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MINISTRY OF FOREIGN AFFAIRS OF DENMARK
Danida

Nature-based Solutions Compendium for Urban Resilience in Kenya

Executive Summary

HARAMBEE

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City Climate Finance Gap Fund

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Global Facility for Disaster Reduction and Recovery

Authors & Acknowledgments

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Global Center on Adaptation

SUEZ Consulting

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ABOUT THE GLOBAL CENTER ON ADAPTATION

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List of abbreviations and acronyms

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ASAL – Arid and Semi-Arid
CASCADE – Catalyzing Strengthened Policy Action for Healthy Diets and Resilience
CBA – Cost Benefit Analysis
CBD – Central Business District
CBK – Central Bank of Kenya
CBO – Community-based organizations
CCTV – Closed-Circuit Television
CFAs – Community Forest Associations
CIDP – Country Integrated Development Plan
CPF – Country Partnership Framework
DLI – Disbursement Link Indicator
DRR – Disaster Risk Reduction
EbA – Ecosystem-based Adaptation
Eco-DRR – Ecosystem-based Disaster Risk Reduction
E&S – Environmental and Social
EMCA – Environmental Management and Coordination Act
FAR – Floor Area Ration
FOWK – Friends of Ondiri Wetland Kenya
GCA – Global Center on Adaptation
GDP – Gross Domestic Product
GeoIKP – Geospatial Information Knowledge Platform
GIS – Geographic Information System
Gok – Government of Kenya
HDP – High-Density Polyethylene
ICRR – Implementation Completion Results Report
UHI – Urban Heat Island
IDeP – Integrated Development Plan
IPF – Investment Project Finance
IUCN – International Union for Conservation of Nature
IUWM – Biomimicry and Integrated Urban Water Management
KADP – Kenya Accountable Devolution Program
KDI – Kounkuey Design Initiative
KDSP – Kenya Devolution Support Program
KeNHA – Kenya National Highways Authority
KenUp – Kenya Urban Program
KFS – Kenya Forest Service
KIIs – Key Informant Interviews
KISIP – Kenya Informal Settlements Improvement Project
KSP – Kenya National Spatial Plan
KT – Kaya Tembo
KURA – Kenya Urban Roads Authority
KUSP – Kenya Urban Support Program
LID – Low-Impact Development
LCZ – Local Climate Zone
MC – Minimum Conditions
MCA – Multi-Criteria Analysis

List of abbreviations and acronyms

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MoU – Memorandum of Understanding
NACCFA – Conservancy Community Forest Association
NbS – Nature-Based Solutions
NDC - Nationally Determined Contribution
NEMA – National Environment Management Authority
NETFUND – National Environmental Trust Fund
NGO – Non-Governmental Organization
NMT – Non-Motorized Transport
NMS – Nairobi Metropolitan Services
NUDP – National Urban Development Policy
PAD – Program Appraisal Document
PDO – Program Development Objective
PforR – Program for Result
POM – Program Operations Manual
PS – Performance Standard
RA – Results Area
SDHUD – State Department of Housing and Urban Development
SSA – Sub-Saharan Africa
SuDS – Sustainable Urban Drainage Systems
ToR – Terms of Reference
UA – Urban Areas
UAC – Urban Areas and Cities
UACA – Urban Areas and Cities Act
UDG – Urban Development Grant
UIG – Urban Institutional Grant
UTNWF – Upper Tana-Nairobi Water Fund
VUMA – Vijana Usafi na Maendeleo
VICCO – Viwandani Comprehensive Community Organization
WB – World Bank
WB – World Bank
WGPP – Wote Green Park Project
WSUD – Water Sensitive Urban Design

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Understanding Nature-based Solutions (NbS) in Kenya

Nature-based Solution is an operational approach, an umbrella framework to address societal challenges combining conservation approach of ecosystem with biodiversity and human well-being as primary objectives (IUCN, 2016). In Kenya, urban areas face multiple challenges, combining rapid population growth, accelerated urbanization, insufficient urban infrastructure and increasing urban climate vulnerability with exacerbated climate hazards like flooding, droughts, and heatwaves. Secondary cities where growth has recently started, can seize pivotal moment in their development to leverage NbS for a resilient and more inclusive urban development.

Kenyan Enabling Environment for NbS

Kenya's policy and regulatory framework is essential for integrating NbS into urban planning and development. As part of the "enabling environment", it plays a pivotal role in either promoting or limiting the integration of NbS into urban projects and policies. The integration of NbS into Kenyan secondary cities requires a careful alignment of urban planning, climate change, and biodiversity frameworks to ensure their effective development.

The national framework provides a foundation for integrating NbS yet overlapping responsibilities among institutions hinder effective implementation. The Constitution (2010) and Kenya Vision 2030 guide urban planning and development as well as climate resilience. Laws like the Climate Change Act (2016) and Urban Areas and Cities Act (2011) promote sustainable development but overlapping roles complicate NbS integration.

Multiple actors at national, county, and municipal levels are responsible for urban planning and development, but effective NbS integration requires clear strategy, better coordination, and stronger local capacity. National ministries, county governments, and municipalities play key roles. However, they face challenges with limited resources, technical capacity, etc. A more coordinated approach is needed to enable municipalities to play a central role in implementing NbS.

NbS development requires a clear and integrated city vision as well as a multi-stakeholder approach to deliver their multiple potential benefits. The current framework lacks cohesion, making it difficult for municipalities to implement integrated, long-term strategies. Strengthening coordination across institutions is essential for successful NbS adoption.

Public participation is also a key component of Kenya's governance and essential in NbS development, but civil society and professional organizations face capacity constraints. Civil society is increasingly engaged in resilient urban development through participatory approaches, to integrate local needs into planning and foster private sector's engagement. Professional bodies also hold a pivotal role in standardizing and promoting good practices. However, these institutions face significant limitations, as much of urbanization occurs without professional design, oversight, or certified advice. Enhancing their role will be essential for developing NbS in urban areas.

NbS development in Kenya benefits from diverse external funding sources, supported by various stakeholders at state and local levels, though challenges in compliance and technical requirements remain for county actors. NbS development in Kenya is supported by multiple external funding sources. Key contributors include multilateral development banks NGOs, and bilateral cooperation frameworks. Notable projects funded through these avenues include the Kenyatta Avenue Green Corridor, one the Compendium case study, or the Safari Green Building Index. Counties access funding via equitable share transfers from the national government and conditional grants tied to specific urban development programs, such as KUSP1 and KUSP2. These grants are often restricted in use and are linked to the achievement of measurable results, influencing the NbS development in Kenyan cities. KUSP2, in particular, offers an opportunity for more resilient and inclusive urban development, increasing the potential for municipalities to adopt NbS solutions. However, the complexity of compliance systems and technical requirements may limit the ability of local actors to fully benefit from these funding opportunities.

NbS Compendium for NbS replicability and scalability

The NbS Compendium aims at enhancing the understanding of NbS and the characteristics of scalable NbS families for promoting urban resilience in Kenyan secondary cities, as well as to provide recommendations for NbS implementation into upcoming projects. It provides actionable guidance to local stakeholders for identifying the replicability potential of existing NbS initiatives, assessing their scalability, and maximizing their benefits in the Kenyan urban context.

The NbS Compendium also facilitates knowledge dissemination and sharing across stakeholders, aiming to improve understanding and foster NbS mainstreaming. By doing so, it promotes informed decision-making in urban planning and development, ensuring that NbS solutions are better integrated into local governance structures.

Kenyan NbS Inspiring Cases

The NbS Compendium draws lessons from 12 selected NbS projects selected from an Inventory of existing NbS cases in Kenyan urban contexts. Eleven NbS projects, representing ten distinct NbS families from World Bank's Catalogue (2021), were selected for running a gap analysis. This assessment, based on data from field missions, key informant interviews (KIIs), expert elicitation, and desktop research, identifies inspiring features of the projects as well as critical features to improve scalability for each NbS family. While the methodological framework is consistent across cases, the situational nature of each NbS family's efficiency and applicability means that the cases cannot be directly compared.

The NbS Compendium seeks to enhance understanding and guide the scalability and replicability of NbS in Kenyan secondary cities, using existing inspirational NbS projects as a foundation. The study delves into eight strategic components to evaluate the potential for replicability and scalability of these projects and identify inspirational features: the response to climate change, benefits for the environment, biodiversity, and soil; the implementation process and technical features; operational and maintenance implications; financial schemes and sustainability; monitoring and evaluation systems; legal, regulatory, and policy frameworks; and stakeholder engagement and social inclusion processes. All of these key features need to be factored in to reach a systemic approach to NbS implementation.

This gap analysis helps identify project features that can be leveraged to promote NbS development across Kenya, as well as areas for improvement to enhance scalability. By examining these eight strategic components, the NbS Compendium contributes to reinforcing NbS understanding among stakeholders and provides a structured framework for evaluating NbS projects. It serves as a tool for ensuring the effective adoption and scaling of NbS, particularly in urban areas, by aligning projects with the necessary conditions for success.

The main results of this gap analysis and a synthetic overview of the conditions for uptake of these NbS families are presented in the following pages.

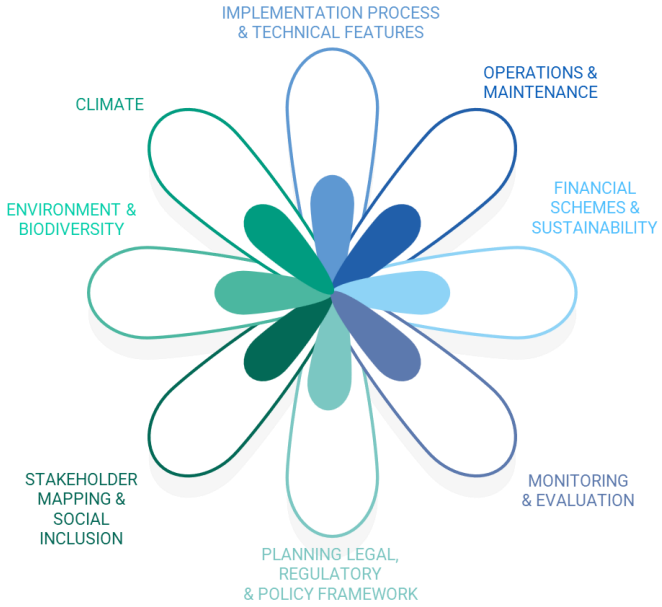

Figure 1 - The eight strategic components for NbS case gap analysis (Source: SUEZ Consulting, 2024)

NbS Compendium Cases Gap Analysis Overview

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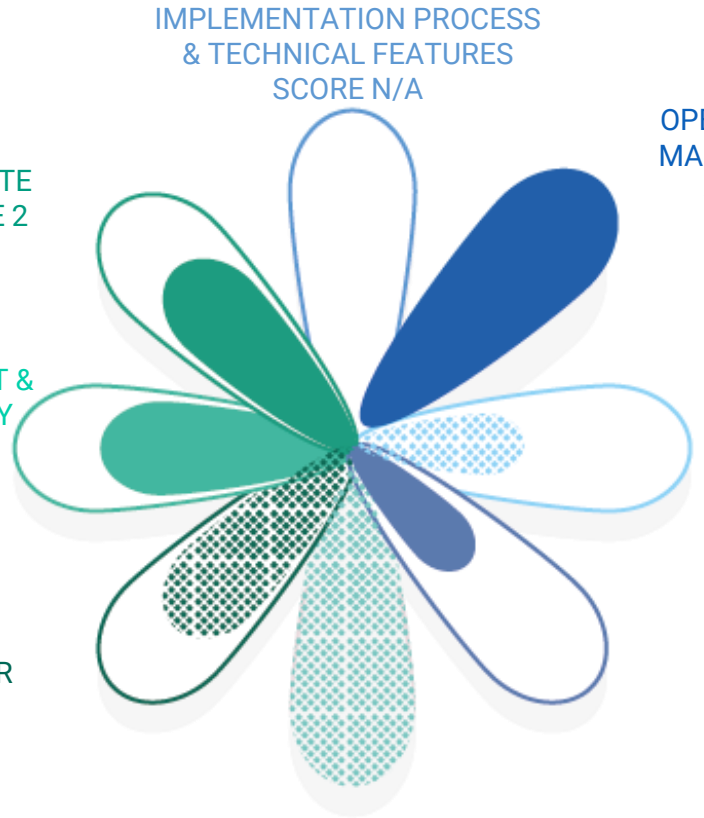
The project analysis consists of 8 components, represented in an evaluation flower to assess the NbS project's maturity and potential for replication in Kenya. Each component includes two equally weighted criteria, with scores ranging from 0 to 3 to assess process mastery and benefits. Score definitions: 0 = insufficient data, 1 = ad hoc elements, 2 = preliminary study, 3 = comprehensive study. For Kaya Tembo Forest, some assessments are marked as N/A. Intermediate scores (0.5, 1.5, 2.5) are indicated by dotted petals, as are components with a score of 0 for any criterion.

Project response to climate risks - score
Project adaptation to local climate conditions and hazards (present and future) - score

Project response to environmental risks (e.g., pollution, biodiversity) - score
Environment and urban biodiversity benefits - score

Stakeholder engagement & consultation strategy - score
Socio-economic benefits and inclusion of vulnerable group - score

Planning and development strategy - score
Regulatory and land tenure strategy - score



Design and implementation process - score
Key features of the technical design - score

Roles and responsibilities - score
Operation & Maintenance plan - score

Project costs, revenue generation and funding - score
Integrated financial plan and project sustainability - score

Key existing indicators - score
M&E system and knowledge dissemination - score

NbS Compendium Cases Gap Analysis Overview

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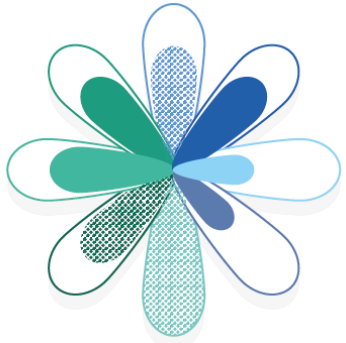
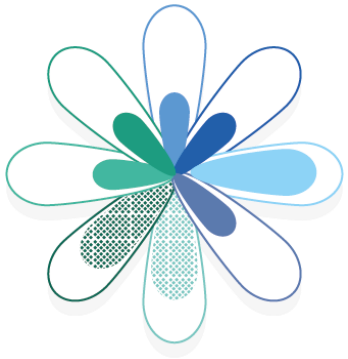
Case #1 Eldoret Arboretum



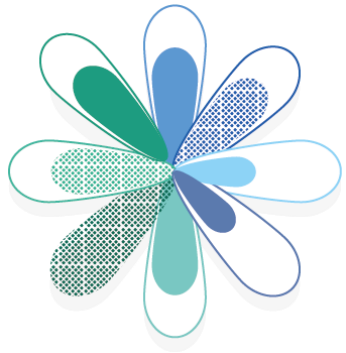
Case #2 Living Smiles

Case #3 Ondiri Wetland

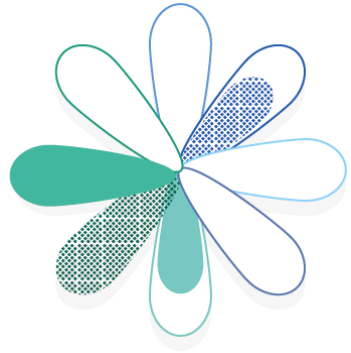
Case #4 Malindi Waterfront Park

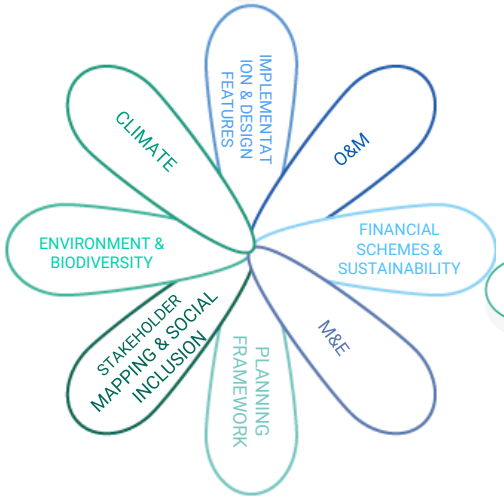


Case #5 Bangladesh Mangrove Restoration Project



Case #6 Kaya Tembo Forest





Case #7 Saint John's Community School

Case #8 Upper Tana-Nairobi Water Fund

Case #9 Kansoul Farm

Case #10 John Michuki Memorial Park

Case #11 Green Corridors

Note:
Level 0 : no data or insufficient data available | Level 1: first elements (*ad hoc*) but disparate, without a proper justification | Level 2: preliminary study but lack of comprehensiveness | Level 3: comprehensiveness (full study)
Given the specific nature of Kaya Tembo Forest, some assessment result in N/A (not applicable)
Intermediate scoring (0.5, 1.5, 2.5) are marked with dotted petal, as well as component having a criterion with a score 0

NbS Compendium Cases Conditions for Uptake

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Case 1. Open Green Space – *Eldoret Arboretum*

The Eldoret Arboretum integrates environmental and social goals to address urban challenges like urban heat. It uses native species for reforestation and promotes community involvement through cultural and recreational spaces.

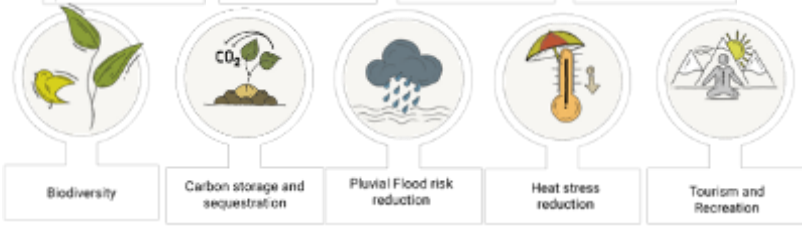
Key inspirational features:

- **Native vegetation**: Promotes biodiversity and climate action through native tree species.
- **Cultural integration**: Features like nature trails and the "Wall of Legends" foster community pride.
- **Positive social impact**: Strengthens rehabilitation program for prisoner through maintenance working opportunities.

Key improvement area for replicability:

- **Urban and ecological integration**: Incorporate parks into urban plans with proper mandates and resources, completed with specific sectoral policies.
- **Community engagement**: Involve vulnerable groups in park management and design.
- **Sustainable funding mechanism**: Use green bonds and eco-tourism for financial sustainability.
- **Public awareness**: Educate citizens on the benefits of green spaces.

Figure 2 – A view of Eldoret Arboretum (Source: SUEZ Consulting, 2024)

Urban setting	CBD – Eldoret City
NbS case category	Green infrastructure
Climate context	Subtropical highland
Addressed risks	
Benefits	

NbS Compendium Cases Conditions for Uptake

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Case 2. Terraces and Slopes – *Living Smiles (Earth Bunds)*

The Living Smiles project combats land degradation using bunds, a low-cost and adaptable technique that stabilizes soil, reduces erosion, and enhances water retention, particularly in arid regions.

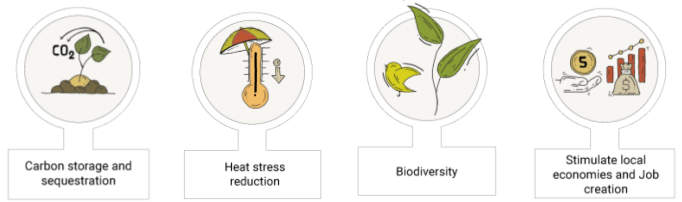
Key inspirational features:

- **Low-cost implementation**: Uses local materials, ensuring affordability and replicability.
- **Community ownership**: Actively involves local communities in restoration efforts.
- **Scalability**: Easily adaptable to various terrains and climates.
- **Ecosystem restoration and adaptation to arid and semi-arid climates:** drought-resistant grasses stabilize soil, improve biodiversity, and enhance water cycles.

Key improvement area for replicability:

- **Suitable terrain**: Ensure adequate rainfall and deep soil for bund effectiveness.
- **Training**: Integrate communities need skills in construction and maintenance.
- **Restoration policies alignment:** Develop partnerships.

Figure 3 – A site after the construction of bunds and after revegetation (Source: https://ourworld.Justdiggit.org/en/chapter/water-bunds)

Urban setting	Rural – Chyulu Hills, Kuku Ranch
NbS case category	Green infrastructure
Climate context	Hot semi-arid
Addressed risks	
Benefits	

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Case 3. Natural Inland Wetlands – *Ondiri Wetland*

The Ondiri Wetland exemplifies the value of wetlands in water purification and biodiversity. It uses a structured management plan, focusing on community involvement and regular monitoring to restore and protect wetlands.

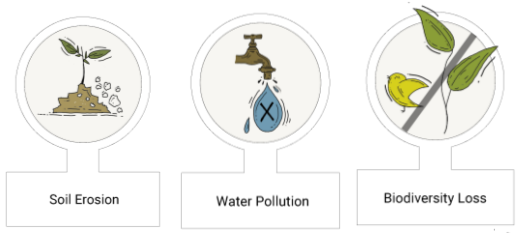
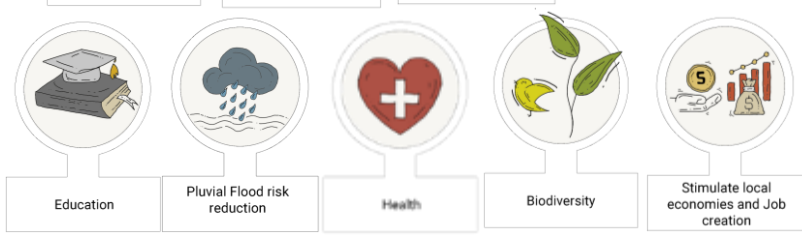
Key inspirational features:

- **Ecosystem restoration**: Combines reforestation and erosion control for wetland health.
- **Management plan**: A structured plan offers a replicable framework for other wetlands.
- **Community involvement**: Local groups play a vital role in conservation.

Key improvement area for replicability:

- **Wetland assessment**: Consider local climate impacts for tailored maintenance.
- **Standardized management plans**: Create evidence-based restoration plans at county level.
- **Engagement and policy support**: Empower communities and enforce wetland laws.

Figure 4 – Vegetable gardens and the swamp in the Ondiri Wetland (Source: SUEZ Consulting, 2024, https://www.youth4nature.org/blog/ondiri-blog)

Urban setting	Peri-urban – Kiambu County
NbS case category	Green infrastructure
Climate context	Subtropical highland
Addressed risks	
Benefits	

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Case 4. Sandy Shores – *Malindi Waterfront Park*

The Malindi Waterfront Park revitalizes a coastal area, blending green infrastructure with recreational spaces. It serves as a model for integrating ecological restoration with urban renewal to boost tourism and community engagement.

Key inspirational features:

- **Green infrastructure**: Uses vegetation for environmental and aesthetic benefits.
- **Tourism and economic growth**: Combines restoration with tourism-driven revitalization.
- **Social benefit**: Promotes social cohesion through recreational spaces.

Key improvement area for replicability:

- **Coastal resilience**: Propose hybrid solutions, like vegetated berms, to mitigate coastal risks.
- **Climate adaptation**: Focus on erosion and saltwater impacts through NbS strategies.
- **Clear roles and responsibilities:** Establish clear responsibilities between various stakeholders for project success, separate design, construction, operation and maintenance responsibilities.

Figure 5 - A view of Malindi Waterfront park (Source: SUEZ Consulting, 2024)

Urban setting	Formal – Malindi City
NbS case category	Hybrid infrastructure
Climate context	Tropical dry savannah
Addressed risks	
Benefits	

NbS Compendium Cases Conditions for Uptake

Case 5. Mangrove Forests – *Bangladesh Mangrove Restoration Project*

The Bangladesh Mangrove Restoration Project demonstrates how restoring mangrove ecosystems can protect coastlines and provide socio-economic benefits. Community-led efforts integrate alternative livelihoods like aquaculture and eco-tourism.

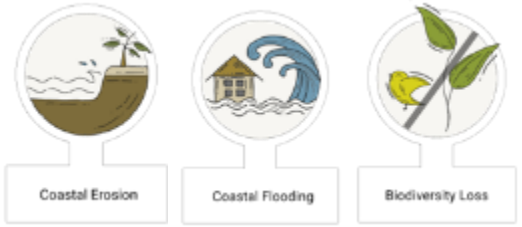
Key inspirational features:

- **Community-led restoration**: Local communities manage restoration and maintenance.
- **Livelihood diversification**: Eco-tourism and aquaculture reduce dependency on mangrove resources.
- **Global awareness**: Engages local communities in global restoration efforts.

Key improvement area for replicability:

- **Community capacity-building**: Provide training for local ownership and long-term sustainability.
- **Alternative livelihoods opportunities**: Encourage income-generating activities (e.g., beekeeping, aquaculture, eco-tourism) to reduce resource pressure.
- **Financial incentives**: Use Payment for Ecosystem Services (PES) and climate funds to finance restoration.

Figure 6 – Community members planting seedlings at the Bangladesh mangrove forest (Source: SUEZ Consulting, 2024)

Urban setting	Formal – Tudor Creek, Mombasa
NbS case category	Green infrastructure
Climate context	Tropical dry savannah
Addressed risks	
Benefits	

NbS Compendium Cases Conditions for Uptake

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Case 6. Urban Forests – *Kaya Tembo Forest*

Kaya Tembo Sacred Forest integrates ecological preservation with cultural heritage. It demonstrates how sacred forests can play a vital role in both environmental conservation and community resilience.

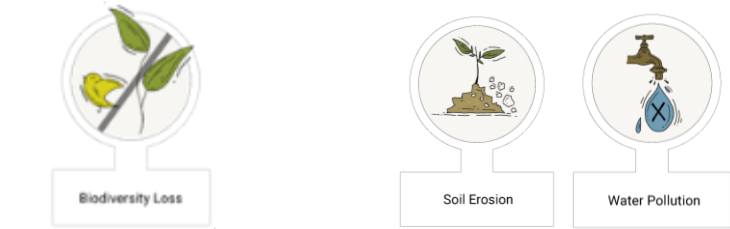
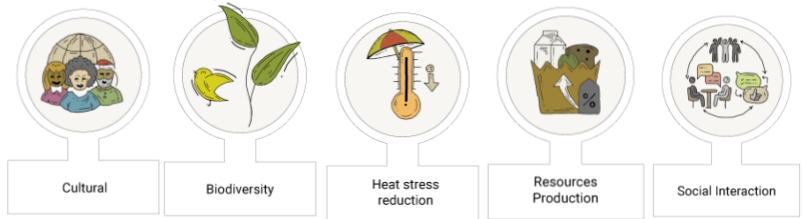
Key inspirational features:

- **Cultural significance**: Preserves cultural practices while addressing ecological challenges.
- **Locally-led management framework**: Local communities manage the forest to ensure ecological health.
- **Biodiversity and water conservation**: Contributes to soil stabilization and water conservation.

Key improvement area for replicability:

- **Specific protection policy**: Apply specific provisions for natural forest conservation and sustainability.
- **Collaborative governance**: Involve local authorities and communities in forest management to ensure adaptative capacity of the Kaya ecosystem.
- **Financial mechanisms**: Explore local carbon mechanisms opportunities and partnerships to support conservation.

Figure 7 – A view of Kaya Tembo Forest (Source: SUEZ Consulting, 2024)

Urban setting	Peri-urban – Dongo Kundu, Likoni sub-County, Mombasa
NbS case category	Green infrastructure
Climate context	Tropical dry savannah
Addressed risks	
Benefits	

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Case 7. Bioretention Areas – *Saint John's Community School*

The rain garden at St. John's Community School improves stormwater management and provides environmental and social benefits, particularly in underserved informal urban areas.

Key inspirational features:

- **Vulnerable population improvement**: Enhances the health and safety of local students.
- **Community-led design**: Ensures the design meets community needs and fosters ownership.
- **Multi-functionality**: The rain garden supports stormwater management, aesthetics, and environmental education.

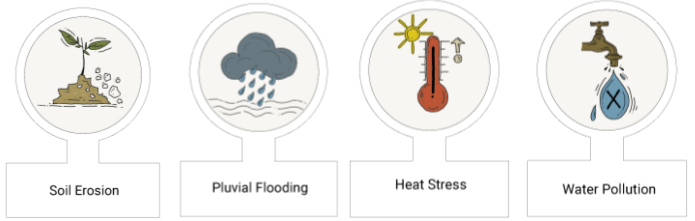
Key improvement area for replicability:

- **Pilot projects replication pathway**: Explore pilot rain garden projects to refine designs and scale solutions.
- **Policy integration**: Include NbS in urban infrastructure upgrades and settlement planning.
- **Tailored technical features**: Customize designs to local soil conditions and space constraints.

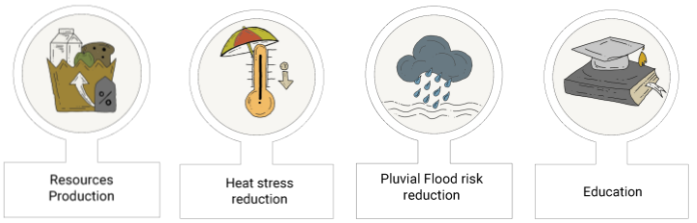
Figure 8 – Installation of green landscaping and rain gardens at St. John's Community School.(Source: https://www.kounkuey.org/projects/realising_urban_NbS)

Urban setting	Informal – Southeast Kibera, Nairobi
NbS case category	Hybrid infrastructure
Climate context	Subtropical highland

Addressed risks



Benefits



NbS Compendium Cases Conditions for Uptake

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Case 8. River and stream renaturation – *Upper Tana-Nairobi Water Fund (Upper Tana-Nairobi Water Fund)*

The UTNWF uses a pioneering funding model to finance NbS at the watershed scale, restoring rivers and streams to enhance water security and ecosystem health through public-private partnerships.

Key inspirational features:

- **Mixed NbS portfolio**: Combines terracing, agroforestry, and riparian restoration.
- **Public-private partnerships**: Engages various stakeholders for shared conservation benefits.
- **Replication potential**: Serves as a model for similar projects in Kenya and Africa.

Key improvement area for replicability:

- **Financial adaptation**: Update continuously financial plans to meet evolving challenges.
- **Pilot sites**: Use pilot projects to refine practices and demonstrate benefits.
- **Farmer incentives**: Engage small farmers early to ensure participation and long-term success.

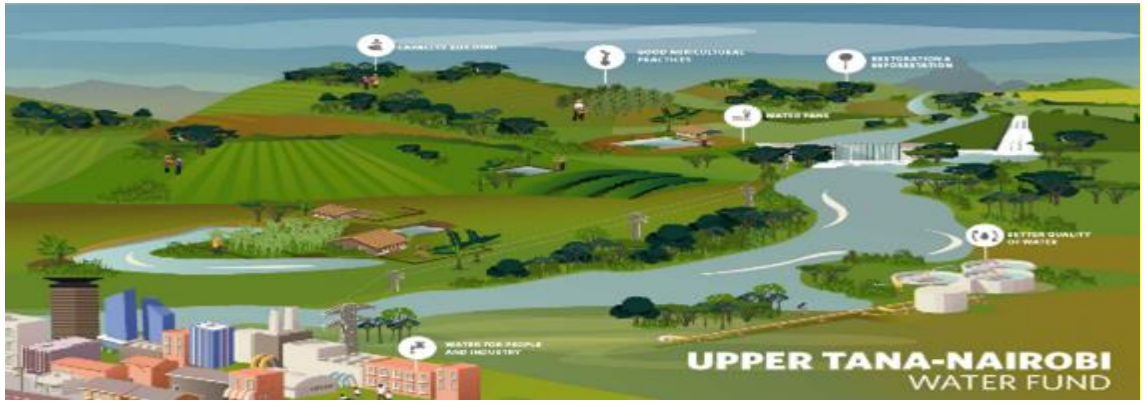
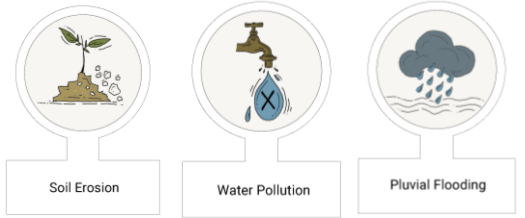
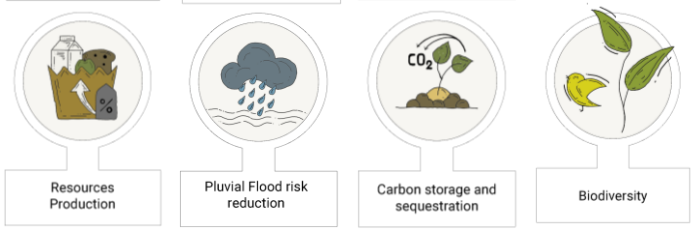


Figure 9 – Aspects of the Upper Tana-Nairobi Water Fund project (Source: https://nairobiwaterfund.org/water-funds-in-africa/)

Urban setting	Peri-urban – Tana River
NbS case category	Policy/Programmatic
Climate context	Subtropical highland
Addressed risks	
Benefits	

NbS Compendium Cases Conditions for Uptake

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Case 9. Urban Farms – *Kansoul Farm*

Kansoul Farm uses space-efficient farming techniques to combat food insecurity and youth unemployment in informal settlements, promoting ecosystem restoration through urban agriculture.

Key inspirational features:

- **Space-efficient techniques**: Uses sack and vertical farming to optimize limited space.
- **Circular sustainability**: Emphasizes composting, water management, and minimal land use.
- **Community impact**: Provides fresh produce and strengthens social cohesion through cooperative farming.

Key improvement area for replicability:

- **Climate adaptation**: Design farms to withstand climate change impacts, especially in dense urban areas.
- **Policy support**: Strengthen urban agriculture policies at the city level to incentivize farming in underserved areas.
- **Community empowerment**: Provide training in sustainable farming to ensure long-term success.

Figure 10 – VICCO's Farm (Source: A Few Years Later -Transforming Nairobi's Informal Settlements Through Urban Farming – HealthyFoodAfrica https://healthyfoodafrica.eu/blog/a-few-years-later-transforming-nairobis-informal-settlements-through-urban-farming/)

Urban setting	Informal – Viwandani, Sinai area, Nairobi
NbS case category	Resource production
Climate context	Subtropical highland
Addressed risks	Drought; Soil Erosion; Food Insecurity
Benefits	Heat stress reduction; Resources Production; Stimulate local economies and Job creation; Education

NbS Compendium Cases Conditions for Uptake

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Case 10. River Stream Renaturation – *John Michuki Memorial Park*

John Michuki Park integrates river stream renaturation with urban green space development, restoring riparian areas and creating recreational spaces for the local community.

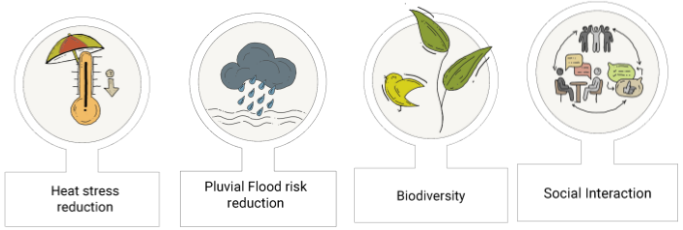
Key inspirational features:

- **NbS combination**: Combines river restoration with green space to provide ecological and social benefits.
- **Land control**: Prevents land-grabbing through strategic management by Kenya Forest Service.
- **Public engagement**: A communication campaign changes perceptions of the park from a dumping ground to a valued community space.

Key improvement area for replicability:

- **Broader ecological integration**: Expand the project to enhance biodiversity and ecosystem benefits.
- **Climate risk assessment**: Ensure the project is resilient to climate impacts, such as riverbank erosion.
- **Collaborative governance**: Develop a shared monitoring and maintenance framework among stakeholders.

Figure 11 – Recent pictures of John N. Michuki Conservation Park (Source: SUEZ Consulting, 2024)

Urban setting	Formal – Nairobi
NbS case category	Green infrastructure
Climate context	Subtropical highland
Addressed risks	
Benefits	

NbS Compendium Cases Conditions for Uptake

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Case 11. Green Corridors – *Nakuru Green Corridors*

Nakuru Green Corridors enhance urban sustainability by integrating tree-lined avenues and pedestrian pathways to manage stormwater, improve mobility, and support biodiversity.

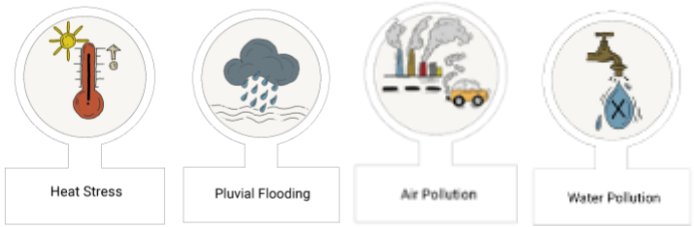
Key inspirational features:

- **Optimizing Non-Motorized Transport (NMT):** Incorporates tree canopies and permeable pavements to manage stormwater and regulate urban temperatures.
- **Community involvement**: Engages local stakeholders in the design process to ensure the project addresses community needs.
- **Multi-functionality**: Green corridors provide both ecological and social benefits.

Key improvement area for replicability:

- **Policy integration**: Integrate green corridors into urban development plans and specific sectoral policy such as sponge-city plan to avoid piecemeal development.
- **Maximize NbS**: Adapt NMT infrastructure to enhance biodiversity and stormwater management.
- **Avoid land-use conflicts**: Use co-design approaches to balance public space functions and ecological needs.

Figure 12 – A104 Highway, Nakuru (Source: Nakuru City)

Urban setting	Green corridors – Nakuru
NbS case category	Green infrastructure
Climate context	Warm-summer Mediterranean
Addressed risks	
Benefits	

Six cities' urban challenges and NbS prioritization assessment

Insights from six cities are provided to assess the potential for Nature-based Solutions development in Kenyan secondary cities. A city assessment was conducted in Kisumu, Mandera, Kilifi, Eldoret, Wote, and Nakuru, selected for their diverse urban and climate contexts, to identify conditions conducive to NbS development. The assessment includes a high-level overview of each city's urban profile and climate risk exposure, covering key geographic, demographic, and institutional characteristics, economic drivers, land-use patterns, urban challenges, climate zone, hazards, and climate projections. This analysis provides a foundational understanding of the cities' urban challenges and climate vulnerabilities.

The assessment also evaluates each city's NbS development potential, considering alignment with urban planning frameworks, ongoing NbS initiatives, and findings from the World Bank's NbS Opportunity Scan (NBSOS). The methodology includes reviewing the integration of climate resilience and environmental protection into planning documents, as well as examining existing NbS initiatives and conducting Key Informant Interviews (KIIs). The NBSOS contributes by offering municipal-level spatial analysis of climate hazard assessment and screening of NbS families that are the most relevant given these urban development challenges.

The assessment highlights key barriers to NbS implementation, such as financial, technical, and regulatory constraints. Additionally, the report links potential NbS opportunities in each city to relevant case studies from the NbS Compendium, offering practical examples and lessons learned from similar urban contexts. A summary table presents the NbS development opportunities for each city, with a focus on four emerging NbS families, rather than well-established practices. This assessment draws from several sources, including a literature and policy review of key planning documents, KIIs with city officials, and results from the NBSOS, which provides spatial modeling to identify NbS interventions that could mitigate hazards like heat and flooding.

Figure 13 – An aerial view of Mandera town where trees have been planted along the road (Source: Mandera History – County Government of Mandera)

Figure 14 - Aerial view of Nakuru City (Source: 19677.pdf, 2022)

Recommendations for NbS Implementation

The recommendations section highlights key and focused recommendations for enabling the integration of Nature-based Solutions into upcoming infrastructure projects. Drawing from lessons learned in existing NbS cases, cities' assessment and challenges identified in the enabling environment drivers, these recommendations offer actionable insights for improving the planning, design, and execution of NbS initiatives. It completes gaps in existing guidance, namely AECOM Resilient Infrastructure Guidelines (2023). This approach aims to facilitate the integration of NbS into infrastructure projects, making it easier for stakeholders to adopt NbS principles.

The recommendations aim at drawing a general framework to facilitate NbS project at each stage of the project cycle as well as expanding on four key enabling environment drivers for NbS development. Though drawing from NbS Compendium NbS cases (link with the NbS Compendium cases are stressed when appropriate) and related NbS family, these recommendations are not specific to any NbS family. 37 recommendations are identified at municipality- and national- levels, and at the different main steps of the project cycle (planning, project identification and design, construction and operation and maintenance, monitoring and evaluation).

The recommendations focus on aligning four enabling environment drivers with NbS development, complementing the technical aspects of implementation. The four enabling environment drivers are: (i) identifying knowledge generation and technical requirements, (ii) fostering the inclusion of stakeholders, (iii) strengthening institutional capacities and ensuring adequate resources and (iv) integrating policies and regulations.

Key features of NbS in the context of resilient infrastructure are emphasized:.

- The report stresses the importance of connecting NbS projects with the ecosystems that support urban development, highlighting the potential for ecosystem services.
- It also underscores the need for sustainability, ensuring NbS solutions remain effective in the long term, especially in the face of climate change.
- The preservation and restoration of existing NbS are highlighted as essential, with strategies incorporated at every stage of the project cycle.
- Finally, the report acknowledges the interdisciplinary complexity of NbS, emphasizing the need for a holistic approach to its implementation to bridge the gaps between various fields of expertise.

An overview of the key recommendations at each project cycle phase is presented in the following pages.

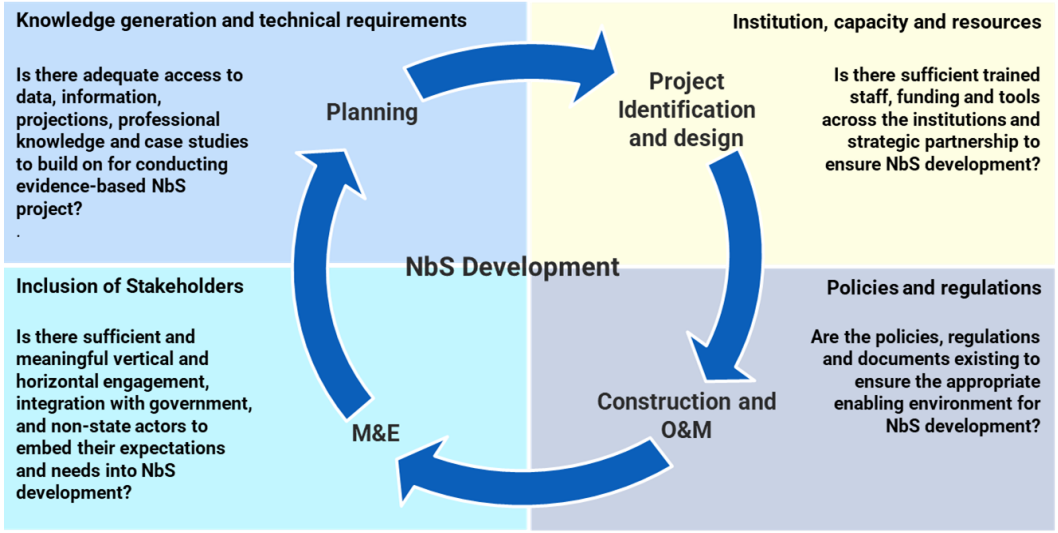


Figure 15 - Project cycle and the four enabling environment drivers (and associated methodological questions) (Source: SUEZ Consulting, 2024)

Recommendations overview

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PLANNING | PROJECT IDENTIFICATION & DESIGN | CONSTRUCTION, OPERATION & MAINTENANCE | MONITORING & EVALUATION

Knowledge generation and technical requirements

#1 Clarify the objectives and contents of environmental baseline for long-term strategic and sectoral planning — Muni. Cou.

#2 Develop evidence-based land-use and investment prioritization strategy — Municipality P

Inclusion of stakeholders

#1 Develop awareness raising platforms and channels with local stakeholders — Municipality

#2 Encourage ownership of local stakeholders — Municipality

#3 Identify and support the development of community-level climate resilience initiatives — Municipality P

Institution, capacity and resources

#1 Ensure coordinated actions under climate change umbrella — Muni. Nat.

#2 Reinforce collaboration between urban planning county departments and city-level authorities — Muni. Cou. P

#3 Shift urban planning from solution-centric to problem-centric approaches — Muni. Nat.

Policies and regulation

#1 Enforce NbS as a national initiative — National P

#2 Transition municipal plans from guidance documents to comprehensive urban planning tools — Municipality

#3 Recognize and formalize community initiatives to enhance urban planning policies — Municipality

Institution — Level of implementation

P — Identified as priority by the stakeholders

Recommendations overview

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PLANNING | **PROJECT IDENTIFICATION & DESIGN** | CONSTRUCTION, OPERATION & MAINTENANCE | MONITORING & EVALUATION

Knowledge generation and technical requirements

#1 Foster interdisciplinary expertise to advance NbS development Muni. Nat. P
#2 Develop a cost-benefit analysis (CBA) framework to prioritize large-scale NbS development Muni. Nat.
#3 Ensure inclusive design Municipality

Inclusion of stakeholders

#1 Adapt NbS projects to community-level scope and capacity through co-design and multi-functional design following local necessities and interests Municipality

Institution, capacity and resources

#1 Clarify roles and foster collaboration for NbS integration Muni. Nat. P
#2 Enhance municipal capacity to support NbS projects and integration Municipality
#3 Strengthen the role of professional bodies in enhancing technical standards for NbS development address Nat.
#4 Land tenure challenges through public-private partnerships for NbS Development Muni. Nat.

Policies and regulation

#1 Integrate environmental quotas and incentives in development control to foster NbS implementation Muni. Nat.
#2 Strengthen the role of environmental and social impact assessment (ESIA) to drive NbS adoption and resilience-oriented investments National P

Institution Level of implementation P Identified as priority by the stakeholders

Recommendations overview

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PLANNING | PROJECT IDENTIFICATION & DESIGN | **CONSTRUCTION, OPERATION & MAINTENANCE** | MONITORING & EVALUATION

Knowledge generation and technical requirements

#1 Activate local supply chains for NbS construction and long-term management — Muni. — Cou. — P

Inclusion of stakeholders

#1 Preserve and enhance the social value of public spaces through NbS development — Municipality

#2 Encourage the participation of local communities in O&M activities — Municipality

Institution, capacity and resources

#1 Pursue coordinated action initiated at the planning throughout construction and O&M — Municipality — P

#2 Develop O&M plans to ensure O&M planning, responsibilities, financial sustainability, and clear management guidance from the NbS design phase — Municipality — P

#3 Develop O&M capacity building programs — National

Policies and regulation

#1 Enhance NbS inspection and enforcement at the local level — Municipality

Institution — Level of implementation

P — Identified as priority by the stakeholders

Recommendations overview

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PLANNING | PROJECT IDENTIFICATION & DESIGN | CONSTRUCTION, OPERATION & MAINTENANCE | **MONITORING & EVALUATION**

Knowledge generation and technical requirements

#1 Develop a robust monitoring framework to evaluate NbS performance and benefits — Municipality

#2 Implement an adaptive management framework for NbS — Municipality

Inclusion of stakeholders

#1 Tap into citizen sensing data potential — National — P

#2 Foster partnerships with Kenyan research institutions for advanced impact analysis and knowledge dissemination — Muni. Nat.

Institution, capacity and resources

#1 Design an appropriate framework for monitoring and evaluation — Municipality — P

#2 Harness labelling initiatives for NbS as an adaptation measure to attract funding — National — P

Policies and regulation

#1 Establish a national NbS monitoring framework to track outcomes across sectors — National — P

#2 Implement a resilience scorecard to evaluate NbS integration in municipal plans — Municipality

#3 Develop community-led NbS impact assessment tools — Municipality

Institution — Level of implementation

P — Identified as priority by the stakeholders

Preliminary checklist for municipalities

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This flowchart presents a detailed checklist of the key tasks and actions required for the development of a NbS project at the municipal level in Kenya, structured across the four main phases of the project cycle. Each phase is broken down into specific steps, with priority recommendations highlighted based on stakeholder input. These recommendations are designed to facilitate the smooth execution of tasks and strengthen the enabling conditions necessary for NbS development. By incorporating these insights, the flowchart aims to provide a practical guide for municipalities, ensuring that the necessary actions are taken at each stage of the project cycle to promote successful NbS outcomes.

PLANNING

- ❑ Use a spatial prioritization framework to map NbS that need to be protected, restored and created #2
- ❑ Engage with local communities where NbS opportunities exist to choose sites suitable for NbS implementation within target communities #3
- ❑ Strengthen coordination and clarify roles and responsibilities between county-level and city-level planning mechanisms #2
- ❑ Elaborate comprehensive planning document #2

PROJECT IDENTIFICATION & DESIGN

- ❑ Identify NbS opportunities #2
- ❑ Define project goals and outline the scope for NbS with the support of an adequate technical advisory committee
- ❑ Set up a project team gathering the required expertise #1 #1
- ❑ Collect project related data (climate, environment, local stakeholders…) #2
- ❑ Identify required permits and ensure regulatory compliance before construction #2

CONSTRUCTION, OPERATION & MAINTENANCE

- ❑ Incorporate local socio-economic development criteria #1
- ❑ Engage the community during and after construction #2
- ❑ Evaluate various NbS construction methods (e.g., phased vs. full-scale implementation) #1 #2
- ❑ Integrate both construction and O&M cost in evaluation criteria
- ❑ Elaborate a comprehensive checklist for inspecting NbS based on NbS family guidelines #1

MONITORING & EVALUATION

- ❑ Establish baseline information and monitoring framework #1
- ❑ Identify sources of potential data to build the project indicators, and centralize these data sources #1
- ❑ Implement a management framework that allows room for adaptative measures #2

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