to NBS projects. These conversions, with a sovereign guarantee, enable interested buyers—like international finance institutions—to purchase a country's existing debt at more favorable terms. By refinancing the debt at a lower interest rate, the debtor country can realize savings, which are then directed toward climate resilience, conservation, and/or other nature-related activities (Chamon et al. 2022). This approach benefits both the debtor country, which reduces its debt servicing costs, and the environment, as it provides a sustainable funding source for climate and nature initiatives. It leverages the structure of debt refinancing to free up resources without requiring new loans, making it an appealing strategy for countries facing high debt burdens and pressing climate and environmental needs.

Example: In 2015, the Republic of Seychelles restructured $21.6 million of its sovereign debt through a debt-for-nature swap with Paris Club creditors (Belgium, France, Italy, and the United Kingdom) (Convergence and TNC 2017), in partnership with The Nature Conservancy's (TNC's) NatureVest and the newly established Seychelles Conservation and Climate Adaptation Trust (SeyCCAT). TNC facilitated the purchase of the debt by combining $5 million in grants with $15.2 million in loans, complemented by $1.4 million in debt forgiveness from creditors (Convergence and TNC 2017). The terms required the Seychelles to repay the loan at a 3 percent interest rate over 10 years toward conservation efforts, including annual contributions of $280,000 to marine- and climate-related projects and $150,000 to the SeyCCAT endowment, which would help sustain future conservation activities in the Seychelles beyond the life of the loan (Convergence and TNC 2017). This blend of public and private financing reduced risk via partial guarantees, and leveraged public debts, while enhancing local tourism and economic activities through marine conservation, including expanding marine reserves to 30 percent (Convergence and TNC 2017).

Opportunities for replication: Debt relief instruments offer strong potential in SSA, where aligning debt forgiveness to climate goals could ease debt burdens tied to multilateral donors (Chamon et al. 2022). Debt-for-nature conversions can help finance green and green-gray projects or bundle smaller green projects into a larger package to maximize impact. However, these mechanisms must be carefully structured and transparently managed to avoid negative impacts on credit ratings and future borrowing costs. Countries with strong public-private partnerships can replicate Seychelles' model by creating autonomous entities like SeyCATT, which attracted private capital and ensured proper fund management (Booth and Brooks 2023; Pouponneau 2021). Capacity building and engagement at the local level are critical for communities to access and benefit from these funds sustainably. The debt-for-nature model is particularly useful for countries aiming to reduce debt distress, while protecting significant biodiversity areas (IISD 2022).

Market-based instruments

Market-based instruments can be used to incentivize land managers or users to implement and maintain NBS. By assigning monetary value to the ecosystem services nature provides, these tools leverage market forces to attract private sector involvement and/or generate revenue that can be reinvested into NBS initiatives.

Payments for ecosystem services

Description: PES compensate landholders for adopting practices that provide or safeguard ecosystem services. They can be used by governments, corporations, water and energy utilities, agricultural enterprises, or irrigation users, among others, to pay upstream landholders for projects that improve water quality and enhance reliable water supply downstream (Salzman et al. 2018; Ezzine-de-Blas et al. 2016). PES are widely used internationally; however, their adoption in SSA remains relatively sparse. While the database did not reveal any successful projects that relied on PES schemes as the main funding source, project developers in SSA expressed interest in developing these models to support O&M costs for established NBS as part of watershed restoration initiatives above hydropower and drinking water facilities.

Example: The Upper Tana-Nairobi Water Fund (UTNWF) was established in 2014 to address deteriorating water quality and quantity in the Tana River, which supplies 95 percent of Nairobi's freshwater supply and 40 percent of Kenya's hydropower (TNC 2021b). The initiative secured over $7 million by 2015, engaged more than 51,000 farmers in the upper watershed, and provided training on land management practices, leading to a 16 percent improvement in water quality and a 10 percent increase in water availability (TNC 2021b). Identified benefits for municipal water suppliers and hydropower producers included increased water yield, which led to fewer interruptions and an increase in electricity generation, as well as lowered sediment concentrations to avoid backwashing and use of flocculants. It is estimated that the fund would increase annual revenue for the Kenya Electricity Generating Company by $600,000, that it would save the Nairobi City Water and Sewerage Company about $250,000 per year (TNC 2015), and that the $10 million investment in interventions would return $21.5 million in economic benefits over 30 years. Post-business case, the UTNWF board successfully promoted and gathered over $1.35 million in seed capital for a Water Fund endowment. This project has helped transition from investments in gray infra-

Upper-Tana Nairobi Water Fund, Kenya. Photo by Michael North/The Nature Conservancy.

structure alone—like water treatment plants and reservoirs—to green-gray projects that protect water sources upstream (TNC 2021b; IWA n.d.).

Opportunities for replication: PES schemes have the potential to be applied effectively to both large- and small-scale green and green-gray projects in SSA. Notable examples in the region include water funds that protect and restore water sources by connecting upstream landholders with payments from downstream beneficiaries of the improved water quality or flood reduction. Other options include biodiversity conservation programs and sustainable agriculture initiatives. For successful PES implementation in SSA, it is crucial to identify and incentivize beneficiaries of NBS projects to pay for the ecosystem services they receive, either through policy measures or compelling cost-benefit analysis. Hydropower operators, irrigation districts, and water utilities are prime candidates for water fund models. By investing in NBS, these entities can lower infrastructure service costs related to climate impacts and unsustainable practices, generate revenue through enhanced service delivery, and improve long-term climate and water security.

Carbon credits

Description: The growing demand for high-quality carbon credits presents new funding opportunities for NBS projects in SSA. Unlike PES, carbon credits specifically fund projects that reduce or sequester carbon, with one credit equivalent to one ton of carbon dioxide reduced, sequestered, or offset. By incorporating carbon credit sales into NBS business models, project developers can enhance financial credibility and generate cash flows, particularly for forest- and agriculture-related NBS projects. SSA, with its vast savannas, forests, and agricultural landscapes, holds significant potential for these nature-based carbon projects. The region is one of the fastest-growing markets for voluntary carbon credits, attracting interest from investors and corporations (Pers. Comm. 2022k; Pers. Comm. 2022b; Filmanovic and Hunt 2023). Governments are also keen to develop domestic markets. At COP27 in November 2022, the Africa Carbon Markets Initiative was launched, aiming to scale voluntary carbon credits to 300 million by 2030, potentially generating over $6 billion in revenue (Owen-Burge 2023). Nonetheless, carbon markets are still relatively new and volatile, with the global voluntary carbon market experiencing a significant dip in 2023 due to growing criticism, particularly regarding the effectiveness of nature-based offsets (see Box 9).

Example: Rabobank developed Acorn, a trading platform that allows companies and consumers to purchase carbon removal units (CRUs) directly from small-shareholder farmers, bypassing intermediaries and returning 80 percent of revenue to farmers (Rabobank 2023; Pers. Comm. 2022h). This model supports sustainable agriculture practices on small farms by providing up-front funding and ensuring rigorous monitoring and verification of carbon sequestration (Rabobank 2023; Pers. Comm. 2022h). To be eligible, buyers must demonstrate operational emission reduction efforts through science-based targets, written strategies, or proven greenhouse gas reductions (Rabobank 2023). To ensure legitimacy, each CRU represents a verifiable carbon biomass on small farms (less than 10 hectares) and is monitored for 20 years using digital platforms (Rabobank 2023; Pers. Comm. 2022h; Rabobank 2021). In parallel, Rabobank created the Cooperative Carbon Fund, a €100–€250 million ($103–$260 million) fund with an 8-to-10-year horizon and 8 percent target return. This fund provides up-front grants or loans to smallholder farms that are repaid through future CRU sales. Rabobank collaborates with cooperatives to help farmers adopt sustainable practices and aggregate farms to achieve the preferred transaction scale to sell CRUs on Acorn (Rabobank 2023; Pers. Comm. 2022h).

Box 9 | Considerations for carbon credits

Africa saw an 11 percent increase in demand for its carbon credits from 2021 to 2023, while global demand stagnated.[a] However, this growth in credit sales was accompanied by technical and ethical concerns regarding the implementation and impact of projects. Carbon project developers rely on scale (i.e., area of land) to be cost-effective and cover the high transaction costs of taking carbon inventories, improved management plans (i.e., longer rotations, no till, or combining trees into crop rows), and third-party monitoring. The minimal viable project size is estimated to be over 2,000 hectares, representing an aggregation challenge for carbon project developers in SSA, as most farms are less than 20 hectares.[b] In addition, these landscape-scale transactions are often mired in regulatory barriers, land tenure uncertainty, and community conflicts.[c] If not carefully managed, IPLCs may be excluded from benefiting financially from carbon credits generated on their land, raising equity, consent, and fair compensation issues, which could also generate conflict.[d] This highlights the need for clear frameworks for ownership and benefit-sharing.

Concerns also remain regarding additionality, greenwashing, and credit stacking.[e] Credit stacking—when multiple ecosystem services, such as carbon sequestration and biodiversity, are credited from the same project—raises the risks of double-counting and inflated environmental claims. To mitigate these risks, both the quality of carbon credits (supply) and the buyer of these credits (demand) matter greatly. For buyers, carbon credits should be considered as a tool to meet net-zero commitments only after making all possible efforts to reduce emissions.[f] For project developers, there should be a robust and transparent verification methodology to ensure claims are legitimate.[g]

Notes: a CPI 2024. b Jayne et al. 2022; Lowder et al. 2021. c Pers. Comm. 2022l; Pers. Comm. 2022g. d Pérez-Cirera et al. 2021. e Elgin et al. 2023. f Elliott et al. forthcoming. g Elgin et al. 2023.

Opportunities for replication: If appropriately designed and sold, carbon credits can be a sustainable income generator for NBS projects, providing long-term cash flows for operations, maintenance, and monitoring. They can also cover various aspects of land and resource management, from grazing practices and mangrove conservation to sustainable agriculture. Well-designed projects prioritize community engagement and benefit-sharing, ensuring that the economic outcomes of carbon credit sales directly benefit the local communities and farmers involved. Carbon credits can be valuable for both large- and small-scale green projects. For large-scale projects, such as reforestation or mangrove restoration, NGOs and carbon developers can support the aggregation of multiple land parcels to meet the minimum viable project size, making it cost-effective to cover transaction costs and ensuring robust carbon inventory and management plans. For small-scale projects, platforms like Rabobank's Acorn enable direct trading of carbon removal units with smallholder farmers.

Risk-sharing instruments

Risk-sharing, or risk-mitigation, instruments, such as guarantees and insurance, can help manage financial and operational uncertainties, lowering the perceived risks of investment in projects for public funders and private investors.

Guarantees

Description: Guarantees are used to reduce risk for investors and lenders by promising compensation for losses if specific criteria or performance benchmarks outlined in the guarantee agreement are not achieved (e.g., environmental benefits or financial returns). Typically, a project developer or borrower seeks a guarantee from a government entity or financial institution (guarantor), who will assess the project's risk and set terms accordingly. Once the guarantee is issued, it provides a safety net for lenders or investors, making it easier for the project to secure financing. Guarantees have been used in SSA for many infrastructure and clean energy projects, but their application for NBS has yet to be realized. There is great potential for them to enhance the attractiveness of NBS projects.

Example: The Swedish International Development Cooperation Agency (SIDA) leverages Sweden's AAA credit rating to offer guarantees to facilitate public-private sector lending aligned with its sustainable development goals (SIDA 2022). These guarantees act as insurance for lenders, covering a portion of losses if borrowers default, which reduces the perceived risk and promotes private investment. Applicants must demonstrate that private sector lenders would not participate without the guarantee, which can increase transaction costs due to additional diligence and approval processes (SIDA 2022; Pers. Comm. 2022i). A risk assessment is performed by Sweden's National Debt Office, evaluating the political or credit risk of the project and assigning an expected loss value, which translates to a fee charged to the guarantee recipient (SIDA 2022; Pers. Comm. 2022i). While the guarantee has supported a wide array of energy and financial projects, the instrument has not yet been utilized for NBS (Pers. Comm. 2022i).

Opportunities for replication: Guarantees can enhance the attractiveness of NBS projects by mitigating risks and improving their risk-return profiles, thereby mobilizing private sector participation and capital (Meattle et al. 2022; FSD Africa 2022; Barry and Adoh 2021). Several development agencies, including the African Guarantee Fund, the Multilateral Investment Guarantee Agency managed by the World Bank Group, and SIDA, are equipped to issue guarantees in the region. In developing countries, guarantees could have a multiplier effect two to four times higher than direct cash or equity inflows (Hourcade et al. 2021), making them an important tool for banks to de-risk investments in cash-limited environments. The key will be identifying investment-ready NBS projects that can attract private investment with a guarantee. Countries with a supportive environment for private investment, strong governance, and sufficient technical capacity should explore the application of this instrument for NBS.

Insurance

Description: Insurance policies provide financial compensation for losses due to damages or risks, such as natural disasters. While these policies mitigate financial impacts, NBS can help reduce physical damage. For example, insurance covers financial payouts, but NBS like reforestation and wetland restoration for flood mitigation can reduce infrastructure damage, ultimately lowering the frequency and cost of claims. This creates a positive cycle for both insurers and policyholders.

Example: Launched in 2011 by the World Food Programme and Oxfam America, the R4 Rural Resilience Initiative is a comprehensive risk management program to increase the resilience of rural households through risk reduction, risk transfer, prudent risk-taking, and risk reserves (WFP 2021). Initially focused on drought resilience, R4 has expanded to address a broader range of climate risks for vulnerable rural communities. The innovation behind R4 lies in its ability to provide microinsurance policies to cash-poor farmers, who can work off their insurance premiums by contributing labor to community-identified NBS projects, like large-scale irrigation systems, improved soil management activities, or flood diversion canals to capture runoff. The initiative uses weather index microinsurance whereby extreme weather events, such as rainfall or drought, trigger rapid payouts (typically within 60 days) to farmers (Chassin 2024). This approach aligns farmers' and insurers' interests in building resilient infrastructure, increasing household financial security, and promoting NBS as significant contributors to enhanced livelihoods and economic opportunities.

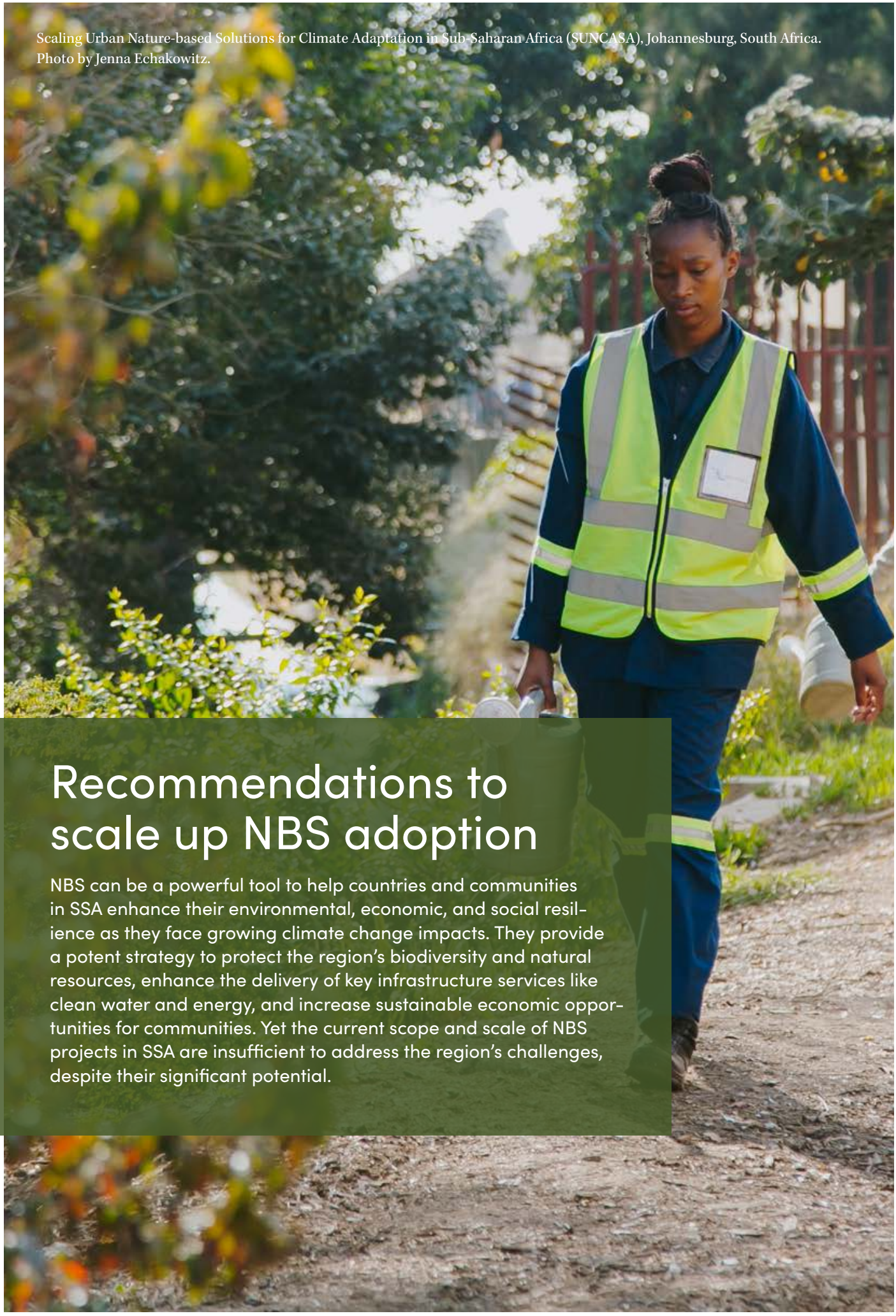
Opportunity for replication: The R4 pilot, originally implemented in Ethiopia, has been successfully replicated in Senegal, Kenya, Burkina Faso, Malawi, Zambia, and Zimbabwe, showcasing its scalability and effectiveness in building resilience across diverse contexts (WFP 2021). Its potential for broader application in drought-prone areas is significant, particularly where agriculture is vital to the economy and rural livelihoods. By integrating tailored relief and risk reduction strategies such as microinsurance with improved water management and drought-resistant crops, communities can enhance their resilience to agricultural drought and safeguard food secu-

NBS, including run-off harvesting measures, installed along three kilometers of road for the "Drain to Gain Project", Kenya. Photo by MetaMeta.

rity, livelihoods, and socioeconomic stability. Engaging local communities and farmers in these initiatives ensures active participation and benefit-sharing, enhancing their buy-in and commitment.

There are a number of funding and financing instruments that can help NBS projects in SSA secure the capital needed to plan, design, implement, and maintain projects. Debt-financing options like green bonds and debt-for-nature swaps or climate conversions can provide significant up-front capital, while market-based tools such as PES and carbon credits can generate long-term revenue for NBS projects. Public funders, such as MDBs and governments, play a key role by providing initial capital and fostering favorable regulatory environments to attract additional public or private investments. Risk-mitigation tools, like guarantees and insurance, can reduce investment risks, making NBS more appealing to private investors.

To garner the interest of commercial and institutional investors, NBS projects will need more than just proof of environmental or economic benefits; NBS projects must clearly show how they will generate consistent cash flow and returns, ensuring they meet the financial goals of both commercial and concessional investors. Leveraging existing expertise and successful initiatives in the region is key to strategically aligning project development with the most appropriate funding instruments to meet local needs. This approach can help countries in SSA scale up NBS investments, support biodiversity, and manage climate impacts more effectively.



Scaling Urban Nature-based Solutions for Climate Adaptation in Sub-Saharan Africa (SUNCASA), Johannesburg, South Africa. Photo by Jenna Echakowitz.

Recommendations to scale up NBS adoption

NBS can be a powerful tool to help countries and communities in SSA enhance their environmental, economic, and social resilience as they face growing climate change impacts. They provide a potent strategy to protect the region's biodiversity and natural resources, enhance the delivery of key infrastructure services like clean water and energy, and increase sustainable economic opportunities for communities. Yet the current scope and scale of NBS projects in SSA are insufficient to address the region's challenges, despite their significant potential.

In this section, we propose six recommendations to increase the adoption of and scale up investment in NBS, while addressing key barriers identified in the region (Table 4):

1. Better integrate NBS into relevant policies and plans across SSA to institutionalize their role in addressing climate and development challenges.
2. Improve NBS project preparation and NBS-specific technical capacity to develop a project pipeline.
3. Enhance NBS project integrity and effectiveness by incorporating gender equity and Indigenous and traditional knowledge, increasing NBS responsiveness to community needs, and safeguarding biodiversity.
4. Diversify funders and funding sources by applying conventional and innovative financial mechanisms.
5. Apply country-level implementation strategies based on natural hazards, fragility, and climate impacts.
6. Improve monitoring, evaluation, and learning to ensure projects deliver intended climate impacts and co-benefits.

Recommendation 1

Better integrate NBS into relevant policies and plans across SSA

Integrate NBS into relevant policies, such as laws, regulations, and technical standards related to infrastructure and climate resilience planning, to further enable their implementation. Reforming existing climate and environmental policies can constitute a first step in integrating NBS in national and local policy frameworks. For instance, several countries in SSA already promote NBS for climate resilience in their climate and biodiversity contributions (NDCs and NBSAPs), and NBS should be further integrated in national adaptation plans and policies. Updating NAPs to prioritize NBS could offer a low-cost approach to enhance climate adaptation efforts while providing co-benefits such as improved climate mitigation, biodiversity protection, and enhanced human well-being.

Table 4 | Barriers to NBS addressed through six recommendations

BARRIERS TO NBS	RECOMMENDATIONS					
	1. Integrate NBS into policies and plans	2. Increase technical capacity	3. Enhance project integrity and effectiveness	4. Diversify funders and funding instruments	5. Apply country-level strategies	6. Invest in MEL
Lack of policies considering NBS	x			x	x	
Policy preference for gray infrastructure	x	x	x	x		x
Limited multisectoral collaboration	x		x	x		
Lack of institutional buy-in	x	x	x			x
Limited technical capacity		x			x	
Insufficient scientific data		x			x	x
Lack of incentives for community support		x	x		x	x
Social conflict and insecure land tenure		x	x		x	
Underdeveloped business case		x		x		x
Lack of long-term funding for NBS	x			x	x	

Notes: See Table 2 for barriers. NBS = nature-based solutions. MEL = monitoring, evaluation, and learning.
Source: Authors.

Mainstream NBS in sectoral policies and planning. To effectively enable NBS, policy reforms must go beyond the traditional scope of environmental and climate policies. Policies in sectors such as water management, agriculture, urban planning, and infrastructure development need to embed NBS as a standard option and adopt an integrated approach. For instance, infrastructure portfolios can consider natural floodplain management or coastal ecosystems as alternatives to traditional gray infrastructure. This can be done through master plans at the national or subnational level for urban development, coastal management, housing, transport, water, and energy (for an example, see Ghana's *Roadmap for Resilient Infrastructure in a Changing Climate*, described in section "Challenges to and strategies for advancing NBS in SSA"). Countries can incorporate natural capital accounting (the process of quantifying and valuing natural resources like forests, water, and biodiversity) to help promote the integration of NBS.

Update policy and regulatory frameworks to remove barriers and unlock funding for NBS. Existing regulations that inadvertently hinder the adoption of NBS should be reviewed and updated. For example, in water or agriculture policies, clear water allowances and pollution control mechanisms need to be integrated to prevent overexploitation and ecosystem degradation. Building codes and land-use regulations should allow the use of blue-green solutions, while limiting construction in vulnerable zones like floodplains and coastlines. Additionally, policy reforms and incentives can drive financing for NBS projects, as demonstrated by Rwanda's Green Growth and Climate Resilience Strategy, which secured a portion of the national budget for NBS initiatives (RoR 2022). These targeted policy actions can serve as a model for other SSA countries to embed NBS into national development agendas.

Recommendation 2

Improve NBS project preparation and NBS-specific technical capacity to develop a project pipeline

Enhancing early-stage project preparation with targeted technical support could significantly improve the bankability and success of NBS projects, especially in low-capacity and FCV environments. Project developers require specialized assistance at this critical phase, where decisions on project objectives and feasibility are made. Preparation facilities and accelerators can be instrumental in delivering this support, helping developers build a strong business case for NBS over traditional infrastructure by demonstrating the comparative benefits and cost-effectiveness of NBS solutions (van Zanten et al. 2023). Developers also need analytical tools and skills in community engagement to adapt projects to the specific ecological, geographic, and socioeconomic conditions of each setting, addressing unique climate threats. Increased integration of gender equity and IPLCs can lead to more successful and enduring outcomes (World Bank 2023). Project developers should also identify weaknesses and barriers in the typical NBS project cycle and help projects advance their planning, design, implementation, and monitoring to improve project readiness for finance (see Box 10).

Lessons and best practices can be drawn from existing programs including the Global Program on Nature-Based Solutions for Climate Resilience (GPNBS), under the World Bank Global Facility for Disaster Reduction and Recovery, and the Nature-Based Infrastructure Global Resource Centre. GPNBS promotes and scales up the use of NBS globally through the sharing of knowledge, tools, and experiences related to design, implementation, and monitoring. This can involve adopting proven strategies, utilizing available resources and guidelines, and participating in capacity-building programs offered by the GPNBS to build a robust pipeline of NBS projects (GFDRR n.d.b). The Nature-Based Infrastructure Global Resource Centre offers a range of resources, including data, training, and sector-specific valuations, to support stakeholders in making informed decisions about infrastructure investments and integrating NBS into infrastructure planning and development processes. Leveraging the insights, methodologies, and successful case studies from these programs can enhance preparation and technical capacity for NBS projects (IISD 2021).

Recommendation 3

Enhance NBS project integrity and effectiveness by incorporating gender equity and Indigenous and traditional knowledge, increasing NBS responsiveness to community needs, and safeguarding biodiversity

NBS projects can help address gender equity gaps through practical actions. Sixty-eight percent of projects in the database—including 98 percent of the projects from the World Bank and AfDB from 2022 to 2023—explicitly mentioned gender equity in their design or implementation. This is a positive development, which should be reflected in non-MDB projects and the practical implementation of NBS. For this, projects should discuss how women and girls are affected by NBS project design (e.g., including street lighting in green parks for safety), and how capacity building activities can ensure gender-balanced participation in training and income-generating opportunities (World Bank 2023). In projects where land tenure is under discussion, project developers should make sure that there is equal tenure access irrespective of gender.

NBS projects can greatly benefit from integrating the insights of Indigenous Peoples and local communities, who possess valuable, intergenerational knowledge shaped by centuries of direct interaction with their environments. Involving IPLCs early and throughout project development fosters shared ownership and responsibility while ensuring that local expertise is harnessed for project success; however, this was done in only 13 percent of the projects in the database. To achieve this, well-defined governance mechanisms are essential, allowing for meaningful participation, dispute resolution, and responsiveness to the unique challenges and aspirations of these communities. Particular attention should be given to land tenure and risk of loss of rights in areas where projects are being considered (Pérez-Cirera et al. 2021; Browder et al. 2019). A culturally sensitive and collaborative approach with

Box 10 | The NBS project cycle

Step 1: Awareness building and upstream engagement. Engage early and often with government officials and local residents to introduce and showcase NBS climate resilience and co-benefits, such as disaster risk mitigation, cost savings, job creation, and improved livelihoods, among others. Upstream engagement is stakeholder engagement conducted before project identification and planning and is crucial for fostering buy-in and support for NBS adoption. Organize introductory regional or sector-specific training sessions and use case studies to demonstrate the tangible economic and social benefits of successful NBS projects.

Step 2: Identification and planning. Map existing natural infrastructure assets and biodiversity hot spots for protection, conservation, or restoration initiatives, safeguarding current ecosystem services. Conduct comprehensive risk and natural capital assessments tailored to SSA's challenges to identify cost-effective climate resilience solutions that protect existing and planned infrastructure, economic development, biodiversity, and communities. Identify potential NBS locations using spatial and data analysis, incorporating climate, biodiversity, and water risks and engaging IPLCs for locally led solutions.

Step 3: Design and implementation. Develop cost-benefit analysis or other valuation tools to integrate NBS with gray infrastructure. Engage key stakeholders, including IPLCs and other potentially vulnerable affected groups, in the design and implementation of NBS to identify trade-offs, discuss compromises and solutions, and enhance project benefits. Improve technical capacity to integrate NBS with traditional engineering through formal training, on-the-job learning, and sector-specific guidelines. Identify indicators for long-term impacts, such as socioeconomic, biodiversity, climate, and water resilience indicators. Confirm and clarify roles, responsibilities, budgets, resources, and activity sequencing. Clearly define O&M responsibilities and MEL indicators during design and planning and confirm them during implementation.

Step 4: Operations and maintenance. Dedicate funding and capacity to support maintenance and monitoring of projects. Incorporate adaptive management to improve project delivery and impact. Document and share lessons learned.

Step 5: Monitoring, evaluation, and learning. Develop cost-effective, locally applicable MEL tools based on pre-identified indicators to establish baselines and measure NBS success over the short, medium, and long terms. Train project developers on geographic information system, spatial, and remote sensing tools to enhance measurement.

grassroots organizations is necessary to design and implement NBS projects that meet the specific social and cultural needs of people in SSA. Without such integration, there is a risk of maladaptation, where projects could harm livelihoods rather than support them, making early inclusion of IPLC concerns crucial for project success (World Bank 2023).

Active involvement of local communities ensures that projects are tailored to their specific needs and conditions, fostering a sense of ownership and responsibility and creating socioeconomic benefits relevant to local needs. This can be achieved through participatory planning processes, regular consultations, and inclusive decision-making frameworks. Including participatory approaches in early stages of project development can help developers identify existing inequities that can be addressed through inclusive NBS projects. This may require identifying groups at risk of exclusion from NBS project benefits, understanding the reason why these groups are being excluded, designing actions to address these gaps, and measuring the impact of proposed actions (World Bank 2023).

NBS projects must result in net gains for biodiversity and ecosystem integrity to ensure long-term environmental sustainability, enhance climate resilience, and meet global conservation and development goals. Fifty-seven percent of projects did not explicitly include biodiversity enhancement or habitat protection as a co-benefit of projects despite the importance of ecosystem health to achieving climate resilience outcomes. Projects that use nature to deliver climate outcomes but introduce invasive species or plant monocultures or displace natural ecosystems undermine the true goals of NBS as these practices can negatively impact native species and compromise ecosystem integrity. Effective NBS must align with efforts to deliver both human well-being and biodiversity benefits. To achieve this, projects need to adhere more strongly to biodiversity safeguards, directly respond to evidence-based assessments of the drivers of ecosystem loss, and avoid or mitigate unintended harm (IUCN 2020).

Recommendation 4

Diversify funders and funding sources by applying conventional and innovative financial mechanisms

To ensure long-term success and scalability, NBS projects will need to explore sustainable financial strategies that go beyond international grants. As laid out in the report, NBS are most often financed from public sources, with international concessional and grant financing forming an important part of financing streams. These forms of financing are critical for capacity building, technical assistance, and early-stage project development, helping to reduce financial risk and attract further investment. However, projects need a broader range of funders and funding instruments to reduce fiscal gaps associated with the cyclical nature of grants, particularly for medium-to-long-term maintenance and operations and monitoring costs. Based on the analysis, this report recommends the following:

- **Continue to tap into conventional funding streams for large-scale green and green-gray projects** from infrastructure funders, like MDBs and multilateral donors, using both market-rate and concessional loans, when fiscally appropriate. This will require additional facilitation to access bank loans and local revenue sources for repayment. Continue to integrate green elements into relevant infrastructure sector portfolios (e.g., water and sanitation, housing and urban development, energy, and transportation).
- **Market the climate and biodiversity benefits of NBS projects to unlock committed climate and biodiversity finance** through the issuance of green, blue, and sustainability bonds or debt-for-nature swaps or climate conversions. These innovative financing mechanisms require clear articulation of a project's intended climate, biodiversity, and social impacts, along with robust monitoring and reporting systems to ensure accountability. Fully aligning NBS projects with national environmental and climate priorities enhances their credibility and can help leverage international funds. Additionally, securing accreditation with international funding bodies can provide access to larger funding pools and enable co-financing opportunities.
- **Increase domestic sources of funding for NBS** through fees, taxes, and subsidies that can provide capital for project initiation, O&M, and ongoing monitoring, or serve as repayment sources for debt finance. Use these dedicated sources of capital to seed national climate funds, conservation trust funds, or water funds for operations and endowments, allowing them to pool multiple sources of capital, thus enabling projects to access more diverse funding sources and smooth funding gaps. Capture the cost savings and additional economic output of NBS to secure local contributions from NBS beneficiaries, such as infrastructure operators or bottling companies, through PES schemes.
- **Continue to develop the revenue-generating potential of NBS.** The carbon market offers the most mature market for NBS projects to tap into, although biodiversity credits may soon become a more mainstream option as well. The integrity of these revenue-generating products is paramount to avoid greenwashing, credit stacking, and the inequitable distribution of benefits.
- **Deploy more risk-sharing instruments, such as guarantees and insurance**, to address the perceived and real risk of investing in NBS projects in SSA. Guarantees can play a significant role in de-risking NBS projects, potentially spurring greater private sector investment in disaster risk mitigation and infrastructure development in the region. Insurance products will be an important tool to safeguard existing infrastructure assets and community livelihoods, like the R4 microinsurance policy. Aligning insurance policies with NBS investments can yield complementary financial protection and reduce physical damage related to climate impacts.

Recommendation 5

Apply country-level implementation strategies based on natural hazards, fragility, and climate impacts

Countries in SSA should establish national priorities for NBS investments that directly address climate change impacts and natural disaster risks specific to their regions. Since these impacts vary widely across SSA, targeted NBS interventions can be more effective in areas of high climate risk, potentially yielding significant welfare gains by increasing resilience. This approach involves not only restoring or creating green or green-gray infrastructure but also strategically protecting natural assets that play a critical role in disaster prevention—such as green belts around urban areas, forested catchments for flood regulation, and coastal dunes and beaches that buffer storm surge impacts. Prioritizing NBS investments at the country level should consider local climate risk exposure, relevant NBS options for the geographic context, institutional capacity, FCV conditions, and financing opportunities (see Table 5).

Urban areas, in particular, require increased investment and targeted approaches to address infrastructure demands and enhance resilience to hazards such as heat stress, flooding, and green space loss. This report found that urban NBS projects received limited funding. For instance, only two projects from 2012 to 2021 addressed urban heat mitigation, both of which were small scale. Addressing these challenges necessitates tailored approaches that consider the complex socioeconomic dynamics, spatial limitations, and local governance structures unique to cities. Effective urban NBS must integrate natural systems into densely populated areas while addressing critical issues such as informal settlements and competing land uses to ensure equitable and sustainable outcomes.

Supporting the implementation of NBS interventions in FCV countries requires strategies to further tailor interventions to their unique sociopolitical contexts. Countries with higher fragility and conflict tend to have a reduced ability to borrow, lower institutional capacity, and less access to funding. In addition, countries characterized by fragility are disproportionately impacted by climate-induced disasters and have a harder time recovering (Jaramillo et al. 2023). NBS can be an impactful tool to build resilience to climate hazards as well as generate additional co-benefits such as job creation, livelihood enhancements, and community cohesion. Investing in community-driven projects that increase local resilience and provide immediate co-benefits can be particularly effective in these settings (World Bank 2024b).

Table 5 | **Climate impacts, exposure, and related NBS strategies**

CLIMATE-RELATED NATURAL HAZARD	EXPOSED COUNTRIES	CONSIDERATIONS FOR DEVELOPING IMPLEMENTATION STRATEGIES				
		NBS interventions	**Geography**	**Planning and policy**	**Financing options**	**Fragility, conflict, and violence**
Riverine flooding	**>2M people exposed to flooding annually:** Ethiopia, Nigeria, Somalia, Sudan **1–2M people exposed to flooding annually:** Democratic Republic of the Congo, Kenya, Madagascar, Mozambique, Tanzania	Restoration or protection of wetlands, floodplains, and forests	Highlands: Countries with highlands, such as Ethiopia, can implement forest conservation or restoration projects in watersheds to reduce flooding and mitigate landslides and erosion risk. Plains: Countries with extensive plains, like Nigeria, can benefit from improved grasslands to manage floodwaters and effectively enhance water retention. Different geographies present varying opportunities for integration with gray infrastructure such as flood bypasses, dikes, and levees.	Governments should mainstream flood risk considerations into policies for relevant sectors. This may include removing perverse incentives that drive degradation, improving watershed management through technical assistance to farmers, and integrating watershed protection into the water supply development agenda.[a]	Economic analysis can determine the return on investment of NBS to avoid flood-related losses. This can build on the work that some countries, such as Ethiopia, have done with NGO partners to build baseline water risk models.[b] Downstream beneficiaries, including governments and businesses, can serve as payers for PES schemes.	FCV: Countries like Sudan and Somalia may choose to focus on many small-scale restoration projects that are highly community driven to ensure interventions survive in a low-resource environment. Non-FCV: Countries like Kenya can invest in larger-scale restoration or floodplain projects, especially upstream of major cities.
Coastal flooding	**>500,000 people exposed to a 100-year flood:** Benin, Mozambique, Nigeria, Senegal, Somalia **200,000–500,000 people exposed to a 100-year flood:** Angola, Cameroon, Guinea, Madagascar, Sierra Leone, Tanzania, Togo	Measures involving mangroves, coral reefs, beaches, and dunes	In high-sediment coastal environments on plains, on barriers, and in deltas, dunes and mangrove measures may mitigate impacts from storms and reduce coastal erosion. Many such coastlines are found in West Africa, Benin, and Senegal. In countries such as Mozambique with partly rocky and coralline coastlines, reefs reduce storm surge, wave impacts, and coastal erosion.	Governments can promote integrating green elements like mangrove or coral reef restoration into infrastructure projects like sea walls and implement robust zoning regulations to prevent construction in high-risk areas.[c]	Disaster resilience funds can pay for coral reef protection or restoration. Ecotourism or fishing revenues can support these activities as they both benefit from healthy coral reefs.	FCV: Countries like Somalia may require high-capacity, multilateral donors to assist with small-scale projects that are also linked to livelihood provision, such as mangrove protection. Non FCV: Countries like Seychelles can invest in larger-ticket coral reef investments, perhaps linked to ecotourism or fisheries projects.

Table 5 | Climate impacts, exposure, and related NBS strategies (cont.)

CLIMATE-RELATED NATURAL HAZARD	EXPOSED COUNTRIES	CONSIDERATIONS FOR DEVELOPING IMPLEMENTATION STRATEGIES				
		NBS interventions	Geography	Planning and policy	Financing options	Fragility, conflict, and violence
Agricultural drought	**Very high exposure to agricultural drought:** Botswana, Lesotho, Mauritania, Namibia, Zimbabwe **High exposure to agricultural drought:** Burkina Faso, Chad, Kenya, Mali, Mozambique, Niger, Senegal Somalia, South Africa, Sudan, Zambia	Measures involving wetlands and floodplains, terraces, agroforestry, and sand dams	Southern Africa and the Horn of Africa face agricultural drought due to a lack of precipitation and increasing temperatures. Agroforestry and sand dams can improve soil moisture retention, reduce runoff, and enhance water supply, supporting agricultural resilience and productivity. The Sahel region faces a lack of precipitation, increased temperatures, and a lack of water mobilization. Small-scale water mobilization can help collect water locally close to point of use.	Governments should implement regulations and incentives to promote sustainable water use, focusing on sector-specific guidance at the basin level. This includes targeted guidance for irrigation—one of the primary water-consuming activities in many SSA countries—while encouraging sustainablegroundwater use where resources remain untapped.[d] Governments can also promote drought resilience through policies that scale up NBS practices. For example, policies that allow farmers greater rights to manage trees on their farms and grazing areas can increase agroforestry practices.[e]	Aid and philanthropic funds may be needed to support initial project development, but more mature projects can seek to use revenue from agricultural production and non-timber forest products, among others.	FCV: Countries with high fragility may focus on many small-scale agroforestry or terracing projects that are highly community driven to ensure survival in a low-resource environment. Non-FCV: Countries like Botswana can invest in larger-scale projects linked to government investments in agricultural extension services and other efforts to increase technical capacity in communities.[f]
Urban flooding	**>100 km^2 of built-up area exposed to flooding:** Chad, Ghana, Mali, Nigeria, South Africa, Sudan, Tanzania **25–100 km^2 of built-up area exposed to flooding:** Angola, Benin, Botswana, Burkina Faso, Cameroon, Côte d'Ivoire, Democratic Republic of the Congo, Ethiopia, Guinea, Kenya, Liberia, Madagascar, Malawi, Mozambique, Niger, Senegal, Sierra Leone, Somalia, Uganda, Zambia	Measures involving wetlands and floodplains, stream renaturation, and bioretention areas	Dry climates: In countries with drier climates, like Sudan, developing green spaces and bioswales can help absorb water from irregular rain events, mitigating urban flooding. Tropical climates: Tropical countries like Ghana can invest in wetland restoration to manage stormwater runoff and reduce urban flood risks.	Governments should enhance disaster preparedness by mandating the use of permeable surfaces in new developments, offering incentives for retrofitting existing infrastructure with green roofs and rain gardens, and investing in comprehensive stormwater management systems that combine green and gray infrastructure solutions.[g]	Stormwater utilities or operators of transportation infrastructure may be potential funders of green roofs or rain gardens for stormwater management. In areas with a robust ratepayer base, tariffs may help finance NBS.	FCV: Countries with high fragility like Sudan may choose to focus on community-based projects to create natural stream buffers. Non-FCV: Countries like South Africa can invest in large green-gray infrastructure systems such as large-scale wetland restoration and urban river restoration.

Table 5 | Climate impacts, exposure, and related NBS strategies (cont.)

CLIMATE-RELATED NATURAL HAZARD	EXPOSED COUNTRIES	CONSIDERATIONS FOR DEVELOPING IMPLEMENTATION STRATEGIES				
		NBS interventions	Geography	Planning and policy	Financing options	Fragility, conflict, and violence
Urban heat	**>15 days of high heat stress days** per year in urban areas: Benin, Burkina Faso, Chad, Eritrea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Togo **5–15 days of high heat stress days** per year in urban areas: Cameroon, Côte d'Ivoire, Ghana, Guinea, Kenya, Mauritania, Mozambique, Sierra Leone, Somalia, South Sudan, Sudan	Urban forests, green spaces, green roofs	Urban heat: Rapid urban growth in West African countries is leading to increased exposure to extreme heat. Urban areas in tropical countries, like Liberia, can significantly reduce heat stress through urban forests, green spaces, and green roofs, which also help manage stormwater runoff.	Governments should integrate green infrastructure into urban planning, incentivize sustainable practices, enforce zoning regulations, foster public-private partnerships, engage communities, and establish monitoring systems to address climate change impacts in African cities.[h] They should establish funding mechanisms for community-based green initiatives and subsidize costs for urban parks and trees in low-income neighborhoods.	Aid and philanthropic funds may be needed to support initial project development, but more mature projects may be able receive support through building code requirements or use of city general revenues.	FCV: Countries with high fragility like Niger may choose to focus on conserving large existing trees in cities to provide shade or tree planting programs that can create jobs. Non-FCV: Countries like Sierra Leone can invest in ambitious urban forest programs and green roofs. For example, the country's #FreetownTheTreetown campaign is a good example of a highly participative approach to addressing urban heat.[i]

Notes: Exposed countries were identified from the data and maps on climate risks presented in section "Intersecting challenges of nature loss, climate risk, and development needs." FCV = fragile, conflict-affected, and violent. M = million. km2 = square kilometer. NGO = nongovernmental organization. PES = payments for ecosystem services. SSA = sub-Saharan Africa.

Sources: a Battistelli et al. 2022. b Adane et al. 2021. c Beeston et al. 2023. d FAO 2021. e Abasse et al. 2023. f Msuya et al. 2017. g WWA 2024. h Dossa and Miassi 2024. i Fisseha et al. 2021.

Recommendation 6

Improve monitoring, evaluation, and learning to ensure projects deliver intended climate impacts and co-benefits

NBS project developers should significantly increase their investment in MEL to better gauge project effectiveness in delivering climate resilience and co-benefits; use the data to improve project design; and showcase the findings to build confidence among communities, governments, and investors. NBS projects are designed to achieve multiple climate objectives and co-benefits, as the database revealed, yet many did not measure, track, or effectively communicate these impacts. For example, more than 50 percent of NBS projects analyzed in this study listed "improved water supply" as an objective, but current research has not consistently demonstrated that NBS improve downstream water quantity (Acreman et al. 2021). Improved monitoring of the impact of NBS projects on water supply could help projects design their interventions more effectively or decide whether to prioritize other objectives or interventions. Furthermore, while many projects cited co-benefits such as biodiversity enhancement or job creation, they often lacked publicly available MEL plans or measurable outcomes to substantiate these claims.

While this study did not evaluate project effectiveness, future research should evaluate these NBS projects and collect data on project impacts and lessons learned to inform future design, enhance the robustness of available scientific data, and demonstrate the viability of NBS as a cost-effective climate resilience tool. Findings should be tailored for specific actors (i.e., investors, governments, or communities) interested in biodiversity, economic and labor conditions, community well-being and public health, or climate adaptation and communicated through knowledge products, technical curricula, and communication tools. Substantial investments in MEL and knowledge dissemination can create a positive feedback loop, generating greater awareness, buy-in, and adoption of NBS.

Actor-specific recommendations

The following are recommendations to specific actors to help scale up NBS projects in SSA. Many of these suggestions tie back to the recommendations outlined above.

African national governments create the policy, institutional, and financing frameworks that set the enabling conditions for NBS design, implementation, maintenance, and replication. We recommend that they do the following:

- **Revise policy and regulatory frameworks:** Update laws, regulations, and infrastructure planning and tendering processes to integrate NBS, focusing on sectors like water, energy, agriculture, and transport. In addition, review commitments to global climate and environmental pacts, such as the NDCs, NAPs, and NBSAPs, to identify opportunities to integrate NBS. Align goals and policy approaches on biodiversity with those on climate and use NBS to help deliver on both.
- **Foster multisectoral collaboration:** Collaboration among cabinet ministries (e.g., finance, water, environment, and infrastructure) can promote cross-sector policies.
- **Build project bankability through technical assessments:** Conduct climate risk assessments, natural capital evaluations, and economic benefit models to demonstrate the value of NBS, fostering investment-ready projects with clear financial and resilience benefits.
- **Promote gender equity and engage with IPLCs:** Strengthen frameworks, laws, and protocols to promote gender equity and ensure inclusive engagement with Indigenous communities by establishing systematic, consultative processes for incorporating Indigenous knowledge and enhancing land titling and resource access (including water) for Indigenous Peoples and women.
- **Increase funding sources for NBS:** Dedicate a portion of the national budget to initiatives or funds, such as national climate funds, conservation trust funds, or water funds, that can reallocate capital to projects. Within ministerial sectors, allocate funding to maintain, protect, and restore NBS.
- **Enhance local capacity and resources:** Partner with international or local NGOs to enhance country-specific NBS research and knowledge transfer. Existing national institutions such as ministries, universities, and agricultural extension services can play a role in translating research and building the capacity of local communities and project developers.
- **Empower local governance for NBS:** Decentralize fiscal authority to give cities and municipalities the budgetary autonomy to develop and implement NBS projects, particularly for localized climate resilience needs.

African subnational governments, including states, provinces, counties, and cities, can use policy and local funding streams to promote NBS as a solution to climate change impacts and urban growth challenges. We recommend that these actors do the following:

- **Integrate NBS into urban planning and local development strategies:** Incorporate NBS or green-gray interventions into local policies, such as urban planning, to improve measurement, monitoring, strategic planning, partnerships, financing, and market development for resilient infrastructure.
- **Increase funding sources for NBS:** Capture the increased value of land and property resulting from infrastructure improvements and reinvest it in NBS. Utilize new financing mechanisms, such as development fees, impact fees, or other land-value capture mechanisms.
- **Use local training and knowledge sharing:** Seek out training and knowledge, including from Indigenous Peoples, on successful community engagement and social equity considerations, and work to build the capacity of the implementing agencies in these areas. Ensure this training and knowledge is formally incorporated into the NBS project development cycle, including planning, financing, implementation, and monitoring.

MDBs, multilateral donors, and multilateral funds are some of the primary funders of NBS projects and play roles as project developers and research organizations. We recommend that these actors do the following:

- **Support policy reform and strategic integration of NBS:** Leverage assessments, like the World Bank's Country Climate and Development Reports (World Bank n.d.) and Climate Change Action Plans (World Bank 2021c), to inform policy dialogue that integrates NBS into national climate and infrastructure strategies.
- **Provide technical assistance and capacity-building support:** Provide early-stage and project preparation support for NBS projects, helping to make the case for new approaches through technical studies. Address capacity gaps through programs like the World Bank and EIB's City Climate Finance Gap Fund and provide tailored technical assistance to ensure that local expertise and resources are available for the effective design and implementation of NBS projects (GIZ et al. 2020).
- **Enforce requirements for social and environmental impact:** These organizations can ensure that their funding recipients meet standards for addressing community engagement, gender and social equity, and Indigenous and traditional knowledge. They can also provide technical assistance and capacity-building resources to help project implementers effectively develop and carry out these inclusive practices and establish monitoring and evaluation mechanisms. Furthermore, they can provide the required assistance and expertise to help ensure NBS deliver on biodiversity and positive environmental outcomes.
- **Expand funding and extend project timelines:** Provide capital to de-risk projects and leverage finance to attract other sources of funds. Increase grant capital for NBS project preparation, implementation, green workforce training, and monitoring. Consider extending project timelines beyond standard cycles to support NBS maturation.

- **Mainstream NBS across sector portfolios:** Integrate NBS within sector-specific portfolios, such as water, sanitation, housing, urban development, energy, and transportation, to increase NBS adoption in infrastructure projects. Collaborate with government finance and planning ministries to highlight the economic and resilience benefits of green-gray infrastructure, reducing barriers to less familiar NBS solutions. These may involve technical studies that explore potential types of NBS applicable in each case, cost-benefit analysis that compares NBS and non-NBS solutions, operations and management plans, and design options, among others.

NGOs (both national and international) can bring their expertise to the planning, design, and implementation of NBS projects. We recommend that these organizations do the following:

- **Provide targeted technical assistance:** Enhance local capacity for NBS by supporting enabling conditions, addressing capacity gaps, and offering tailored technical assistance. This includes providing tailored technical assistance to ensure that local expertise and resources are available for the effective design and implementation of NBS projects.
- **Build and disseminate knowledge:** Strengthen the business case for NBS by producing white papers, case studies, and reports, as well as thorough project monitoring and tracking. Sharing successful examples and best practices can help expand awareness and drive further adoption of NBS.
- **Host or support project preparation facilities, accelerators, and other programs dedicated to enhancing NBS projects:** Accelerator programs devoted to NBS could further enhance technical capacity by providing resources, training, and support to project developers (see Box 5). This approach would not only enhance the understanding of what NBS are and how to prepare NBS projects but also foster a network of practitioners committed to advancing climate resilience and sustainable development across SSA. In addition, establishing communities of practice can facilitate coordinated efforts to address specific challenges, share knowledge, and develop solutions collaboratively (see Box 8).
- **Ensure social considerations are a core component of project planning and technical support:** NGOs serve as intermediaries between local communities and outside actors (project developers including governments, multilateral organizations, and businesses) to ensure that community needs are integrated in projects. They can work with forest and agricultural producers to adopt NBS-friendly strategies and help these producers benefit from improved resilience and economic opportunities.
- **Support country-specific NBS interventions:** Well-established NGOs have a strong understanding of the local context, including with historic localized datasets, and can play a crucial role in conveying community needs to project developers including governments, multilateral organizations, and businesses. This can include facilitating communities of practice to share knowledge, coordinate efforts, and collaboratively address region-specific challenges in NBS adoption.

Private sector actors including commercial banks, institutional investors, and real asset investors can enhance project bankability. We recommend that these actors do the following:

- **Provide technical assistance for project development:** Support the development of risk assessments, including scenario planning and long-term forecasting, that can equip project developers with data and insights to improve project design and increase confidence among investors.
- **Expand financing for NBS projects:** Increase financial contributions to NBS through mechanisms like equity, green bonds, and insurance tools, addressing the funding gap in NBS by meeting sustainability targets and creating new market opportunities in green finance.
- **Showcase and advocate for NBS investments:** Promote successful NBS case studies to showcase financial viability, risk reduction benefits, and potential returns, helping to create a clear business case for private sector adoption.
- **Enforce requirements for social considerations:** This can ensure that projects they fund meet standards for addressing community engagement, gender and social equity, and Indigenous and traditional knowledge. They can require monitoring and evaluation from project developers to ensure compliance and measure impact.

Infrastructure operators including water and energy utilities, along with transportation networks, can greatly benefit from NBS as a cost-effective means to extend the lifespan of existing assets and protect future investments. A few actionable items include the following:

- **Integrate NBS in project planning:** Proactively assess the potential of NBS solutions for both existing and planned infrastructure projects. Where feasible, include NBS elements in green-gray or standalone green project designs to enhance asset longevity and resilience.
- **Advocate for NBS in financing packages:** Collaborate with financiers to champion green-gray financing packages that incorporate NBS, helping to secure funding by demonstrating the cost-effectiveness and added value of NBS in extending infrastructure lifespan.
- **Commit to sustainable funding for NBS:** Establish long-term funding contributions for NBS projects, moving beyond traditional grant cycles to provide ongoing support that strengthens and sustains NBS outcomes over time.

"Women Net Fishing", Madagascar. Photo by Rod Waddington.

Conclusion

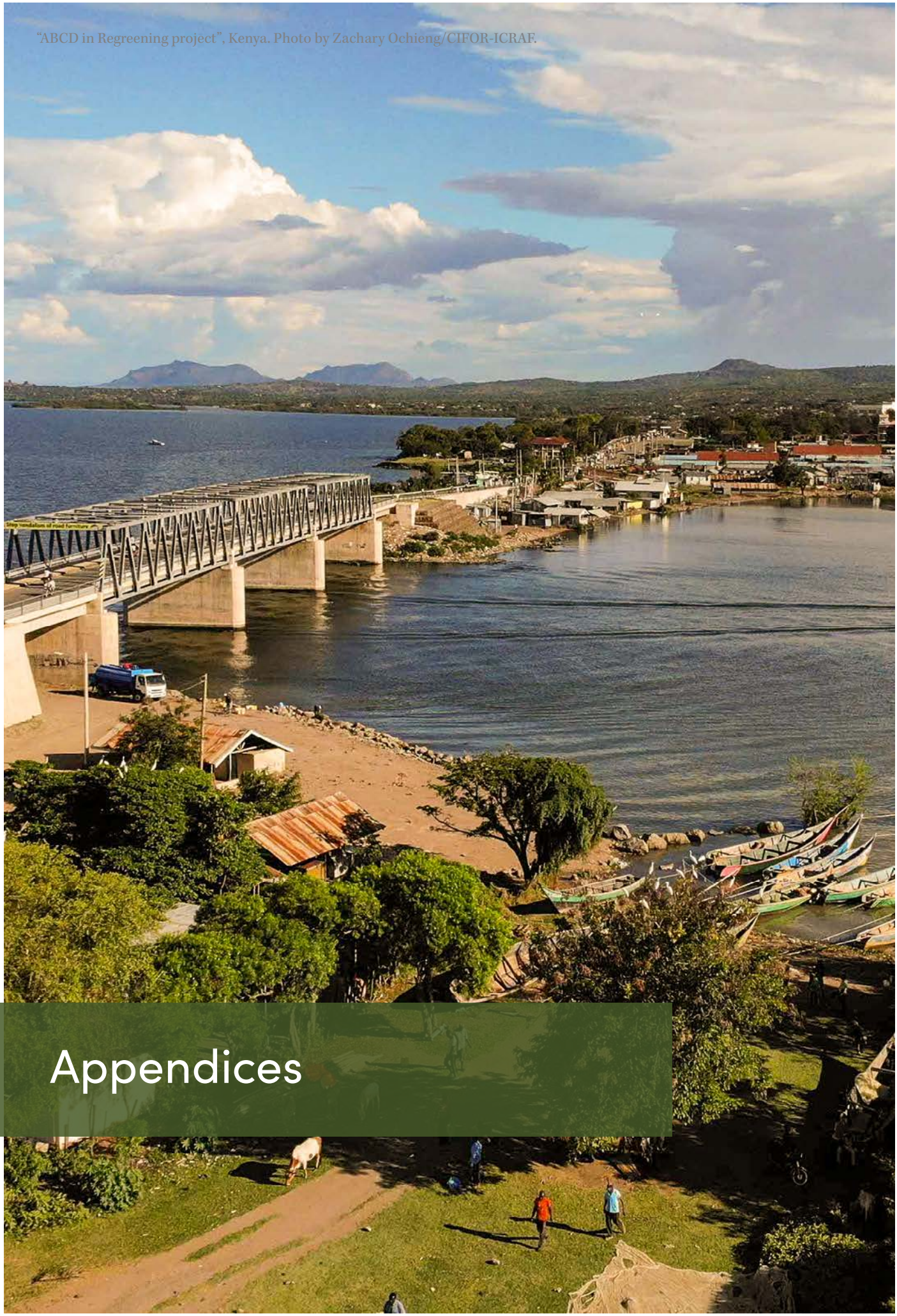
Next steps

NBS offer a promising pathway for addressing SSA's multi-faceted climate and developmental challenges. This report highlights a steady increase in NBS project initiation and funding over the past decade, as well as a diversity of project objectives, geographies, and intervention types. Despite this growing interest, current levels of funding and project implementation fall short of meeting SSA's urgent climate adaptation needs. As climate change impacts intensify and urbanization accelerates, SSA's vulnerability to natural disasters and environmental degradation will likely deepen, making NBS essential for sustainable, climate-resilient development.

To close this gap, SSA must foster a supportive policy environment, diversify funding sources, and invest in local capacity building to accelerate NBS adoption. Mainstreaming NBS across policy sectors and enhancing access to innovative financial instruments are crucial steps to scale these solutions effectively. Additionally, prioritizing community involvement and incorporating gender and social equity as well as Indigenous knowledge in NBS project design will further align projects with local needs, enhancing their resilience and sustainability.

With targeted efforts to overcome policy, financial, and technical barriers, NBS can be transformative in protecting SSA's natural resources, reducing disaster risk, and building climate resilience. We hope that policymakers embrace this report's recommendations to build a roadmap for NBS as a vital component of SSA's climate adaptation strategy, promoting long-term ecological, economic, and societal benefits for the region and its people.

"COBAM workshop group", Democratic Republic of Congo. Photo by Ollivier Girard/CIFOR.



"ABCD in Regreening project", Kenya. Photo by Zachary Ochieng/CIFOR-ICRAF.

Appendices

Appendix A. Project database

This report is accompanied by a technical note that details the research methods used to find NBS projects in the World Bank's and AfDB's portfolios from 2012 to 2021 (Oliver and Marsters 2022). This report builds on that methodology for a broader scan of NBS projects. Additional details regarding the methods of this report follow.

Project selection criteria for database

WRI established the following criteria for projects' eligibility for inclusion in the report's database:

1. Projects must be implemented in a country in SSA as defined by the World Bank in 2023.[5] Projects in North Africa were not included in the scope of this report.
2. Projects should have a start date between 2012 and 2021 (except for the analysis of World Bank and AfDB projects from 2022 to 2023). This is the year the project begins and/or secured first financing. In MDB projects, this correlates with "approval year."
3. Projects must have secured at least $50,000 in funding.
4. Projects must have used NBS as a tool to achieve climate risk reduction objectives (detailed further below).

To select projects using these four criteria, we reviewed publicly available and internal project databases, and conducted desktop scans, a literature review, and a survey. For the databases, WRI used keyword searches to filter and identify eligible projects and then did a deeper qualitative evaluation of documents to evaluate whether projects should be included in the report's database. Further detail on these processes is provided in the project identification section below.

Additional details on the fourth criterion of project selection: NBS as a tool for climate risk reduction objectives

1. Climate resilience objectives included in project selection

Projects selected in the database for this report **employed NBS to achieve specific climate resilience objectives**, ensuring that natural systems contribute to both environmental and structural resilience. Projects selected had to meet at least one and up to three of these climate resilience objectives:

- Improved water quality
- Improved water supply (encompassing drought prevention, improvement of seasonal flows, and aquifer recharge)
- Urban flood mitigation
- Flood mitigation
- Landslide or erosion risk reduction
- Fire risk mitigation
- Urban heat mitigation

We assigned the climate resilience objectives qualitatively through an evaluation of project documents. Although meeting at least one climate resilience objective was a key criterion to being included in the database, these objectives were not necessarily the official project development objectives for the projects, which were often more related to broader development goals. We analyzed additional goals in selected projects as co-benefits, including job creation/livelihood enhancement, biodiversity/habitat protection, enhanced food security, climate mitigation, public health enhancement, community cohesion, and recreation/ecotourism. Projects benefiting the agriculture sector were limited to those that did so through at least one of the climate resilience objectives listed (e.g., water supply) and did not include those that delivered benefits solely outside of this scope.

2. Types of NBS interventions included for project selection

We also analyzed NBS intervention types, with each project listing between one and three NBS interventions used to address the climate resilience objectives identified. We also assigned NBS intervention type qualitatively through an evaluation of project documents.

The categories for climate resilience objectives and NBS interventions used in this report are based on past literature from a global context including Browder et al. (2019), Watkins et al. (2019), and Ozment et al. (2021), denoted in Table A-1. We used them to develop the typology for this study in SSA, noting that the actual application could be broader. The landscape where the NBS project takes place was added in the first column, recognizing that many of these NBS interventions can fall across landscape categories and that projects were often designed to address more than one landscape.

Project identification

We identified projects through a multipronged review process, which included the following five processes:

1. An assessment of the World Bank and AfDB project databases
2. A desktop assessment of climate-related databases (e.g., climate fund databases) and websites
3. An assessment of AFR100's TerraMatch database
4. An assessment of projects from a literature review on NBS for climate resilience
5. Identification of projects from a survey designed and conducted by WRI

Each approach varied slightly due to the nature of the assessment and is described in detail below:

Assessment 1: MDB project databases. WRI worked with partners at the World Bank and AfDB to scan their project portfolios for projects that were likely to meet our selection criteria. The World Bank had already conducted a scan of NBS projects and provided WRI with a project list that was developed based on a list of keywords and phrases (see Table A-2). For AfDB, WRI used

Table A-1 | **Typology of NBS interventions for climate resilience objectives**

LANDSCAPE	PROTECT, RESTORE, MANAGE, OR CREATE ...	FLOOD MITIGATION	IMPROVED WATER QUALITY	IMPROVED WATER SUPPLY[A]	EROSION/ LANDSLIDE MITIGATION	FIRE RISK MITIGATION	HEAT MITIGATION
Rural	Forest						
	Agroforestry/silvo-pasture						
	Farmland best practices						
	Floodplains and bypasses						
	Riverbeds and riparian areas						
	Grasslands and other vegetation						
	Sand dams						
	Inland wetlands						
Coastal	Mangroves						
	Salt marshes						
	Coral reefs						
	Seagrasses						
	Sandy beaches and dunes						
Urban	Bioretention areas/ rain gardens						
	Urban canopy						
	Urban parks						
	Constructed and urban wetlands						
	Green roofs and other green build-ing spaces						

Notes: Dark green denotes common NBS applications; light green indicates that NBS are sometimes used to address the objective; and white indicates that the given NBS generally do not apply to the corresponding objective. a Water supply encompasses drought prevention, improvement of seasonal flows, and aquifer recharge.

Sources: Authors, adapted from Browder et al. 2019; Watkins et al. 2019; Ozment et al. 2021.

the MapAfrica draws from the Bank's internal project systems that fit the criteria and then conducted a rapid review of projects with keywords to determine if the project was "in," "out," or "to be determined." The projects were then reviewed in more detail with a deep dive qualitative assessment of project documents. Projects that did not meet the criteria were removed. Eighty projects were identified from the MDB project databases. See Oliver and Marsters (2022) for further details on MDB projects from 2012 to 2021. As this was the first of the project scans conducted, projects found through either of the MDBs' portfolios were counted and included under the MDBs, recognizing that many projects were co-funded by other entities. For example, the Nigeria Erosion and Watershed Management Project was funded by the World Bank, GEF, EIB, government of Nigeria, and others and is counted in the World Bank portfolio because it was first identified there during the initial scan.

A second review of World Bank and AfDB projects added projects approved between 2022 and 2023. The MDBs each provided a list of projects and filled out the associated attributes relevant for the study. WRI then combed through the list and flagged, double-checked, and removed any projects that did not meet the criteria. An additional 51 projects were identified.

Assessment 2: Project databases and websites. WRI conducted a desktop scan to identify relevant databases of NBS projects in SSA (see Table A-3). Other databases that were searched but for which no projects were found are not listed. As each database is distinct, the authors applied a combination of using database filters and a keyword search. For example, we first applied a filter for region (sub-Saharan Africa) or theme (climate resilience or climate adaptation), and then conducted a keyword search using the words outlined in Assessment 1 to identify an initial list of potential projects. Afterward, we did a qualitative scan for each project by looking through project documents to verify whether projects met the criteria. If we identified a specific project website during the desktop scan, we reviewed the website and any relevant project documents to assess the project's eligibility. We identified 105 projects from this assessment.

Assessment 3: TerraMatch. WRI's AFR100 TerraMatch program includes projects funded in 2021. The program's data include application materials from submitted proposals that are not publicly available; however, the authors were able to access these documents to identify eligible projects. We reviewed only projects that secured funding of at least $50,000. We then filtered these projects through a keyword search using the same terms as those used in Assessments 1 and 2 and performed a qualitative scan of project documents to ensure projects met the criteria. In some cases, we contacted the project developers to request additional information. We identified 48 projects from this assessment.

Assessment 4: Literature review. WRI conducted a literature review for the report that covered the challenges of NBS, enabling conditions of NBS, NBS for climate resilience, NBS for water resilience, funding and financing needs for NBS, and co-benefits of NBS. The authors reviewed global and SSA-specific sources using Google Scholar and other online search engines to find scholarly articles. Instead of using a keyword search, during the literature review, we flagged NBS projects that were listed in publications. For each project flagged, we then reviewed online websites and project documents to verify if it met the project criteria. We identified six projects this way.

Assessment 5: Survey. To capture any projects that were not identified in the desktop or literature scan, WRI developed and sent a survey in French and English to partner listservs to solicit additional projects. Participants and their email addresses were identified through the AFR100, NDC Partnership, and Cities4Forests Network, totaling over 15,000 individuals. The survey detailed the four selection criteria for the database. WRI received 40

Table A-2 | Keyword list for project identification for assessments 1–3

Natural infrastructure	Forestation	Ecosystem management
Nature-based infrastructure	Wetlands	Natural resource based
Green infrastructure	Bioengineering	Nature regeneration
Nature-based solutions	Water quality	Co-benefits
Nature based	Drought	Watershed management
Ecosystem based	Erosion reduction	Storage
Ecosystem-based adaptation	Nature restoration	Land use
Building with nature	Discharge regulation	Aquifer storage
Engineering with nature	Watershed investments	Discharge regulation
Green space	Reservoirs	Integrated planning
	Payments for ecosystem services	Ecosystem recovery
	Retention	Flood mitigation

Note: The initial word search in orange expanded to also include any documents that referenced the terms in orange in combination with those in green. The list of keywords and phrases were used in portfolio review exercises conducted by the World Bank Global Water Practices and the Global Facility for Disaster Reduction and Recovery to screen for projects that used nature-based solutions (NBS) to enhance water quality, address water security issues, control flooding, or mitigate other environmental hazards. This list was applied to the desktop scan of NBS projects throughout this study.

Source: Authors, adapted from Oliver and Marsters 2022.

Table A-3 | **List of sources to build NBS project database for climate resilience**

ASSESSMENT	PROJECT INFORMATION SOURCE	NUMBER OF PROJECTS	WEBSITE OR REFERENCE
1: MDB lending portfolio	World Bank portfolio	80	https://projects.worldbank.org/en/projects-operations/projects-home
	African Development Bank database	51	https://mapafrica.afdb.org/en/
2: NBS project databases and websites	Adaptation Fund	10	https://www.adaptation-fund.org/
	Forest Trends project list	2	https://www.forest-trends.org/project-list/
	Global Environment Facility	44	https://www.thegef.org/projects-operations/database
	Green Climate Fund	15	https://www.greenclimate.fund/projects
	International Climate Initiative (IKI) project database	9	https://www.international-climate-initiative.com/en/
	Nature 4 Cities project database	3	http://implementation-models.nature4cities-platform.eu/
	Nature-based Solutions Initiative	1	https://www.naturebasedsolutionsinitiative.org/research/projects
	Nordic Development Fund	1	https://www.ndf.int/what-we-finance/projects/project-database.html
	SANBI project list	2	https://www.sanbi.org/
	UNEP EbA database	5	https://www.unep.org/explore-topics/climate-action/what-we-do/climate-adaptation/ecosystem-based-adaptation
	Urban Nature Atlas	3	https://una.city/
	WWF NBS database	2	https://www.worldwildlife.org/pages/nature-based-solutions
	Mali Climate Fund	2	https://mptf.undp.org/fund/3ml00
	SeyCCAT	2	https://seyccat.org/projects/
	TNC Water Fund	3	https://waterfundstoolbox.org/
	Islamic Development Bank (website was under maintenance at time of research)	1	https://www.isdb.org/llf/approved-projects
3: TerraMatch projects	TerraMatch	48	https://www.terramatch.org/
4: Literature scan	C40 report	1	C40. 2021. *Urban Heat and Equity: Experiences from C40's Cool Cities Network*. C40.
	Cities4Forests	1	https://cities4forests.com/cities/fianarantsoa/.
	Ecological Infrastructure for Water Security (South Africa)	1	Government of South Africa. 2014. "SIP 19: Ecological Infrastructure for Water Security: Minister's Approved Draft for Submission to the Presidential Infrastructure Coordinating Commission." Government of South Africa.
	NatuRes: Natural Resources Stewardship Programme	1	NatuRes. n.d. "South Africa – Economic Growth Powered by Its Diverse Natural Resources: UMhlathuze Water Stewardship Partnership (UWASP)." *NatuReS* (blog). https://nature-stewardship.org/where-we-work/south-africa/. Accessed April 7, 2023.
	UN Economic Commission for Africa	1	UN Economic Commission for Africa. 2020. "Launch of Project to Enhance 'Nature Based Solutions for Water Resources Infrastructure and Community Resilience in Ethiopia.'" UN Economic Commission for Africa.
	WWF report	1	Magdelenat, C., N. Malpiece, and Y. Josse, Eds. 2021. *Urban Nature Based Solutions: Cities Leading the Way*. WWF and EcoAct.
5: Survey	Survey (French and English)	7	AFR100, NDC Partnership, and Cities4Forests Network

Note: MDB = multilateral development bank. NBS = nature-based solutions. SANBI = South African National Biodiversity Institute. UNEP EbA = United Nations Environment Programme Ecosystem-based Adaptation. WWF = World Wildlife Fund. SeyCCAT = Seychelles Conservation and Climate Adaptation Trust. TNC = The Nature Conservancy. UN = United Nations. AFR100 = African Forest Landscape Restoration initiative. NDC = nationally determined contribution.

Source: Authors.

responses, and the authors then examined each response and its corresponding project documents to evaluate the project's eligibility. A keyword search was not used. We included seven additional projects based on the survey.

Project documentation

For each project that met the selection criteria, we created files containing project documents, project descriptions, and any other key project information that was available for that given project (Table A-4). One researcher recorded each project and its corresponding information and another reviewed the files for accuracy. A systematic scan of the database was performed to flag inconsistencies that were then resolved. As with any manual-entry database, a certain margin of error must be acknowledged.

Dataset limitations

The dataset aimed to capture NBS investments for climate resilience from 2012 to 2021, and additional investments from the World Bank and AfDB for projects approved between 2022 and 2023. We recognize the limitations of this selection. Many online databases do not currently have coordinated systems to systematically and publicly tag, track, and report use of NBS in projects, whether they are being implemented to support climate adaptation and/or mitigation, deliver infrastructure services, or address other types of societal challenges, nor do they have clear and agreed on criteria to identify what would be considered NBS for climate resilience. We used a multifaceted approach to identify as many NBS projects in SSA as possible; however, the varied methods used in each assessment may have introduced inconsistencies, potentially leading to data limitations across the scanned projects. Limited time and resources available for this study inhibited a thorough review of all documents for all projects in relevant sectors that were implemented in SSA during the study's time period. As such, the NBS project portfolios likely reflect an undercount of total projects that meet the selection criteria.

This research project was ambitious in scope by attempting to identify projects across 48 countries. Data collection encountered several limitations worth noting, including the following:

Comprehensiveness. For NBS project database reviews, we performed a keyword search on project titles and tagged project attributes to identify possible matches with the project criteria. Given this approach, it is possible that some projects that met the inclusion criteria but did not have the right keywords in their titles or cataloging were omitted from the database. For example, since the drafting of this report, additional NBS projects were identified in Rwanda, Gabon, Somalia, Kenya, and Tanzania and within the AfDB portfolio, an indication that this report has underrepresented the number of projects being developed across the region and that the initial scans failed to encompass all eligible projects.

Representative sample limitations. Some NBS projects meeting the eligibility requirements for this study may not have been included in the inventory due to the difficulty of identifying, tagging, and cataloging them. Moreover, many projects may incorporate NBS practices, but these might not have been identified as such if the practices were not tagged or included in publicly available documents. Initial project filtering was performed by several researchers who may have had different interpretations of eligibility criteria, which could have resulted in project omissions. However, a second researcher reviewed each project to confirm that the project was eligible and that attributes had been accurately tagged.

Anglophone lean: Most of the projects discovered during the scan were centered in Anglophone nations potentially because English is the dominant language of the author team. Furthermore, international databases tend to be populated in English, which can lead to underrepresentation of relevant projects in non-Anglophone countries. While the NBS project survey was distributed in French as well, the French survey had a lower response rate compared with the English survey, which is in line with other academic research findings (Enu et al. 2023).

Data availability and data gaps: Most of the projects surveyed provided only public-facing documents, which did not include assessments to confirm that the project was executed as planned. Follow-up surveys and interviews with project developers attempted to verify accuracy on all projects that passed

Table A-4 | **Project information collected and analyzed**

BASIC PROJECT INFORMATION	PROJECT OBJECTIVES OR NBS DATA	FUNDING AND FINANCING DATA
Project name	Climate resilience objectives (up to 3)	Funder or financer (up to 3)
Start and end years	Intervention type (green, green-gray)	Funder or financer type
Project developer (up to 3)	NBS intervention (up to 3)	Financial instruments (up to 2)
Project developer type	Co-benefits (up to 3)	Total secured funding ($, millions)
Country	Gender equity inclusion (Y/N)	Total secured NBS funding ($, millions)
Region	Indigenous knowledge inclusion (Y/N)	

Note: Not all data types were available for all projects. NBS = nature-based solutions. Y/N = yes/no.
Source: Authors.

initial eligibility, but the response rate was not 100 percent. If the minimum project selection criteria were not verifiable, projects were excluded.

The level of project detail varied greatly by source: There are many data types for individual projects that were "unknown" due to data gaps. Information on funder type, funding instruments, and total funding amount was not available for all projects. While projects in the database secured at least $50,000, total project amounts or alternative funding mechanisms were not always known. In addition, financial data were not often disaggregated to separate NBS funding from total project funding, making it difficult to pinpoint exact funding allocations. O&M and M&E are also data categories that often lacked funding amounts and project information. It was common to find information that indicated an O&M and M&E program was in place, but no information on the status and findings of the projects. Projects from the World Bank and AfDB portfolios had more comprehensive information available, and as a result, the findings may disproportionately reflect these projects.

Effectiveness of NBS: This study did not evaluate the effectiveness or sustainability of the NBS components of the projects. It relied on publicly available data, usually from project preparation and implementation materials, which as stated above, did not provide updates on NBS performance or durability in the region.

Additional considerations for 2022–23 projects: Additional limitations exist for the 2022–23 MDB portfolio. First, projects from only these two MDBs were collected, and the MDBs provided the initial lists. WRI did its best to scan and filter these projects to exclude any projects that did not meet the criteria. Additionally, projects were added and analyzed later, not becoming part of the full data analysis but rather a sub-analysis comparing the 2022–23 projects to those from 2012 to 2021.

Appendix B. Interviews

We conducted semi-structured interviews with 51 representatives involved in implementing, funding, or investing in NBS or similar nature-based assets. The individuals interviewed fell into three categories:

Project developers (23): National, state, and local governments; international and national NGOs; and private companies

Funders (19): Development finance institutions, UN agencies, and multilateral and national climate funds

Investors (9): Public and private equity investors and commercial banks

We selected interviewees using a combination of sources. Interviewees included project developers in the NBS project database with representatives from each region (East, West, Central, and Southern Africa), country, project location (urban, coastal, and rural), sector, and NBS project objective. Interviewees were also sourced from in-country experts and WRI project partners helping to design, fund, finance, or invest in SSA. Interviews were conducted virtually, and research questions sought to understand the challenges during the NBS project stages: project identification and design, O&M, MEL, and funding and financing.

We prepared summaries for each of the interviews completed. We then analyzed the text to record the barriers mentioned into a "barriers matrix" with the following categories: political; legal; policy, governance; institutional; technical; funding; and social. We designed the barriers matrix based on the authors' experiences and a literature review on barriers to implementing and investing in NBS. A list of the interviewees and definitions for each of the barriers are provided in Tables B-1 and B-2, respectively.

Table B-1 | List of interview participants by type

NAME(S)	ORGANIZATION	TYPE OF ORGANIZATION
Project developers		
Anastasia Deligianni, Michael Maluki	MetaMeta, Makueni County Government, Kenya	Government/not-for-profit
Michael Vice, Hannah Benn	Pegasys	Private sector
Vahid Fotuhi	Blue Forest	NGO
Harrison Nnoko	AJESH	NGO
Emmanuel Niyonsenga	ADEAR Ltd.	Private sector
Emmanuel Kogo, Richard Ntibrey	Catholic Relief Services	NGO
Georgina van Biljon	Intaba Environmental Services	NGO
Thomas Sberna	IUCN	NGO
Kasenga Hara	National Water Supply and Sanitation Council, Zambia	Government
Scott Thacker	Oxford Infrastructure Analytics	Private sector
Fred Kihara	The Nature Conservancy	NGO
Caroline Gelderblom	WWF	NGO

Table B-1 | List of interview participants by type (cont.)

NAME(S)	ORGANIZATION	TYPE OF ORGANIZATION
Chris Henderson	Practical Action	NGO
Benjamin Larroquette	UNDP	UN agency
Radhika Dave, Charles Nyandiga	UNDP	UN agency
Adewale Awoyemi	International Institute of Tropical Agriculture	NGO
Lilian Nyaega	Wetlands International	NGO
Mandy Barnett	SANBI	Government
Evans Lyndon Baines-Johnson, Tommy Garnett	Environmental Foundation for Africa	NGO
Samantha Petersen, Louise Heaps	WWF	NGO
Rod Braun	Conservation International	Nonprofit
Charlotte Boyd	Conservation International	Nonprofit
Jessica Chaplin	Northern Rangelands Trust	Nonprofit
Funders		
Timmo Gaasbeek	Embassy of the Netherlands	Bilateral donor
Rowan Palmer	UNEP	UN agency
James Nyarobi, Paz Lopez-Rey	Tanzania Vice President's Office, UNEP	Government/UN agency
Alexander Forbes	UNEP	UN agency
Kenichiro Tachi	World Bank	MDB
Benson Bumbe Nkhoma	African Development Bank	MDB
Claudia Soto	World Bank	MDB
Dinkneh Tefera, Martin Onyach-Olaa	World Bank	MDB
Nelvina Barreto	UNDP	UN agency
Eric Dickson	World Bank	MDB
Saphira Patel	The Development Bank of Southern Africa	African Development Bank
Avril Dominguez	GEF	Multilateral climate fund
Samuel Lefèvre, Célina Carrier, Audrey Chenevoy	Agence Française de Développement	DFI
Remy Ruat	GEF	Multilateral climate fund
Ole Stubdrup	Urban and Municipal Development Fund, AFDB	DFI
Lisa Sundberg	SIDA	DFI
Jeanne Adanbiokou Akakpo, Martin Pépin Aina, Memanton Boni Yalla	Ministry of Environment and Sustainable Development, Benin	Government
Investors		
Roland Hunter	South Pole	Private equity
Ahmed Aziz	South Pole	Private equity
George McPherson	Criterion Africa Partners	Private equity
Stephanie Bishop	New Forests	Private equity
Oliver Phillips, Lamia Alkhoori	Standard Chartered	Commercial bank

Table B-1 | List of interview participants by type (cont.)

NAME(S)	ORGANIZATION	TYPE OF ORGANIZATION
Kelvin Massingham, Jonathan Israel, and Ravi Sikand	FSD Africa	Nonprofit
Noah Wescombe	PRI	Technical financial advisor
Margreet Muizebelt, Julia Peters	Rabobank	Commercial bank
Carl Johan Wahlund	Norfund (Norwegian Investment Fund)	DFI

Note: NGO = nongovernmental organization. IUCN = International Union for Conservation of Nature. WWF = World Wildlife Fund. UNDP = United Nations Development Programme. SANBI = South African National Biodiversity Institute. UNEP = United Nations Environment Programme. UN = United Nations. GEF = Global Environment Facility. MDB = multilateral development bank. DFI = development finance institution. SIDA = Swedish International Development Cooperation Agency.

Source: Authors.

Table B-2 | Definitions of barriers for project developer and investor interviews

CRITERION	SUBCATEGORY	DEFINITION	MENTIONS
Funding	Eligibility challenges (scale of project too small)	NBS projects did not meet funder requirements (i.e., the project identified available capital but it was ineligible to secure the funds or the scale of the project was too small for funders)	9
	Inability to attract funding or finance	NBS projects did not secure the up-front or long-term capital to implement, maintain, or scale up projects	21
	Lack of credit worthiness or high risk	Risk profiles between funders via grants/equity/debt and project developers were not aligned (i.e., investment was considered too risky compared with expected financial or environmental outcomes)	11
	Financing mechanisms do not match project needs	Misalignment between funding cycles and NBS benefit accruals (i.e., two-to-three-year grant cycles versus long-term, consistent funds to support the full project life cycle)	21
	Inability to develop detailed business case	NBS projects did not secure funding due to an inability to demonstrate cost savings, net profits, or a compelling business case	20
Policy	Lack of incentives or supportive policies	Lack of federal, state, or municipal regulations that promote or incentivize action	22
	Lack of political support for NBS over traditional infrastructure	Unable to obtain required verbal or written commitments from elected officials for NBS	16
	Perceived corruption	Concerns about or reputation of dishonest or fraudulent practices by the government	8
	Regulatory uncertainty	Refers to the legal, regulatory, and political uncertainty arising out of changing rules, regulations, and interpretations of federal and state agencies and other government entities	14
Institutional	Lack of institutional buy-in	An organization's leadership does not support NBS objectives through verbal or written policies (includes public and private organizations)	19
	High staff turnover	Refers to staff departures at an institution that halt or delay support for NBS	3
	Counterparty risk	Refers to concerns about project or investor confidence in the counterparty's ability to deliver on contract or their part of the deal	6
	Lack of coordination among sectors, levels, or scales	Siloed operations that prevent cross-sectoral collaboration at both inter- and intra- levels	15
	Limited resources or budget	Refers to insufficient staff capacity or budget constraints at an organization or government agency	21

Table B-2 | **Definitions of barriers for project developer and investor interviews (cont.)**

CRITERION	SUBCATEGORY	DEFINITION	MENTIONS
Social	Insecure land tenure	Refers to conflict or issues with how property rights to land are allocated, transferred, used, or managed	17
	Lack of social or community buy-in, politically unpopular	Refers to a lack of social or community understanding, awareness, or support for NBS	9
	Lack of community champion	The lack of a community leader or project manager to promote NBS and help execute project goals to include and incorporate NBS	9
	Lack of incentives to promote community support	Lack of incentives (or benefits) for local communities to meaningfully participate throughout all stages of the NBS project	19
Technical	Lack of data	Missing or gaps in technical information to inform decision-making and prioritization of interventions	14
	Lack of staff capacity for design	Limited staff capacity or technical ability to support the design, planning, and feasibility of NBS projects	16
	Lack of capacity for implementation	Lack of staff capacity or technical ability to implement the NBS projects	22
	Lack of capacity for ongoing operations and maintenance	Lack of staff capacity or technical ability to maintain NBS projects past implementation	21
	Lack of scientific clarity on project outcomes/impacts	Uncertainty about NBS performance post-implementation due to a lack of data or inability to track and collect these metrics; typically in reference to how gray infrastructure performs as a risk-mitigation solution or for service delivery	20
Political	Redirection of project's objective priorities by the client	Project objectives changed after kickoff	3
	De-prioritization of NBS due to changes in political, environmental, or financial priorities	NBS were initially a priority in project planning or investments, but were deprioritized due to changes in political (i.e., elections) or environmental (i.e., degradation, disasters) priorities or budget resources	4

Note: NBS = nature-based solutions.
Source: Authors.

Appendix C. List of NBS projects in Sub-Saharan Africa

Table C-1. List of NBS projects in Sub-Saharan Africa, 2012–23 is available here: https://files.wri.org/d8/s3fs-public/2025-02/growing-resilience-table-c-projects-list.csv.

Abbreviations

AfDB	African Development Bank
AFR100	African Forest Landscape Restoration Initiative
CAPEX	capital expenditure
CBD	United Nations Convention on Biological Diversity
CRU	carbon removal unit
DFI	development finance institution
EIB	European Investment Bank
FCV	fragile, conflict-affected, and violent
FNEC	Fonds National pour l'Environnement et le Climat; National Fund for the Environment and Climate
FONERWA	Rwanda Green Fund
GBF	Global Biodiversity Framework
GDP	gross domestic product
GCF	Green Climate Fund
GCTWF	Greater Cape Town Water Fund
GEF	Global Environment Facility
GGW	Great Green Wall
GR4W	Green Roads for Water
GVWC	Guma Valley Water Company
IPLC	Indigenous Peoples and Local Communities
IUCN	International Union for Conservation of Nature
MDB	multilateral development bank
MEL	monitoring, evaluation, and learning
NAP	national adaptation plan
NBSAP	National Biodiversity Strategy and Action Plan
NBS	nature-based solutions
NDC	nationally determined contribution
NGO	nongovernmental organization
O&M	operations and maintenance
PES	payments for ecosystem services
SDG	Sustainable Development Goals
SeyCCAT	Seychelles Conservation and Climate Adaptation Trust
SIDA	Swedish International Development Cooperation Agency
SSA	sub-Saharan Africa
TNC	The Nature Conservancy
UBF	Uganda's Biodiversity Trust Fund
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
UTNWF	Upper Tana-Nairobi Water Fund
WACA	West Africa Coastal Areas
WASH	water, sanitation, and hygiene
WRI	World Resources Institute
WWF	World Wildlife Fund

Endnotes

1. The term "project" is used throughout the report and refers to NBS initiatives including individual projects, programs, or funds.

2. Subregions and the respective 48 countries in SSA are defined by the World Bank and include Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo (Democratic Republic), Congo (Republic), Côte d'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, São Tomé and Príncipe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Tanzania, Togo, Uganda, Zambia, and Zimbabwe. See "FOCUS: Sub-Saharan Africa," Open Knowledge Repository, World Bank Group, n.d., https://openknowledge.worldbank.org/pages/focus-sub-saharan-africa, accessed July 2024.

3. Multilateral donors refers to entities that provide financial aid pooled from various governments and organizations, such as international organizations like the United Nations Environment Programme and United Nations Development Programme. Multilateral funds mobilize and allocate resources from multiple donor countries or organizations, and examples include the Global Environment Facility and Green Climate Fund.

4. Indigenous Peoples and local communities include Sub-Saharan African Historically Underserved Traditional Local Communities. These are groups that have identities and aspirations that are distinct from mainstream groups in national societies and often are disadvantaged by traditional models of development. See "Environmental and Social Framework," Open Knowledge Repository, World Bank Group, 2017, https://thedocs.worldbank.org/en/doc/276101511809520481-0290022017/original/EnvironmentalSocialStandardESS7FactSheetWBESF.pdf.

5. Subregions and the respective 48 countries in SSA are defined by the World Bank and include Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo (Democratic Republic), Congo (Republic), Côte d'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, São Tomé and Príncipe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Tanzania, Togo, Uganda, Zambia, and Zimbabwe.

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