Nature-based green infrastructure: A review of African experience and potential

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Executive Summary

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This document contains a concise summary of the main report, providing key findings and recommendations. The full report, which offers a comprehensive analysis and supporting details, can be accessed separately at:

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Summary

Why nature-based solutions for green infrastructure?

A means of achieving multiple Sustainable Development Goals

Nature-based solutions for green infrastructure (NBS-GI) can bring considerable, multi-dimensional benefits to people and their environment, if designed with meaningful public engagement.

In these conditions, green infrastructure can demonstrably contribute to Sustainable Development Goals and targets. In the detailed full report of the study, we present evidence from diverse African contexts of how green infrastructure:

- improves land integrity and soil fertility
- enhances the quality and reliability of freshwater flows; wastewater filtration and management
- improves coastal-marine fisheries productivity
- facilitates human mobility, including for productive and recreational uses, in urban environments.

A means of reducing disaster risk in selected contexts

In disaster risk reduction (DRR) terms, green infrastructure may be effective in mitigating risk for frequent, low-intensity hazards such as:

- riverine flooding and riverbank erosion
- coastal wave surges and erosion
- landslides
- heatwaves, especially in urban areas.

Green infrastructure may be inadequate in mitigating the risk of high-impact events, such as very intense storms, droughts or floods, although it may still be useful in combination with built infrastructure for such purposes. Measures such as vegetation planting and soil stabilisation can play a role in extending the lifetime and enhancing the effectiveness of built or 'grey' infrastructure.

How can nature-based solutions for green infrastructure be useful in African contexts?

The study finds that three ecosystem restoration trends are increasingly prevalent in Africa – in recognition of their multidimensional benefits for sustainable development and DRR. These are:

- land degradation neutrality and/or reversal: investment in the fertility and stability of soils to safeguard settlements and infrastructure and underpin agricultural and forestry production
- catchment restoration: investment in replanting of native species and other diverse nature-based and hybrid grey-green methods to manage scarce water resources, deliver on essential water and sanitation needs, provide water for essential food production and regulate water flows across landscapes
- coastal ecosystem restoration: investment in mangrove, reef and seagrass ecosystems to boost fisheries productivity and mitigate erosion from sea level rise and storm surges.

These trends are garnering commitment among African political leaders. They are reflected in Agenda 2063, the African Union's development blueprint, which has as a key goal: 'Environmentally

sustainable and climate resilient economies and communities' – as well as numerous other initiatives and agreements.

What do we know about the use of nature-based solutions for green infrastructure in Africa?

How options are selected

The case study evidence in the main report finds that:

- when a city, district or landscape unit takes a strategic, cross-sectoral approach to mapping and prioritising its development and DRR needs and assessing intervention options, *and*
- when this strategic planning exercise is undertaken in a highly consultative way

then, stakeholders are likely to recognise and prioritise the multifunctional benefits of NBS-GI as a favoured option(s).

By definition, strategic portfolio approaches are more likely to capture a balance of development and DRR needs across society. Here, a fully consultative, participatory approach means involving representatives of diverse stakeholder groups including women, children, people living with disabilities and Indigenous peoples; and actively incorporating diverse forms of indigenous and local knowledge.

The evidence shows that such approaches are more likely to capture people's priorities for what they value and what contributes to their well-being. Some of these green infrastructure benefits cannot be readily assigned a monetary value. The value of nature for people includes both quantifiable and non-quantified values, such as:

- income security and improvement
- food security and nutrition improvement
- enhancement of productive assets (trees, etc.)
- reduced heat stress and improved thermal comfort
- recreational, cultural, religious and aesthetic values
- biodiversity values.

Green infrastructure is often overlooked in planning and options assessment processes that focus too narrowly on one single, sectoral objective. Conventional financial frameworks and business models do not adequately value the multidimensional benefits of nature-based green infrastructure, particularly their non-market benefits. It requires resourcing – both funding and skilled human resources – to manage effective city- and landscape-level planning processes and to undertake a more comprehensive options assessment.

How NBS-GI are financed

The financial case for governments and donors to invest in NBS-GI is often made on the basis of avoided disaster losses. Namely, investing in green infrastructure to reduce disaster risk may be shown to cost less to the public purse than addressing losses and damages later – if the project did not take place. In Dar es Salaam, Tanzania, a mix of NBS-GI activities was projected to provide a positive return on investment in as little as seven years, based on avoided losses from climate-related damages.

More broadly, the African Union supports the rehabilitation of nature as a foundation for the continent's sustainable development, as noted earlier. In applications of NBS-GI analysed in the study, investments are generating

multidimensional development benefits in communities with very low incomes. Those who benefit from green infrastructure construction and maintenance have limited ability to pay for it. In many cases, they also have considerable ability to contribute in-kind inputs, such as labour, knowledge and social organising, toward its effectiveness.

In these sustainable development and DRR contexts, it may not be feasible or fair to charge user fees and so generate financial revenues from many NBS-GI. The public goods nature of many NBS-GI schemes may lend themselves definitively toward public or not-for-profit funding, and may discourage private investors who are seeking financial returns.

Nonetheless, there are examples where private actors could benefit directly from the positive externalities of the NBS-GI intervention and be willing to pay towards it: for example, the increased aesthetic values of green urban landscaping, or reduced flood risks, could both enhance the values of private property and assets. In practice, this study only found one such example, involving a Seychellois hotel's willingness to pay for mangrove restoration on account of the DRR benefits.

However, the study contains instances of private actors' willingness to purchase carbon credits or sustainability credits from local NBS-GI initiatives as part of their environmental, social and governance (ESG) missions and mandates. In the Madagascar and Kenya cases, a reliable revenue stream was instigated from carbon credit sales; in Sierra Leone, a new scheme is generating environmental impact tokens for sale to impact investors. In these cases, schemes were developed to meet local development priorities, *then* the carbon pricing and credit sale revenues were introduced later, as opposed to being designed from the outset. Initial public funding was required to get the projects off the ground and provide proof of concept for carbon sequestration or environmental benefits.

What do we not yet know about the use of nature-based solutions for green infrastructure in Africa?

Benefits and disbenefits of NBS-GI

There is still much that we do not know on the topics of:

- the benefits (and any disbenefits) of different approaches to urban tree and vegetation planting in mitigating poor air quality and especially particulate pollution
- the benefits, risks and risk mitigation strategies for using green roofs and green walls in dense African urban environments
- the contribution of NBS-GI to improved human health outcomes outside of the known cooling (heat-health) benefits, e.g. whether there is any possible improvement in lung or cardiovascular health associated with urban greening and land use innovations, and/or any possible improvement in gastrointestinal health associated with NBS-GI for wastewater filtering
- the ability of NBS-GI to enhance biodiversity over time.

This review found insufficient evidence on these topics, especially in African contexts, and flags them as subjects for future study.

Gazi Bay mangrove restoration site, Kenya. Photo credit: Rob Barnes

Net benefits and maintenance regimes in the long term versus the short term

Depending on the specific case, NBS-GI may take some time to yield their full benefits. For some planting schemes, it may take years for certain species to reach maturity and deliver the full range of services intended – be they carbon sequestration, soil retention, shade provision, etc.

Some of the case studies in this research, and related literature, document the planting and maintenance activities that have taken place over one to three decades and whose results are measurable over that longer term.

However, in general, there is not enough long-term systematic tracking of the benefits of NBS-GI actions, including their often-significant job-creation, livelihood and well-being benefits, and assessment of these benefits against operations and maintenance costs. This is an important area for more research.

Recommendations

Recommendations for national and local governments and regional bodies

Establish guidance for options assessment that is situated at the strategic, cross-sectoral level and informed by the broader values of nature. NBS-GI options are more often identified for their multidimensional development and DRR benefits than for single infrastructural purposes. When an agency or decision process is steered too early by a single infrastructural purpose, this can privilege hard engineered solutions with negative environmental externalities. Such approaches may inadvertently hide or ignore the multiple benefits from NBS-GI.

Sometimes hard-engineered solutions are most appropriate for managing climate risks in a particular place. However, **decision-makers should consider how grey infrastructures' operational efficiency can be enhanced by supplementing it with NBS-GI.** Grey-green hybrid solutions in the context of new interventions or rehabilitation of existing grey infrastructures can extend some of the multidimensional benefits of green infrastructure to 'conventional' engineering projects.

Blend expertise in the valuation of nature from both scientific-academic communities and local communities and apply this blended knowledge to specific decision-making contexts. Such partnerships are needed to fill the massive implementation gap between natural capital valuation (where it does exist) and its application to real-life decisions. Invite a wide range of stakeholders to express the market and non-market values of nature, including cultural and spiritual values, and to express their priorities for the uses of ecosystem services at defined geographic scales (e.g. city, province, country, catchment, ecosystem or landscape).

Don't wait for 'perfect' information before taking action. 'Perfect' information on the stocks and flows of natural capital may be unattainable. Information about ecosystems and their benefits can be 'good enough' to support robust public consultation and decision-making. It is possible to quantify and map selected ecosystem services and who benefits from them, or who suffers disbenefits from lack of access to them, and how different options could affect people's access to benefits. Case studies in the main report, including Praslin Island, Seychelles, show that local authorities and community members are teaming up with scientists to map ecosystem services and incorporate this data into highly consultative modes of planning to choose NBS-GI interventions that are considered broadly legitimate and feasible to implement.

Support open, inclusive decision-making processes that invite stakeholder input. Acknowledge explicitly the different priorities for ecosystem services use of diverse user groups, and the trade-offs that may exist between them. Finance deliberative locally-owned and led processes that are viewed as transparent and fair.

Recommendations for donors and development partners

Endorse and fund locally-led adaptation that is mandating the use of ecological infrastructure to reduce climate risk and create green jobs.

Open unrestricted funding windows for cities and local organisations to finance the planting–maintenance–growing life cycle of urban nature-based solutions.

As above, follow options assessment processes that are situated at the **strategic, cross-sectoral level** to ensure that the multidimensional benefits to society of green infrastructure are adequately recognised.

Provide funding for open, inclusive decision-making processes that assess options for the use and protection of ecosystem functions from a holistic perspective. Recognise that portfolio level planning processes with true gender and social inclusion take time and money to do well.

Support natural capital accounting (valuation of nature) to build understanding of the diverse benefits of ecosystems, including biodiversity, to society, including indigenous and local knowledge thereof.

Consider the potential to establish and nurture centres of excellence for natural capital accounting (valuation of nature) in Africa and by African researchers to consolidate understanding of the diverse benefits of ecosystem services to society and link this expertise and analysis directly to policy challenges and opportunities.

Fund the successive strengthening of the evidence base on stocks and flows of natural capital in Africa and the contributions of ecosystems to society and use this knowledge to actively inform international donor programmes as well as national and local policies. This requires investment in observation and monitoring systems, and data management and sharing. This also requires increased investment in: (a) human resource and systems capacity strengthening in scientific institutions and (b) environmental education, including continuing education and citizen science initiatives across society.

Recommendations for researchers

Explore how to partner with communities to map ecosystem services, to foster broader understanding of the state of nature and its values to different groups of people (across genders, ages, ethnicities and abilities), locally, across catchments and ecosystems, and nationally.

Recognise that 'citizen science' – citizen-based data collection – on the status of ecosystem services can be an incredibly empowering and useful tool, both democratising and practical (e.g. see the Darfur case study in the main report). Community members themselves have the potential to contribute to environmental data collection and monitoring: data that is vital for feeding into local-, landscape-level and national decision-making processes. This may alleviate many practical and financial issues for researchers and scientists and be motivating for community participants if designed collaboratively and with practicality in mind.

Assist in capturing lessons learned of the broad social and economic benefits and disbenefits of NBS-GI implementation over time: with a stress on the need for longitudinal documentation and reflective learning processes. There is an important role for long-term cooperative agreements between local and national universities, with civil society-based organisations, non-governmental organisations (NGOs) and governments, to advance applied knowledge.