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The Critical Role of Nature-based Solutions for Enhancing Climate Resilience in Informal Areas

An Urban Supplement to the UNFCCC Technical Guidelines on National Adaptation Plans





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Abbreviations

AAC	Adaptation Action Coalition
AdComm	Adaptation Communication
ARA	Adaptation Research Alliance
CBA	Cost-benefit analysis
CCVRA	Climate Change Vulnerability and Risk Assessment
CEA	Cost-effectiveness analysis
EBA	Ecosystem-based Adaptation
GCF	Green Climate Fund
GEF	Global Environment Facility
GGA	Global Goal on Adaptation
GIS	Geographic Information Systems
GRAA	Global Research and Action Agenda
IPCC	Intergovernmental Panel on Climate Change
KENSUP	Kenya Slum Upgrading Programme
KJIP	Kiribati Joint Implementation Plan
LDC	Least Developed Countries
LEG	Least Developed Countries Expert Group
M&E	Monitoring and Evaluation
MCA	Multicriteria analysis
NAP	National Adaptation Plan
NAPA	National Adaptation Program of Action
NBS	Nature-based Solutions
NDC	Nationally Determined Contributions

PDP	Participatory Development Programme
PSUP	Participatory Slum Upgrading Programme
RISE UP	Resilient Settlements for the Urban Poor
SDG	Sustainable Development Goal
Sida	Swedish International Development Cooperation Agency
SIDS	Small Island Development States
UN-Habitat	United Nations Human Settlements Programme
UNFCCC	United Nations Framework Convention for Climate Change
UNEP	United Nations Environment Programme
VRA	Vulnerability and Risk Assessments



Mangrove Replantation, Morondava, Madagascar 2022, UN Habitat

Foreword

The world's present and future are urban. As of 2023, more than half of the world's population is residing in cities. This number is projected to grow significantly by 2050, marking a critical phase characterized by innovation trends and a substantial shift towards urban migration. We are confronted with the urgent task of addressing these challenges while also managing the climate crisis. This urban transition increases the demands on resources, simultaneously contributing to the degradation of biodiversity and heightened vulnerability to climate change.

Unfortunately, it is the most vulnerable, who contribute the least to the climate crisis, face the harshest consequences. As highlighted in the IPCC Working Group II report on Impacts, Adaptation and Vulnerability in 2022, 3.3 to 3.6 billion people live in climate change vulnerability hotspots, and over 618 million people reside in low-lying coastal zones. These regions are particularly susceptible to climate-related impacts, including sea-level rise, land deviation, coastal erosion, and saltwater intrusion. It is also alarming to note that over 10 per cent of the world's physical assets and population are concentrated in urban centers situated less than 10 meters above sea level. These statistics emphasize the critical importance of integrating resilience and adaptation planning elements into discussions concerning National Adaptation Plans (NAPs) and Nationally Determined Contributions (NDCs).

A significant concern for UN-Habitat is the current state of approximately one billion informal dwellers worldwide. Whilst urban growth has continued to expand at a rate of around 1.6 per cent, annual global informal settlements growth is at 9.85 per cent, making informal settlements the most common form of urbanization. These informal areas, often characterized by inadequate housing and living conditions, are becoming increasingly vulnerable to the impacts of climate change, further exacerbating the inequalities faced by their inhabitants.

UN-Habitat believes that nature-based solutions fostering resilience for the most vulnerable communities can affordably and efficiently

improve their adaptive capacity to climate impacts. Nature-based solutions can reduce heat island effects, improve flood retention, and stabilize erosion prone land, while they stimulate socio-economic security, and in particular food security. This brings the triple dividend of reducing greenhouse gas emissions, protecting ecological assets and biodiversity, and effectively adapting the most vulnerable communities to climate change. All these are outcomes of UN-Habitat's Strategic Plan 2020 – 2025 with the objective of strengthening climate action and improving urban environment.

As significant challenges persist, this publication seeks to strengthen the links between urban adaptation, informal areas, and nature-based solutions. In particular, it is intended as an urban supplementary technical guideline to the UNFCCC on National Adaptation Plans. I would like to encourage policymakers, practitioners, and researchers alike to use this tool to mainstream the implementation of nature-based solutions in informal urban and local areas within the different elements of the National Adaptation Plan processes and adaptation planning in general. At the same time, I hope this publication connects national and urban actors striving to build a more resilient and sustainable world for all.

By focusing on adapting the most vulnerable communities to the impacts of climate change, together, we can create a better urban future, leaving no one and no place behind.



Maimunah Mohd Sharif

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Part 1. Introduction

1.1 Overview of the guidelines

This guidance note is designed as an urban supplementary material to the Technical Guidelines for the National Adaptation Plan (NAP) process, which were developed in 2012 by the UNFCCC Least Developed Countries Expert Group (LEG). This supplementary material seeks to strengthen the links between urban adaptation, informal areas, and NBS within the different elements of the NAP processes and adaptation planning more broadly. It aims to enhance the understanding and provide guidance for national authorities, national decision-makers, and other key technical stakeholders working on the planning, development, and implementation of NAP.

The target audience of this supplementary guide are national and sub-national decision makers and officials who are concerned about climate change issues, and particularly those who may be involved in the consultation process that accompanies the formulation of NAPs or are involved in the implementation of NAP priorities in urban areas. The tool aims to increase the understanding of national governments of the importance of local planning for the national agenda. Additionally, it includes sub-national governments as a primary audience to foster a multilevel approach when defining national priorities. Another important secondary target audience are academics, researchers or similar professionals involved in conducting analysis in support of governments that are formulating or implementing NAPs.

The guidance note draws on the experiences of UN-Habitat's Flagship Programme Resilient Settlements for the Urban Poor (RISE UP)¹ and the Participatory Slum Upgrading Programme

(PSUP)² and presents a flexible approach that can be adapted to the country's context, capacities and resources available. It has four parts:

Part 1. Introduces the supplementary guide.

Part 2. Describes the context of informal settlements and the informal economy.

Part 3. Examines the critical role of NBS for resilience building in informal areas.

Part 4. Provides a step-by-step guide to integrate NBS and informal areas in NAPs.

The urban supplementary guide reviews good practice from towns, cities and countries that have taken urban actions to adapt to climate change and offers practical guidance on scaling this work to the national level through the NAP. Using this guide, climate change focal points or relevant institutions, who are formulating NAPs or overseeing their implementation, should be able to identify climate change priorities specific to urban vulnerabilities especially in informal areas in their countries and incorporate them at different stages of the NAP process.

1.2 The need for enhancing climate resilience in informal areas

Informal areas and other poor residential neighbourhoods are a global urban phenomenon.³ They exist in urban contexts worldwide, in various forms and typologies, dimensions, and locations. Although urban informality is more present in cities in the southern hemisphere, housing informality and poor living conditions can also be found in developed countries.

More than 4 billion people live in cities as of

1 UN-Habitat. RISE UP: Resilient Settlements for the Urban Poor. Available at: <https://unhabitat.org/programme/rise-up-resilient-settlements-for-the-urban-poor>

2 UN-Habitat. Participatory Slum Upgrading Programme (PSUP). Available at: <https://unhabitat.org/programme/the-participatory-slum-upgrading-programme-psup>

3 UN-Habitat, The State of the World's Cities Report, 2009; 2011; 2013

2023. The global urban population has risen by more than 400 million between 2015–2020. By 2050, an estimated 2.5 billion people will be added to the urban population (a total of 68 per cent of the world’s population) with almost all this growth occurring in the Global South, particularly in informal areas, leading to even greater inequality and vulnerability of the population.⁴ 165 million more slum dwellers have emerged globally over 20 years, reaching nearly 1.1 billion in 2020, with 90 per cent living in Africa or Asia. Meanwhile, 318 million people globally are experiencing homelessness.⁵

Whilst urban growth has continued to expand at a rate of around 1.6 per cent, annual global informal settlements growth is at 9.85 per cent, making informal settlements growth the most common form of urbanization.⁶ Therefore, the prominence, growth and importance of informal settlements will need to become more of a focus for urban planning, specifically in national and local adaptation planning.

Cities have greater vulnerability to climate hazards, mainly due to the density of infrastructure and people, and limitations on land that may be less exposed to risks, leading to unsustainable land development. Unsustainable land development is compounding not only socio-economic factors but also climate change vulnerabilities, that can trigger heat island effects and water-logged floods in urban environments. The current rate of urban population growth in limited urban land, lack of good urban planning, land management and housing strategies in the Global South – especially in Least Developed

Countries (LDCs) and Small Islands Developing States (SIDS) – pushes the most vulnerable urban poor people into informal areas. Meanwhile, the global housing deficit pushes people into inadequate shelter highly susceptible to climate impacts. 1.6 billion people globally, continue to live in inadequate shelter making them even more vulnerable to heat waves, floods, storms and other adverse climate change impacts.⁷

Infrastructure aimed at reducing risks such as paved roads, storm and surface drainage systems, and piped water, along with essential services for building resilience like healthcare and emergency services, often fails to reach informal areas.⁸ These areas face additional challenges, including security issues and a lack of law enforcement, leaving them ill-equipped to cope with climate-related shocks. As urban areas continue to expand informally, inequality worsens, with a significant portion of the population, around one in eight people or approximately one billion individuals globally, living in these informal areas and economies.⁹

1.3 The case for integrating informal areas in the NAP planning and implementation

Despite the scale of the climate crisis, there is a vast implementation gap in tackling climate change, including in cities, let alone in informal areas.¹⁰ Although more than 170 countries and many cities are incorporating adaptation strategies into their plans and policies, (including National Adaptation Plans (NAPs) and Nationally

4 UN-DESA, 2018

5 UN-HLPF, UN-Habitat, “Key Facts”

6 Samper, Jota., Shelby, Jennifer A., Behary, Dean (2020). *The Paradox of Informal Settlements Revealed in an ATLAS of Informality: Findings from Mapping Growth in the Most Common Yet Unmapped Forms of Urbanization*. Sustainability 12, no. 22: 9510.

7 United Nations General Assembly resolution 76/133

8 A. Revi, D. et al. (2014). IPCC - Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Chapter 8: Urban areas in field.

9 IPCC, “Climate change 2022: Impacts, Adaptation and Vulnerability. Chapter 6: Cities, Settlements and Key Infrastructure,” 2022

10 GCoM, UN-Habitat, “New insights for the 2018 Global Research and Action Agenda on Cities and Climate Change Science, 2021 Innovate4Cities conference,” 2022, Edited by J. Greenwalt and B. Walsh.

Determined Contributions (NDCs)), there are significant disparities between what has been planned, the adaptation action implemented, and what is needed on the ground to address specific needs of the most vulnerable people. 171 NDCs, or 89% of the total NDCs reviewed, identify national adaptation challenges; while 59 NDCs, 30% of the total NDCs reviewed and 48% of the NDCs with urban content, identify urban adaptation challenges. The misalignment on the identification of adaptation challenges, between national and urban level, is very evident analyzing specific sectors.¹¹ A similar trend is seen in NAPs, with only 26 identifying 'Urban/Human Settlements and/or Housing' as a priority sector. With regards to nature-based solutions (NBS) or Ecosystem-based Adaptation (EBA), 68% of NAPs mention this critical aspect when building resilience, and only 48% specifically mention NBS/EBA adaptation measures.¹²

While much has been written on urban adaptation, NBS and informality, there is little research and guidance on the intersection of these important areas in local adaptation planning, let alone how to integrate them in the NAPs. [Part 4](#) of this report looks at how adaptation measures are currently identified in the NAP process. NAPs need to be better supported to link the national dynamic and understanding of climate risk down to the municipal and local level. This has been an ongoing challenge in the NAP development, and the next iterations of NAPs need to bridge this gap. The adaptation measures that are developed as part of the NAPs are typically based on national understanding of climate risks, however they do not always reflect the needs on the ground and of those who are the key bearers of climate risk. This urban supplementary material seeks to bridge one of those gaps, with a focus on informality and the use of NBS to build resilience.

Adaptation is an ongoing process and requires integration from different levels of society from the national down to the local, embedding scientific knowledge as well as local, traditional communities and indigenous knowledge. As such an adaptation plan which is solely focused on the national level, misses out on the value that a fully integrated adaptation plan with vertical alignment, both top-down and bottom-up, can bring. Multi-level action includes other levels of integration between diverse stakeholders and ministries, and between time and territories, that are needed to better integrate urban and informal settlements into adaptation planning:

- **Horizontal Integration** - Promoting linkages between sectoral policies and related ministries
- **Vertical Integration** - Promoting linkages between national, regional and local governments and policies
- **Territorial Development** - Promoting strengthened urban, peri-urban, and rural links across jurisdictions
- **Temporal Integration** - Promoting a longer-term, national-level vision of urban development priorities and a "system of cities"
- **Stakeholder Integration** - Providing a framework to consult various urban actors, based on principles of transparency and participation and partnership.

Integrating urban systems and informality as a cross-cutting theme, fully embedded throughout an adaptation plan process, can provide the opportunity for inclusive and participatory multi-stakeholder engagement. By bringing in city-level stakeholders, the adaptation planning process will get a step closer to engagement with those most vulnerable to climate risks, and those that adaptation planning needs to engage with to enhance the positive impacts of adaptation and

11 UN-Habitat, "Urban Climate Action: The Urban Content of the NDCs: Global Review 2022," 2022, https://unhabitat.org/sites/default/files/2022/12/ndc_urban_content_2022_report.pdf

12 NAP Global Network, Data reflects NAPs submitted to the UNFCCC as of 30/04/2023, <https://trends.napglobalnetwork.org/trend-in-key-themes/nature-based-solutions>

reduce the likelihood of maladaptation. Whilst a focus on urban issues and stakeholders is important to the success of national adaptation planning, it is also essential that urban issues also encompass informality.

In addition to the arguments provided in [Section 1.1](#) and in more detail in [Part 2](#), which describes how **climate change impacts are felt disproportionately by people in informal areas**, there are other reasons to include informal areas in the NAP process, such as:

- **Fostering paradigm shifts:**

Notwithstanding the efforts that cities are making in preparation for the incipient climate crisis, the poorest and most precarious neighbourhoods are rarely included in the development of public policies, infrastructure, urban design solutions, and technologies. As a result, poverty and inequality in informal areas continue to deepen, and opportunities continue to be limited, thus leading to even higher vulnerability to climate change of the local population. Including informal areas in the NAPs will instead foster a paradigm shift towards a climate resilient development pathway, by ensuring inclusive policies, mobilized investments, committed local and national governments. The Intergovernmental Panel of Climate Change (IPCC) notes how upgrading interventions carried out in informal neighbourhoods with communities can lead to a more resilient future thanks to improved infrastructure functionality and empowerment of residents.¹³ A paradigm shift is also required with regards to climate finance, with currently only 21% of climate finance to date being channelled to climate adaptation, of which less than 10% flows to local levels.¹⁴ Informal areas,

despite their projected growth rates, are barely recognized in local adaptation planning, thus a non-defined marginal amount reaches informal areas. The United Nations Environment Programme (UNEP) states that by 2030, the developing world will have to spend up to USD 300 billion a year just to cope with exacerbated climate impacts.¹⁵ If policies do not reflect urban priorities, let alone the needs of informal settlements (the most common form of urbanization), then no mandate is given to cities and settlements that allows them to budget for the adaptation measures needed locally. NAPs can contribute to this paradigm change, and with implementation of NAPs, a focus linking urban and informal settlements to climate finance should be one of the priorities for NAPs.

- **Enhancing participation and inclusion:**

Typically, minority groups and residents from informal settlements are excluded from national level and even local level planning. Giving people living in informal settlements an opportunity to get involved and become partners in the design and implementation of adaptation measures provides them ownership, empowers them, and provides adaptation measures a better chance of being implemented successfully. A great example of participatory adaptation planning to support informal settlements was the [Participatory Development Programme in Urban Areas \(PDP\)](#) implemented in Cairo between 2010-2018. This programme led to improved spatial conditions, the introduction of social development measures, as well as improved environmental, educational and medical standards for the city.¹⁶

13 IPCC (ed.), "Chapter 6: Cities, Settlements and Key Infrastructure," in *Climate change 2022: Impacts, Adaptation and Vulnerability*, 2022

14 IFRC, *Where It Matters Most. Smart Climate Financing for the Hardest Hit People*, 2022, https://www.ifrc.org/sites/default/files/2022-11/20221108_ClimateSmartFinance.pdf

15 UNEP, *Adaptation Gap Report 2020*, 2020, https://www.unep.org/resources/adaptation-gap-report-2020?_ga=2.207160982.444710792.1684754170-465414614.1684178968

16 Participatory Development Programme in Urban Areas, <http://egypt-urban.net/> (accessed 28 March 2023)

- Embedding local knowledge: people living in informal settlements have unique local knowledge and experiences that can be brought into the planning process to help inform and maximize the positive impact of an adaptation measure, and crucially, ensure the benefits are felt more equally. Informal areas may host more people who have migrated recently from rural areas, and who have a stronger connection and knowledge of natural resource management and therefore might be better equipped to deliver NBS. Urban vulnerabilities, and explicitly in informal areas, can either form a cross-cutting theme for NAPs or they can form a central part of a national or local adaptation plan; either way, they need to be considered to maximize the impact of adaptation planning and ensure an equal distribution of its benefits. However, climate adaptation should also be understood as a cross-cutting theme when the focus is on informal areas. There are multiple priorities already embedded in their planning process and adaptation should be linked to them throughout the process.

Box 1. Examples and tools for integrating informal areas into adaptation efforts.

The City of Accra accessed the Global Cities Fund to deliver adaptation projects that also helped support migrants, refugees and other marginalized groups to better access healthcare, social care, education, waste management services, and other basic urban services. This improved participation of urban poor and vulnerable groups in citywide resilience building.

In Zambia, there are mandated Integrated Development Plans (IDPs) and instruments such as the 'local climate adaptive living grant' which aim to enhance climate resilience. Informal settlements are included in the IDPs, and this offers actors the opportunity to integrate these areas into adaptation planning. Each subnational government is accountable for developing and implementing these plans. There is also monitoring of plans to ensure they meet targets. IDPs can be used to mobilize resources for adaptation; as decentralized instruments, they can be very useful in integrating informal areas in NBS and NAPs.

Above are examples of Adaptive Social Protection, an approach that can help help to integrate informal areas in adaptation efforts by combining social protection, disaster risk reduction and climate change adaptation.



African Clean Cities Platform's PPE Distribution to waste pickers in Dandora dumpsite Nairobi, Kenya
 2021 UN-Habitat Julius Mwelu

1.4 Stocktake of adaptation in informal areas

Global overview

The Paris Agreement, adopted in 2015 and entered into force in 2016, aims to limit global warming to well below 2°C above pre-industrial levels, while pursuing efforts to limit the temperature increase to 1.5°C. To achieve this, the agreement requires countries to submit their own Nationally Determined Contributions (NDCs) outlining their climate action plans and goals, which are focused on a country's reduction in national emissions and how they plan to adapt to the impacts of climate change.

The Paris Agreement Global Stocktake of Climate Action is a crucial milestone in the fight against climate change, providing an opportunity to conduct a comprehensive assessment of the state of our planet and develop a more effective strategy for the future. By conducting a global stocktake every five years, countries and other stakeholders can evaluate the progress made towards achieving the objectives of the Paris Agreement, as well as identify areas where progress has been lacking.

The Paris Agreement on Climate Change recognizes the importance of NBS in achieving its objectives and encourages countries to incorporate them in their climate actions. Moreover, the United Nations Framework Convention on Climate Change (UNFCCC) has developed guidelines for the inclusion of NBS in NDCs and NAPs. The “monitoring, reporting, and review” component of the NAP process will inform national contributions to this global stocktake. It will report not only on adaptation needs and priorities but also on whether sufficient planning is in place and enough action has been taken.

The Global Goal on Adaptation (GGA) was established under the Paris Agreement, with the aim to enhance climate change adaptation by increasing awareness of and funding towards countries'

adaptation needs in par with the Global Mitigation Goal of 1.5/2° C goal of the Paris Agreement. The local context of adaptation outcomes is underpinned by building the resilience of ecosystems and local communities.¹⁷

The Sustainable Development Goal (SDG) 11 is 'Make cities inclusive, safe, resilient and sustainable'. SDG Indicator 11.1.1 focus on 'Urban population living in slums', with the definition: 'the proportion of urban population living in slums, informal settlements or inadequate housing'. The goal is defined as: 'By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums'.

The New Urban Agenda, a global framework for sustainable urban development that provides a roadmap for creating inclusive, safe, climate resilient, and sustainable cities and settlements, comes at a time of unprecedented rapid urbanization in many parts of the world, especially the Global South and recognizes the informal aspects of global urban development.¹⁸ It highlights that the patterns of urbanization today require a re-framing of the discourse and the implementation of good urban planning to foster an integrated approach and enhance inclusive sustainable development. The New Urban Agenda emphasizes the profound roles that multi-functional green, open and public spaces can play in contributing to human prosperity, health and well-being and connection to nature.

Local climate action and urban vulnerability have been stressed globally in the past 5 years. Some of the relevant key outcomes of COP 26 are as follows:

- Over 70 endorsements to the Principles for Locally Led Adaptation, and over \$450 million mobilized for initiatives and programmes enhancing locally led approaches.
- 40 members committed to the Adaptation Action Coalition (AAC) and launch of the Adaptation Research Alliance (ARA).

17 FEBA, *Nature-Based Solutions and the Global Goal on Adaptation*, https://www.iucn.org/sites/default/files/2022-11/feba-issue-brief-on-nbs-and-the-gga-for-cop27_0.pdf

18 UN, *The New Urban Agenda: Key Commitments - United Nations Sustainable Development*, 2016

- Record adaptation finance pledges to the Adaptation Fund and the Least Developed Country Fund.

Since COP26 there has been further progress on adaptation and ‘Loss and Damage’:

- Half the world’s population is now covered by a NAP or Adaptation Communication (AdComm), with 10 new AdComms and nine new NAPs published since COP26.
- Progress towards doubling adaptation finance on 2019 levels by 2025.
- The ARA now has 157 members, representing funders, academics, civil society and international organizations.
- Over 80 endorsements by governments and organizations to the Principles for Locally led Adaptation, with climate finance donors, intermediaries and grassroots organizations working to put these principles into practice.
- Pledges of over (USD, EUR, GBP) 20 million to the Santiago Network.
- The World Meteorological Organisation launched an “Early Warning System for All” initiative, pledging to cover the world’s population with early warning systems in the next five years.¹⁹

Local Climate Action at the city level was also a key feature of COP27. On 17 November 2022, the Egyptian COP27 Presidency with the support of UN-Habitat convened the first-ever Ministerial Meeting on Urbanization and Climate Change. In addition, in 2022, G7 nations recognized the role of cities in fighting climate change for the first time, acknowledging that the role of cities and their local democratic leadership have in solving the major challenges our nations face is significant.

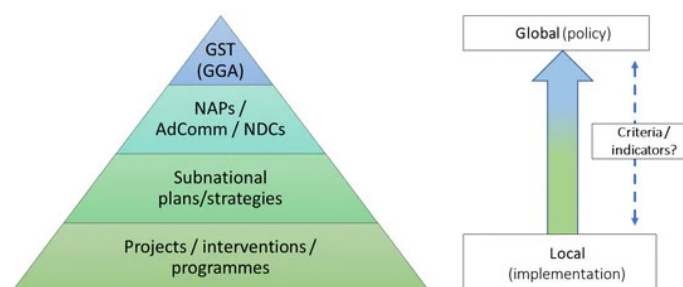


Figure 1. Adaptation planning from local to global. Source: Tania et al., 2022. <https://doi.org/10.3390/su14095350>

As informal areas are particularly vulnerable to the impacts of climate change and other natural hazards, many countries have started integrating informal areas and NBS in their NDCs and NAPs, recognizing their potential in addressing climate change challenges and enhancing sustainable development. For example, the Philippines has included the rehabilitation of mangrove forests in its NDCs to reduce emissions and increase resilience to climate change impacts. In Bangladesh, the government has incorporated the use of green infrastructure and wetlands in its NAP to address flooding and other climate-related hazards in informal areas. In its NAP, Kenya has recognized the importance of ecosystem-based adaptation approaches, such as reforestation and soil conservation, in addressing climate change impacts. The country has also prioritized the upgrading of informal areas through slum upgrading projects. The Government of Kenya, in collaboration with UN-Habitat and other stakeholders, initiated the Kenya Slum Upgrading Programme (KENSUP) in 2004. The key objective of the programme is to improve the lives and livelihoods of people working and living in slums through various initiatives and interventions. Specifically, through the construction of low-cost houses and the installation of social and physical infrastructure.²⁰

Kiribati is another example that has taken a proactive approach to adapting to the impacts of climate change and disaster risk management through the development of the National

¹⁹ UK Government, Policy Paper: COP26 Presidency Outcomes, 2022

²⁰ Republic of Kenya, State Department of Housing and Urban Development, Kenya Slum Upgrading Programme (KENSUP), <https://housingandurban.go.ke/kenya-slum-upgrading-programme-kensup/>

Adaptation Program of Action (NAPA) and the Kiribati Adaptation Project in 2004, followed by the Kiribati Joint Implementation Plan (KJIP) revised in 2019 that focuses on ecosystem-based adaptation (EbA) for coastal resilience. This includes rehabilitating and protecting mangroves, coral reefs, and beaches, and restoring habitats and ecosystems for agriculture.²¹

The integration of informal areas and NBS in NDCs and NAPs is also being supported by international organizations, such as the World Bank, Adaptation Fund, Global Environment Facility (GEF) and the Green Climate Fund (GCF), which fund NBS and adaptation projects for areas highly vulnerable to climate change such as informal areas and urban poor communities.

Overall, there is still much work to be done in promoting adaptation, and NBS specifically, in informal areas. However, by recognizing the challenges and building on the successes that have already been achieved, it is possible to build the resilience of the communities and ecosystems in informal areas to climate and disaster risk.

Regional Insights

In the Global South, despite the challenges, there have been some promising efforts to integrate informal areas into urban planning and development strategies. One approach that has gained traction in recent years is the concept of “inclusive cities,” which seeks to provide equal access to basic services and opportunities for all residents, regardless of their socio-economic status.

Another promising trend is the growing recognition of the importance of community-led development and participatory planning, where residents of informal areas are included in

decision-making processes and given a voice in shaping their communities. This approach has been successful in empowering residents and fostering a sense of ownership and investment in their communities. The Participatory Slum Upgrading Programme (PSUP), as previously mentioned, focuses on the challenges in slums and informal settlements and works in close cooperation with the communities based on partnership. The programme pursues one principle in particular: participation and initiative, ensuring that slum dwellers have a say in how they want to live in the future and to have a decisive role in the development of their communities.²²

However, there is still much work to be done in terms of integrating informal areas into urban planning and development strategies. In many cases, governments and urban planners still view informal areas as temporary or illegal, and do not prioritize their needs. There is also a lack of funding and resources available to support the upgrading and resilience of informal areas. Overall, while there have been some positive developments, there is still a long way to go in terms of fully integrating informal areas into urban planning and development strategies. Efforts must be made to prioritize the needs and rights of informal settlement residents and to provide them with the infrastructure and services they need to thrive.

21 UNFCCC, *Guidelines for Integrating Ecosystem-based Adaptation into National Adaptation Plans: Supplement to the UNFCCC NAP Technical Guidelines*, 2021, https://unfccc.int/sites/default/files/resource/EbA_NAP.pdf

22 UN-Habitat, *The Participatory Slum Upgrading Programme (PSUP)*, <https://unhabitat.org/programme/the-participatory-slum-upgrading-programme-psup#:~:text=The%20PSUP%20addresses%20the%20living,the%20communities%20based%20on%20partnership.>



A girl walks past newly constructed houses in Aceh, Indonesia. 2016 © UN-Habitat

Part 2. Informal areas as hotspots for climate change risks

2.1 Characteristics of informal areas

There are currently two billion people working in the informal economy and one billion residents of informal settlements worldwide who are impacted by poverty, social exclusion, climate change, and inadequate urban and health services.²³

Informal settlements are on the margins of official urban regulation and planning systems and have distinctive features that match the urban poor's conditions, needs, and priorities. Such areas experience inadequate provision for socio-economic benefits and essential basic services, including safety challenges, unsafe and unhealthy working conditions, limited opportunities for education, lack of access to green areas, the lack of electricity, piped water, sanitation and sewage systems, adequate drainage, and solid waste collection, severely constraining informal settlements.

Where informal areas house a significant proportion of a city's population, they also include an informal economy, for example, Mumbai, Lagos, Lima, and Cairo. It is common for informal settlements to develop close to ports, markets, industrial areas, and airports/bus/rail terminals high-risk zones or green areas in the perimeters of cities, which may cause biodiversity loss. This is due to a myriad of reasons such as access to livelihoods and availability of affordable or under-utilized land.

People living in informal areas and/or working in the informal economy are particularly vulnerable to multiple climate risks and are affected by their impacts. An estimated 3.3 to 3.6 billion people live in hotspots of high vulnerability to climate change.²⁴ Given the urban growth and future

climate change projections, there will be an expected increase in people living and working in informal areas in parallel with the intensification of the climate crisis. The current rate of city expansion, lack of planning, land management, and housing strategies in the Global South – especially in Least Developed Countries (LDCs) and Small Islands Developing States (SIDS) – pushes the most vulnerable urban poor into informal settlements. Informal settlements are often positioned on vulnerable and high-risk lands due to a combination of social, economic, and environmental factors. The following are some key reasons that contribute to the prevalence of informal settlements in such areas:

- **Affordability and Accessibility:** Vulnerable lands, such as floodplains, steep slopes, or coastal zones, are often less expensive and more accessible to low-income populations. Land prices in safer and well-developed areas are typically higher, making them unaffordable for many residents of informal settlements. As a result, people gravitate towards cheaper land options, even if they are situated in hazard-prone zones.
- **Informal Economy and Livelihood Opportunities:** Many informal settlements develop close to economic nodes, such as markets, industrial areas, ports, and transportation hubs. This proximity to economic opportunities is essential for the livelihoods of informal settlers who often engage in informal economic activities like street vending, small businesses, and informal labour. The convenience of being near potential customers and job opportunities outweighs the risks associated with living in vulnerable areas.
- **Lack of Formal Housing Options:** In rapidly urbanizing areas, the demand for affordable housing often needs to be higher than formal housing units. Formal

²³ Cities Alliance, "Understanding Informality - Towards a Multi-dimensional Analysis of the Concept," Brussels: Cities Alliance, 2021

²⁴ Roberts, D. (2022). "Background and Main Findings of the Report." Findings of the IPCC 6th Assessment Report: Impacts, Adaptation and Vulnerability – Implications for urban programming and action.

housing options might be limited, especially for those with low incomes or inadequate access to credit. Consequently, informal settlements become the only feasible housing option for a significant portion of the population.

- **Historical and Cultural Factors:** In some cases, informal settlements have evolved over time due to historical and cultural reasons. They might represent the initial settlement patterns of a city, or the result of migration flows from rural to urban areas. As cities grow, these settlements often expand into areas that were previously considered unsuitable for formal development.
- **Lack of Land Use Planning and Enforcement:** Weak land use planning and enforcement in rapidly urbanizing regions contribute to the haphazard growth of informal settlements. The absence of adequate zoning regulations and building codes allows settlements to proliferate in hazardous areas, disregarding potential risks.
- **Informal Land Tenure:** Informal settlements often need formal land tenure, leading to the occupation of lands without legal ownership or proper documentation. Since vulnerable

lands may be less desirable to formal developers, they may remain unclaimed and become occupied by informal settlers seeking shelter.

- **Population Pressure and Housing Shortage:** High population growth rates, rural-urban migration, and the lack of adequate social housing programmes can exacerbate the demand for housing. As a result, people are forced to settle in vulnerable areas, where land is more readily available.
- **Migration and refugees:** Wars and disaster events can cause an increase in migration to an urban settlement which might exceed the capacity of the settlement to provide formal housing in which case informal settlements may arise both temporarily, or in some cases, permanently.

Addressing the issue of informal settlements in vulnerable areas requires a comprehensive approach that includes urban planning, affordable housing initiatives, social safety nets, and sustainable development strategies. It is essential to provide secure land tenure, access to basic services, and climate resilient infrastructure to improve the living conditions and reduce the risks faced by residents of informal settlements.



NBS in Honiara, the Solomon Islands, 2022, © PACSOL

2.2 Key climate risks in informal areas

The main risks affecting informal areas include thermal risk, floods, landslides, and droughts. Thermal risk refers to the combination of increased temperatures generated by construction material, population density, habitat degradation, and changes in the microclimate of neighbourhoods and their consequences on the well-being of citizens. This phenomenon is created by the heat island effect, according to which temperatures in urban areas are generally higher than in surrounding areas. Other risks are represented by drought and flooding, caused by changes in precipitation patterns, impermeable surfaces, lack of or inadequate stormwater drainage infrastructure, land management, lack of riparian buffer zones, sea level rise, and erosion. These elements can limit the capacity of potable and general water supply and, in the case of floods and extreme weather events, compromise the safety of urban infrastructure, housing and commercial activities, in addition to representing a risk to the health of the inhabitants.²⁵

The risks associated with sea level rise, erosion and loss of biodiversity can also have a devastating effect on local economies and the lives of the most vulnerable inhabitants, in addition to affecting the capacity of ecosystems to maintain their functionality over time and absorb future extreme weather events.²⁶ Sea level-rise is a particularly key slow-onset hazard for informal settlements, though only covering 2 per cent of the world's land area, 13 per cent of the world's population live in coastal cities shifting hotspots of climate vulnerabilities to low elevation zones. As such, predictions of a rise of sea-levels by 0.74 meters by 2100 may well displace over 115 million people with

Box 2. What is informality?

Informal economy is understood as basic activities or enterprises that are not subject to formal regulation.

Informal settlements are residential areas where:

inhabitants have no security of tenure of the land or dwellings they inhabit, with modalities ranging from squatting to informal rental housing;

the neighbourhoods usually lack, or are cut off from, basic services and city infrastructure; and

the housing may not comply with current planning and building regulations.

Source: UN-Habitat

420,000 km² of land at risk of being lost to the encroaching seas.²⁷

Climate fluctuations and subsequent climate-related hazards contribute to the definition of informal settlements' spatial boundary. The impact and subsequent response to hazard events contribute to future growth patterns of informal settlements which are rarely linear. One example of this is the informal settlements of Mandala, West Point and Ngueli, which sit along the Chari River in Chad. During the rainy season, the flow increases and floods portions of the settlements destroying the most vulnerable housing units. The following years the boundaries of these settlements grew, but in different areas and directions. The Atlas of Informality

²⁵ IPCC (ed.), "Chapter 6: Cities, Settlements and Key Infrastructure," in *Climate change 2022: Impacts, Adaptation and Vulnerability, 2022*

²⁶ Ibid.

²⁷ Atlas of the End of the World, NASA Socioeconomic Data and Applications Center (SEDAC) of the Center for International Earth Science Information (CIESIN) / Columbia University, "Low Elevation Coastal Zone: Urban-Rural Population and Land Area Estimates version 2," (Palisades, NY: 2013). Available at <http://sedac.ciesin.columbia.edu/data/set/lec2-urban-rural-population-land-area-estimates-v2> (accessed October 8, 2023)

concluded that these cases create evidence of how peripheral urbanization through informal land occupation of environmentally sensitive areas is one of the most pressing problems of the Global South (Pimentel Walker and Arquero de Alarcón 2018).²⁸

2.3 Underlying factors of vulnerability to climate change in informal areas

Informality shapes the vulnerability of people, and as urban areas continue to grow, the gap between available infrastructure and needs will likely grow. Driven by demographic change, rapid urbanization, social and economic pressures as well as policy failures, vulnerability to climate change is growing in urban areas.²⁹ As a consequence, increasing numbers of people living in towns and cities are exposed to heat extremes, flooding, as well as water, food, or energy insecurity. Within cities, the different capacities of neighbourhoods and individuals to respond to such shocks and stresses with vulnerability-reducing strategies lead to an adaptation gap between the urban rich and the urban poor. Climate change increases the likelihood and frequency of such events, which combined with the described vulnerability translates to an increase in the number of urban habitats and assets at risk from climate change, affecting socially and economically marginalized communities the most.³⁰ In addition, the cost of basic necessities might be more expensive in informal settlements with residents having to pay a 'poverty' penalty. In Mukuru, Nairobi, drinking water costs four times more in informal settlements compared to formal settlements.³¹ The lack of social safety nets and social capital also contribute to increased vulnerability of residents in informal settlements with informal

workers rarely having unemployment insurance, or social assistance in any form. Informal workers also tend to have limited rights, and face harassment and penalization from subnational governments, and exclusion from urban development processes.²⁹

Box 3. What makes informal areas highly vulnerable to climate change?

Climate vulnerability faced by residents of informal settlements is underpinned by a range of complex underlying factors including *limited adaptive capacity* (ex. low and insecure income, limited access to risk transfer mechanisms, etc.), *insecure tenure rights, low-quality housing, unstable and inadequate access to basic services, lacking or insufficient risk-reducing infrastructure and most importantly, location at high risk-prone areas.*

Source: UN-Habitat

Unplanned, inefficient and poorly located urbanization is a major factor in the expansion of cities to areas with increased climate risks like flooding or lands with inadequate water supply for the needs of growing settlements.³² However, often these areas of growing climate risks are the only areas affordable and available for the poorest urban settlers. Economic dynamics dictating the rules of urban planning and policy development, prioritize investments in affluent districts rather than in informal areas where the infrastructure need is often higher. If the prioritization of investments and urban planning is aimed at serving this vulnerable population from the outset, it is possible to reduce vulnerability

28 Atlas of Informality: <https://www.atlasofinformality.com/> (accessed in March 2023)

29 IPCC, Climate Change 2022: Impacts, Adaptation and Vulnerability, 2022

30 Ibid.

31 UN-Habitat, World Cities Report, 2021

32 Tellman, B. et al. (2021). "Satellite imaging reveals increased proportion of population exposed to floods," Nature, 596 (7870), pp. 80–86. doi:10.1038/s41586-021-03695-w.

effectively vulnerabilities effectively. Figure 2 provides an overview of the principal underlying

factors for the vulnerability of informal areas to climate change:



Figure 2. Underlying factors determining vulnerability to climate change of informal areas and their inhabitants (Source: Adapted from UN-Habitat, World Cities Report, 2021).

Informality is one pathway through which the process of urbanization widens the adaptation gap and increases climate exposure and vulnerability for low-income urban residents.³³ Informality plays a defining role in cities and settlements of the Global South.^{34,35} Yet, there is a need to identify adaptation trajectories and how to integrate them in local and national policies.³⁶

2.4 Adaptation efforts in informal areas

Adaptation efforts in informal areas may take different forms where participation and

collaboration with local authorities in upgrading settlements and integrated planning can ensure durable and forward-looking solutions to addressing development deficits with future climate impacts in mind. Typical adaptation measures fall into the following categories³⁷:

- Upgrading to more resilient housing in informal areas:** As previously discussed, poor quality of housing in informal settlements is an underlying factor for the vulnerability of residents to climate hazards, especially flooding, heat and wind – and therefore improving housing should be a

33 Dobson, S. (2017). "Community-driven pathways for implementation of global urban resilience goals in Africa," *International Journal of Disaster Risk Reduction*, 26, pp. 78– 84. doi:10.1016/j.ijdr.2017.09.028.

34 UN-Habitat, *World Cities Report 2016: Urbanization and Development - Emerging Futures*. United Nations, 2016

35 Banks, N., Lombard, M. and Mitlin, D. (2020). "Urban Informality as a Site of Critical Analysis," *The journal of development studies*, 56(2), pp. 223–238

36 Prieur-Richard, A.-H. et al. (2019). *Global research and action agenda on cities and climate change science*

37 UN-Habitat, *Addressing the most vulnerable first: Pro-poor climate action in informal areas*, 2018

key area of intervention to reduce disaster risk, facilitate post-disaster recovery and build resilience to climate change. However, the extent to which housing can be made climate resilient is limited by several factors, including affordability, ownership status, technical and scientific knowledge, and underlying factors such as location and security of tenure which will determine the extent to which residents will want and be able to invest in their housing. For many, if not all, residents of informal settlements the cost of building resilient housing from scratch will be prohibitive – so retrofitting or upgrading existing housing with resilience in mind is the most likely option.

- **Upgrading infrastructure for more climate-resilient informal areas:** As outlined earlier, infrastructure and basic services can play an essential risk-reducing role – but in many informal settlements, these infrastructures and services are strikingly absent. Simply increasing the coverage of these essential services like water, energy, sanitation, waste disposal, transportation, and thus access to education, jobs, health, or telecommunication will improve the adaptive capacities of the communities and reduce the impact of climatic hazards. Certain existing infrastructures need upgrading and re-dimensioning, and some more community-scale infrastructures require connecting to city-wide systems and therefore require technical solutions and new collaborative approaches between local communities, suppliers, municipalities and national utilities working towards integration.
- **Enhancing ecosystems to build resilience and protect communities:** Low-income urban residents often depend on ecosystem services to meet part of their needs, such as gardening for fruits and vegetables and sourcing fuelwood, water, and food from urban forests, lakes and wetlands, as their settlements may be in peripheral areas of cities. Ecosystems and NBS can also play a part in building the resilience of informal settlements. Investing in 'green and blue

infrastructure' can help address climate change impacts through approaches that incorporate ecosystem services and ecosystem-based adaptation. This can include actions at the household level, such as rooftop gardening or growing vines on walls and roofs. On a larger scale, this can extend to community gardening and preservation or the creation of green, communal spaces in the settlement, contributing to temperature regulation and the social and health benefits of having green space.

The feasibility of employing adaptation strategies in areas with informal settlements is, however, contingent upon the level of risk involved. There are instances where the potential hazards are so substantial that resettlement emerges as the most viable solution. While this alternative is not without its array of challenges, it unquestionably holds a pivotal role in the ongoing conversation surrounding urban planning and development in such contexts. Attempting to adapt the existing structures might not only prove costly but also insufficient in providing adequate protection for the residents. For instance, reinforcing infrastructure could require significant investments, and even then, the safety of inhabitants might not be guaranteed. In such cases, the prospect of resettlement gains prominence as it offers the potential to relocate these vulnerable communities to safer zones, thereby reducing the threat to human lives and minimizing property damage.

However, the option of resettlement comes with its own set of challenges. Social and economic considerations play a substantial role, as these communities often have deep-rooted ties to their current locations. Displacing residents from their familiar surroundings can disrupt social networks, livelihoods, and cultural identities. Adequate provision of essential services such as healthcare, education, and employment opportunities must be assured in the new settlements to prevent further marginalization.

Balancing the urgency to mitigate risks with respecting the rights and well-being of informal settlement residents is a complex task. Careful deliberation, community engagement, and collaboration between local authorities, non-governmental organizations, and residents are

imperative. While resettlement is undeniably a challenging proposition, and is never promoted by many organisations including UN-Habitat, it cannot be disregarded in the discourse on enhancing the resilience and safety of vulnerable communities.



Mangrove Replantation, Morondava, Madagascar 2022, UN-Habitat



Part 3. The critical role of nature-based solutions for informal areas

3.1 Nature-based solutions for Urban climate resilience

Cities, and specifically informal areas within and around them, rely on healthy and interconnected ecosystems for their functioning. As informal communities often lie on the boundary between urbanized and naturalized areas, it is important to recognize the value such natural systems inherently provide and the adverse socio-economic effects that can result from the loss and degradation of the associated ecosystem services. For example, recent studies have correlated deforestation with an increase in malaria cases in Brazil, Peru and Indonesia.³⁸ More targeted action towards informal settlements, including but not limited to NBS, can significantly increase socio-economic resilience by generating co-benefits such as employment, improved health, and security.

Nature-based solutions (NBS) are actions that promote the relationship between ecosystems and human well-being³⁹ and encourage interventions such as protection, enhancement and sustainable use of ecosystems for their continued provision of services to address societal challenges.⁴⁰ As climate solutions, NBS include a range of measures designed to mitigate greenhouse gas emissions and/or increase climate resilience. NBS for climate adaptation, often also referred to as Ecosystem-based Adaptation (EbA), rely on using nature to reduce climate impacts like droughts,

heatwaves and floods while supporting people's livelihoods.⁴¹ As the climate crisis intensifies, NBS are increasingly highlighted as an approach for building resilience in cities with multiple benefits for climate, biodiversity, and social and economic development.

Box 4. What is Nature-based Solutions (NBS)?

NBS are actions to protect, conserve, restore, sustainably use, and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic, and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits.

Source: UNEA-5 Resolution, 2022

NBS can play a fundamental role in improving climate resilience in informal areas while providing socio-economic benefits on multiple scales and functions. For example, integrating NBS in public spaces can: reduce the urban heat island intensity, provide permeable surfaces to reduce flood risks, improve soil quality, stabilize erosion prone land, improve the efficiency of water use and maintenance costs, protect and increase biodiversity, and above all improve quality of life. The potential of NBS for addressing the precarious living conditions in informal settlements and climate change lies in their cost-efficient and multifunctional properties. NBS can play an important role in addressing urban

38 Garg, T. (2014). Public Health Effects of Natural Resource Degradation: Evidence from Indonesia. 169822. Agricultural and Applied Economics Association.

39 Cohen-Shacham, E., Andrade, A., Dalton, J., Dudley, N., Jones, M., Kumar, C., Maginnis, S., Maynard, S., Nelson, C. R., Renaud, F. G., Welling, R., & Walters, G. (2019). Core principles for successfully implementing and upscaling Nature-based Solutions. *Environmental Science & Policy*, 98, 20–29

40 Cohen-Shacham et al.; 2016, UNEA, 2022

41 Roberts, D. (2022). "Background and Main Findings of the Report." Findings of the IPCC 6th Assessment Report: Impacts, Adaptation and Vulnerability – Implications for urban programming and action

challenges including disaster risk reduction, urban water management, heat mitigation, and social resilience and other benefits to the population.⁴²

Targeting resilience interventions in informal areas, where vulnerability can be the highest, has a strong impact on the overall growth and stability of the whole city, in comparison to a similar intervention targeting resilience in urban areas with higher adaptive capacity. As it takes fewer resources to reduce vulnerability in these areas, as the vulnerability is higher, this can lead to savings being able to be redistributed.

The exploration of NBS for climate resilience in informal areas responds in part to the need for a systemic approach to adaptation for climate-resilient development in cities which can enable positive transformations.⁴³ Providing climate resilient basic services to urban settlements, especially informal communities, increases their adaptive capacity while green spaces in the city contribute to human well-being. Green spaces generate access to land that in turn improves the quality of life while restoring the ecosystems that help protect life on land and below water.⁴⁴

The IPCC has identified four core ways in which NBS may provide climate adaptive functions for cities and urban settlements, including informal areas⁴⁵ (Figure 3):

1. Urban NBS like green roofs and walls, urban vegetation as well as lakes, ponds and streams can increase resilience to extreme temperatures and provide urban cooling through evapotranspiration and shading;⁴⁶
2. Grass and riparian buffers, forested watersheds, freshwater wetlands, trees and green roofs may help to manage storm and wastewater by reducing the rate of runoff and surface flooding, decreasing contamination through pollutant runoff, and providing stormwater retention;^{47,48}
3. Coastal ecosystems including coastal forests, mangroves, coral and oyster reefs, salt marshes and coastal wetlands, seagrass dunes and more, can provide coastal flood protection through physical barriers, stormwater absorption and a reduction of wave energy;^{49 50}
4. Similarly, NBS alongside rivers and floodplains are seen as measures for riverine flood impact reduction since they can reduce the volume of floodwater, take away river energy and flood speed, increase water storage and stabilize riverbanks, and minimize the potential for development for impermeable surfaces, thereby creating space for floodwater to expand, improving urban water quality and management, drought protection and overall water supply management;^{51,52,53}

42 Wolff, e. et al. (2023). Nature-based solutions in informal settlements: A systematic review of projects in Southeast Asian and Pacific countries. *Environmental science and policy* Vol. 145.

43 GCoM, UN-Habitat, "New insights for the 2018 Global Research and Action Agenda on Cities and Climate Change Science, 2021 Innovate4Cities conference," 2022, Edited by J. Greenwalt and B. Walsh.

44 Roberts, D. (2022). "Background and Main Findings of the Report." Findings of the IPCC 6th Assessment Report: Impacts, Adaptation and Vulnerability – Implications for urban programming and action

45 IPCC, *Climate Change 2022: Impacts, Adaptation and Vulnerability*, IPCC, 2022

46 Gunawardena, K.R., Wells, M.J. and Kershaw, T. (2017). "Utilising green and blue space to mitigate urban heat island intensity," *The Science of the total environment*, 584-585

47 Webber, J.L. et al. (2020). "Is green infrastructure a viable strategy for managing urban surface water flooding?" *Urban Water Journal*, 17(7), pp. 598–608

48 McPhillips, L.E. et al. (2021). "What is the role of green stormwater infrastructure in managing extreme precipitation events?" *Sustainable and Resilient Infrastructure*, 6(3-4), pp. 133–142

49 Zhu, L. et al. (2020). "Aquaculture farms as nature-based coastal protection: Random wave attenuation by suspended and submerged canopies," *Coastal Engineering*, 160, p. 103737

50 Dasgupta, S. et al. (2019). "Quantifying the protective capacity of mangroves from storm surges in coastal Bangladesh," *PLoS one*, 14(3), p. e0214079

51 Keeler, B.L. et al. (2019). "Social-ecological and technological factors moderate the value of urban nature," *Nature Sustainability*, 2(1), pp. 29–38

52 Webber, J.L. et al. (2020). "Is green infrastructure a viable strategy for managing urban surface water flooding?" *Urban Water Journal*, 17(7), pp. 598–608

53 Berland, A. et al. (2017). "The role of trees in urban stormwater management," *Landscape and urban planning*, 162, pp. 167– 177

Finally, urban agriculture can be understood as a nature-based food security intervention, which is especially important among poorer communities, and can simultaneously advance circularity and urban greening.⁵⁴ However, this NBS is often practically limited by land availability, especially in areas of rapid land conversion, and in some cases, land use history that makes it unsuited for food production.⁵⁵

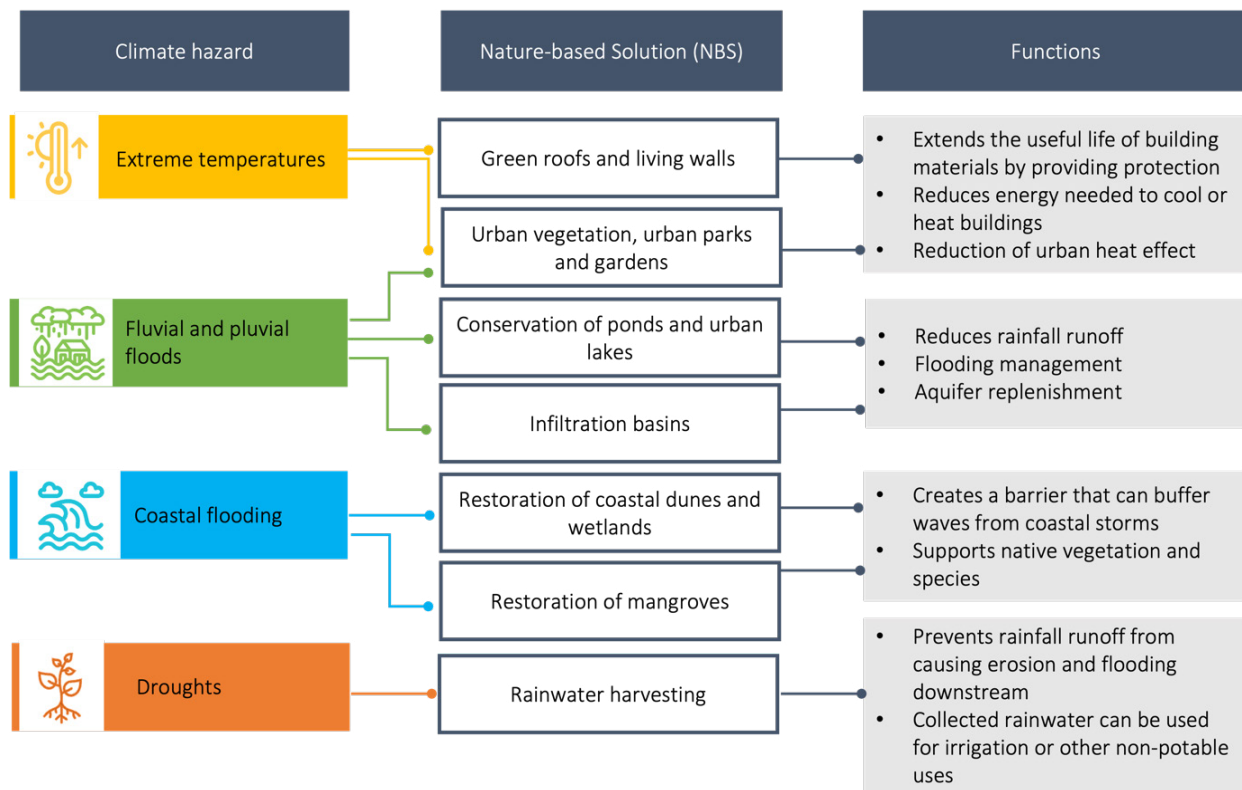


Figure 3. Examples of NBS and their adaptation functions for informal areas

54 Orsini et al., 2013; IPCC, 2022b

55 Satterthwaite, McGranahan and Tacoli, 2010; Vermeiren et al., 2013; Martellozzo et al., 2014; Badami and Ramankutty, 2015

3.2 Case studies

Successful examples of adopting NBS in informal areas include the cities of Lilongwe in Malawi, Morondava in Madagascar and Honiara in the Solomon Islands, which are part of UN-Habitat's RISE UP Programme, implemented in 2022 under Swedish International Development Cooperation Agency (Sida) funding (Boxes 5-7). Moyale in Kenya (Box 8) is another successful example, implemented in collaboration with Arcadis.

Box 5. Implementation of tree planting in Lilongwe, Malawi

More than 76 per cent of the residents of Lilongwe are living in informal areas, which are situated in poorly drained and flood-prone areas. Heavy seasonal rains have led to massive flooding and human activity such as deforestation, riverbank erosion, development of gullies and, indiscriminate disposal of waste along the riverbanks and drainage systems have contributed to the frequent occurrence of flash flooding. UN-Habitat, therefore, is supporting the communities surrounding the two rivers of Lingadzi and Mchesi with nature-based risk reduction measures that were proposed by the communities based on local vulnerability assessments.

With support from the Parks and Recreation Services Department of the Lilongwe City Council, the most effective type of vegetative cover to be planted was identified. The vegetative cover now planted slows down run-off water and, in the process, controls flooding incidents in the community. The nature-based solution selected in this case contributes to the resilience of the most vulnerable urban poor along the riverbanks of the Lilongwe and Mchesi rivers.



*Tree planting in Lilongwe, 2022
© UN-Habitat*

Box 6. Mangrove restoration activities in Morondava, Madagascar

Morondava is surrounded by water bodies and exposed to tropical cyclones. The city is highly prone to flooding and suffers from poor drainage and weak solid waste management systems. Morondava has an estimated population of 60,000 inhabitants and is urbanizing rapidly – with a relatively young population. Approximately 45 per cent of its neighbourhoods are considered informal and 25 per cent of the inhabitants live below the national poverty line.

UN-Habitat promoted the afforestation of the mangroves with the help of the residents of Lovobe and Kimony and in collaboration with the municipality of Bemanonga, and the local associations, which has led to significant improvement of the wetlands and removal of invasive species. The mangrove forest will provide a buffer zone reducing the impacts of storm surges and saltwater intrusion while the improved wetlands provide an increased freshwater storage. Both interventions strengthen the resilience of the most vulnerable urban poor communities in Lovobe and Kimony.



*Youth planting mangroves in Lovobe,
2022 © UN-Habitat*

Box 7. Flood prevention measures in Honiara, the Solomon Islands

Honiara struggles to cope with the growth of informal settlements while climate change amplifies the existing stresses into the future. Many houses in informal areas near the riverbanks have been destroyed by flash flooding and many more located on the hillside have been affected by landslides. Other vulnerabilities worsened by climate change impacts include water supply, drainage, road access, waste disposal and overcrowding.

The informal area in Koa Hill located along the Mataniko River in Honiara was identified as a climate vulnerability hotspot using UN-Habitat's multilayered vulnerability mapping overlaying climate change and urban spatial vulnerabilities. Flood mitigation measures such as slope stabilization using community-selected tree varieties, along the riverbank and on top of the hill, implemented by UN-Habitat in collaboration with the communities, have moderated the impacts of extreme rainfall and landslides and improved the resilience of informal settlements in Koa Hill. The project also included an urban garden and nursery to have a safe space for propagating seedlings for future use.



Women and children planting vetiver grass along the Mataniko River, 2022 © PACSOL

Box 8. Integrated Water Management

A project undertaken through a partnership between Arcadis – Shelter Program and UN-Habitat provides a regional planning example of incorporating NBS that affect urban and peri-urban areas in Kenya. The Shelter Program team evaluated a variety of low-technology methods to increase water supply to support an Integrated Urban Sustainable Development Plan for Moyale, Kenya. The team assessed the feasibility of NBS methods currently implemented in the regions (e.g., pans/detention basins and sand dams) as well as more traditional grey infrastructure approaches (e.g., check dams and rainwater harvesting tanks). Feasibility was assessed by accounting for factors such as soil infiltration rates, slope, surrounding land use and available land to select appropriate adaptation approaches in various geographic areas surrounding Moyale. While the evaluation did not conclude that all water demands could be met through the evaluated approaches, it highlighted the need for selecting solutions that included NBS methods and traditional infrastructure methods at a variety of scales. Such an approach would help alleviate some of the water stress experienced by communities in the region and would help bolster local water resources to communities in the regions outlying the city proper.



Arcadis and UN-Habitats Integrated Water Management program in Moyale, Kenya.

Source: Arcadis (www.arcadis.com)

3.3 Benefits and limitations for adopting nature-based solutions in informal areas

Benefits

Advancing NBS for climate resilience in informal areas is particularly interesting to explore given the potential synergies as well as the possibility of breaking new ground. As mentioned, building resilience in informal settlements has a multiplier effect on city and urban settlement resilience. With NBS, this can be further multiplied. Compared to ‘grey infrastructure’, NBS offer a more holistic resilience building strategy as they typically engage whole transboundary ecosystems. Following are a few of the potential benefits of bringing these areas together, including innovation, increased benefits for people and nature, addressing interconnected problems, and adopting an integrated approach (Figure 4).

<p>Promote an integrated approach</p>	<p>Address interconnected problems</p>
<p>There is an opportunity to bring communities together who previously have worked on NBS and informality separately for integrated solutions that address multiple problems. Leveraging synergies and interdependencies, can lead to capacity building, empowerment, and knowledge transfer.</p>	<p>NBS – if implemented with strong community engagement – have the potential to address multiple problems that are faced by informal settlements and cities simultaneously, including the lack of urban services, loss of biodiversity and increasing vulnerability to climate change.</p>
<p>Foster innovation</p>	<p>Increase benefits for nature and people</p>
<p>Although there are a growing number of examples for NBS contributing to climate resilience, this has been limited in informal areas. There is a large potential to test and scale innovative solutions.</p>	<p>By considering these integrated solutions, there is a potential to maximize environmental and social benefits, including enhanced urban biodiversity and ecosystem functions while creating green job opportunities.</p>
<p>Financial Benefit</p>	

Worldwide ecosystem services are worth an estimated USD \$125 trillion annually. The investment in green or hybrid infrastructure does not depreciate over time but keeps growing. Increased climate resilience through NBS also increases land value and can stimulate economic activities. Increased land value can bring basic services to informal areas, but it is also to note that the transformation from informal to formal settlement shall not lead to repercussions for informal settlers or forced evictions.

Figure 4. Opportunities in adopting NBS as an adaptation strategy in informal areas.

Limitations

Despite encouraging prospects of implementing NBS in informal areas, many unknowns require more exploration and better understanding. There may also be limitations in how feasible NBS are in some contexts, and how effective they will be in building climate services and improving the wellbeing of informal workers and residents of informal settlements.

There may be instances where trade-offs instead of synergies need to be considered in terms of which problems to prioritize and how there may be unintended or adverse consequences in some cases. Key institutional and capacity challenges include among others: synergies between different sectors and stakeholders; lack of technical capacities and policy support, limited financial instruments and resources. Addressing climate risks in informal areas with NBS requires collaboration among a wide range of actors between multiple levels of governance, from horizontal to vertical, from temporal to territorial, to impact a range of critical physical and basic service sectors. Such sectors of vital importance to urban areas, include energy, transport, buildings and construction, urban planning, health and information and communication. However, there is an opportunity to bring together communities who have worked either on NBS or informality fostering integrated solutions that seek to build resilience, whether by supporting development goals or protecting them via disaster risk reduction and adaptation measures.

Other challenges include:

- **Lack of understanding and knowledge**
Limited awareness hampers the decision maker's and the community's ability to make informed decisions about adopting nature-based approaches to address

various climate related challenges such as flooding. Often, the perceived complexity of technical aspects of NBS can appear discouraging, making them seem inaccessible. As a result, the potential benefits of using NBS might be overlooked due to misconceptions about their feasibility.

- **Insecure land tenure**
This could hinder the organization and/or community implementing NBS because obtaining licences may be complex. Also, some of the most successful NBS projects are usually resident led, and if land tenure is an issue, residents may not be encouraged to invest time and effort into NBS if they may not benefit from it in the long term.
- **Lack of basic infrastructure**
Some NBS initiatives, such as green roofs or rainwater harvesting, require infrastructure which might be limited, temporary, or not available in an informal settlement.
- **Limited space**
NBS approaches such as greening and artificial wetlands for sewage treatment require significant provision of land and physical space. Land-intensive responses to environmental crises may not be practical or may generate additional challenges, especially when they displace existing land users and lead to resettlements.
- **Limited capacity and resources**
Currently, only 29 per cent of climate finance goes towards adaptation⁵⁶ and less than 10 per cent of available global climate finance architecture disbursements are prioritized for locally focused climate investments.⁵⁷ NBS require resources to be implemented and maintained, which might be challenging for local governments and residents in

56 OECD, *Aggregate Trends of Climate Finance Provided and Mobilised by Developed Countries in 2013-2020, 2022*, Available at: https://www.oecd-ilibrary.org/sites/d28f963c-en/1/3/1/index.html?itemId=/content/publication/d28f963c-en&_csp_=-91f270eef9995f9eead11c083bdb0928&itemIGO=oecd&itemContentType=book#section-d1e804

57 Soanes, M., Rai, N., Steele, P., Shakya, C. and Macgregor, *Delivering real change: getting international climate finance to the local level*, 2017, IIED Working Paper. IIED, London.

informal areas. As such programming will need to ensure the sufficient resources are available not just for implementation, but also for maintenance for the duration of the project's life cycle. While NBS can be cost-effective and sustainable, their implementation often requires specialized knowledge, technical expertise, and financial resources that are not always available to informal areas. Furthermore, institutional and policy barriers may prevent the effective integration of NBS into urban planning and development processes. There is also often a lack of coordination and vertical integration between different levels of government and stakeholders in the development of National Adaptation Plans and National Determined Contributions (NDCs), which can result in the exclusion of informal areas and NBS from the planning process.

- **Lack of data**

Sufficient data is usually a requirement for NBS projects for them to be successfully designed and implemented. Whilst data is an issue in most geographies, it can be particularly scarce in informal areas. Informal areas are often excluded from official records and data collection and management, making it difficult to accurately assess their population, infrastructure, and services. This lack of data also makes it challenging to identify

the most effective and appropriate NBS for enhancing resilience in these areas.

- **Lack of political will**

National and local governments tend to be less inclined to invest in climate adaptation or NBS measures in informal areas, as there is generally more effort and resources invested into areas that are highly visible. So that it will ensure voters for the political party in question and/or in interventions that politicians think will contribute to the well-being of a popular and economically viable area/sector. This also leads to short-term mindset, which can deter them from investing time and effort in understanding and adopting new, nature-based approaches that might offer long-term benefits.

There is a need for more supportive policy frameworks and institutional arrangements to enable the integration of informal areas and NBS into urban planning and development. Many existing policies and regulations may be designed for formal areas and may not consider the unique characteristics and needs of informal areas. Some may even actively work against informal areas, as such, policy reforms are needed to enable greater participation and decision-making by informal settlement residents, and to create more flexible and adaptive planning and development processes that can accommodate the diverse and dynamic nature of informal areas.



Part 4. Integrating informal areas into NAPs

By integrating informal areas into national adaptation planning, countries can ensure that their strategies are inclusive, effective, and tailored to all their citizens' specific needs and vulnerabilities. It will also contribute to achieving Climate Resilient Development Pathways.⁵⁸ While some countries have advanced NAPs that look forward to developing implementation roadmaps, others are just starting this planning process.

4.1 Degree of integration of informal areas in NAPs

Having 'informality' or 'urban' as a central theme or sector in a country's NAP process will ensure its effective consideration and integration into the national adaptation planning process to ensure those outcomes. However, there are always different competing demands and pressures of the NAP and in many contexts, it may not be possible or feasible to include them as a central theme. In which case a range of entry points have been provided in this section to ensure that 'informality' and 'urban' can be integrated across a NAP even if they are not central themes/sectors of focus.

4.2 Informal areas as a cross-cutting theme: entry points for integration in NAPs

Cities are complex systems where various sectors operate interdependently. While it is ideal to have a city-wide approach, most planning and interventions are carried out through individual sectors. Instead of seeing this as a disadvantage, cities can combine sectoral initiatives within a cohesive and comprehensive adaptation framework to effectively build resilience. Recognizing informal areas as a cross-cutting

theme across key sectors allows for addressing the challenges faced by these communities via a holistic approach. Integration efforts should focus on improving basic services and infrastructure, livelihoods and employment, health, food security, and environmental sustainability. This can be achieved by identifying entry points for integrating informal areas in those sectors. One distinct feature of integrating informal areas as part of sector-targeted initiatives is the dual functionality: they enhance urban resilience while simultaneously addressing broader development issues. It is important to note that resilience building does not have to take resources away from other priority areas but rather provides a strategic framework to coordinate efforts across different sectors.

4.3 Pathways for integrating informal areas in NAPs

Aligned with the LEG/UNFCCC NAP Technical Guidelines, this Urban Supplement Document recommends five mainstreaming pathways to integrate the perspective of informal areas and NBS systemically in NAP processes.

Recognizing that pathways to urban climate change resilience are diverse, the sequence of the following entry points is not meant to prescribe a tightly bound set of steps that must be adhered to, particularly given the complex and dynamic nature of informal areas. However, a comprehensive approach to building climate resilience may best begin with collecting the right information and knowledge, moving on to planning and policy processes, strengthening capacity, engaging with various stakeholders, and accessing finance. Nevertheless, several cities may have more opportunities or made more progress on one entry point over another, which indicates how some actions may be more important than others in different contexts.

58 IPCC, *Climate Change 2022: Impacts, Adaptation and Vulnerability*, IPCC, 2022.

Figure 5 demonstrates the five entry points identified to integrate the dimension of informal areas and NBS and be the foundation for creating the pathways:

Pathway A. Enhancing institutional capacities for climate resilience in informal areas: This pathway focuses on enhancing the capabilities of local government and other stakeholders on key aspects regarding resilience building in informal areas. It covers techniques and strategies for recognizing and comprehending the possible effects of climate change on achieving urban development goals and the need for action in informal areas. This includes incorporating climate risk considerations into inclusive development policies and investments and ensuring effective operation and maintenance of assets and services in informal areas.

Pathway B. Generating relevant data for climate resilience in informal areas. This pathway focuses on the critical task of gathering pertinent data and advances in the analysis of climate vulnerability and risks. It explores methodologies for collecting and analysing data in informal contexts, highlighting the unique challenges and opportunities.

Pathway C. Developing an adaptation portfolio with NBS for informal areas. This pathway provides an overview of steps and elements needed for creating an adaptation portfolio with NBS in the context of informal settlements. It highlights opportunities for integrating informal areas such as a cross-cutting theme of different sectors as infrastructure, water, among others.

Pathway D. Catalyzing finance for implementation. This pathway highlights the pivotal role of catalyzing finance for the successful implementation of the adaptation strategies and actions. It examines various mechanisms to secure the necessary funding. The section highlights the importance of innovative financing approaches in driving the realization of impactful initiatives.

Pathway E. Monitoring and evaluation. The pathway explores how to effectively assess climate adaptation strategies in informal urban settlements. It emphasizes that monitoring and evaluation (M&E) are crucial for successful adaptation. Key points covered include tailoring M&E approaches to local conditions, defining relevant indicators, involving the community in data collection, using diverse methods, and establishing feedback loops for adaptive management. Challenges like resource limitations and data quality are acknowledged, but innovative technologies and collaborations offer solutions. Ultimately, it highlights how to ensure that M&E inform policy decisions and improve the resilience of informal settlements to climate change impacts.

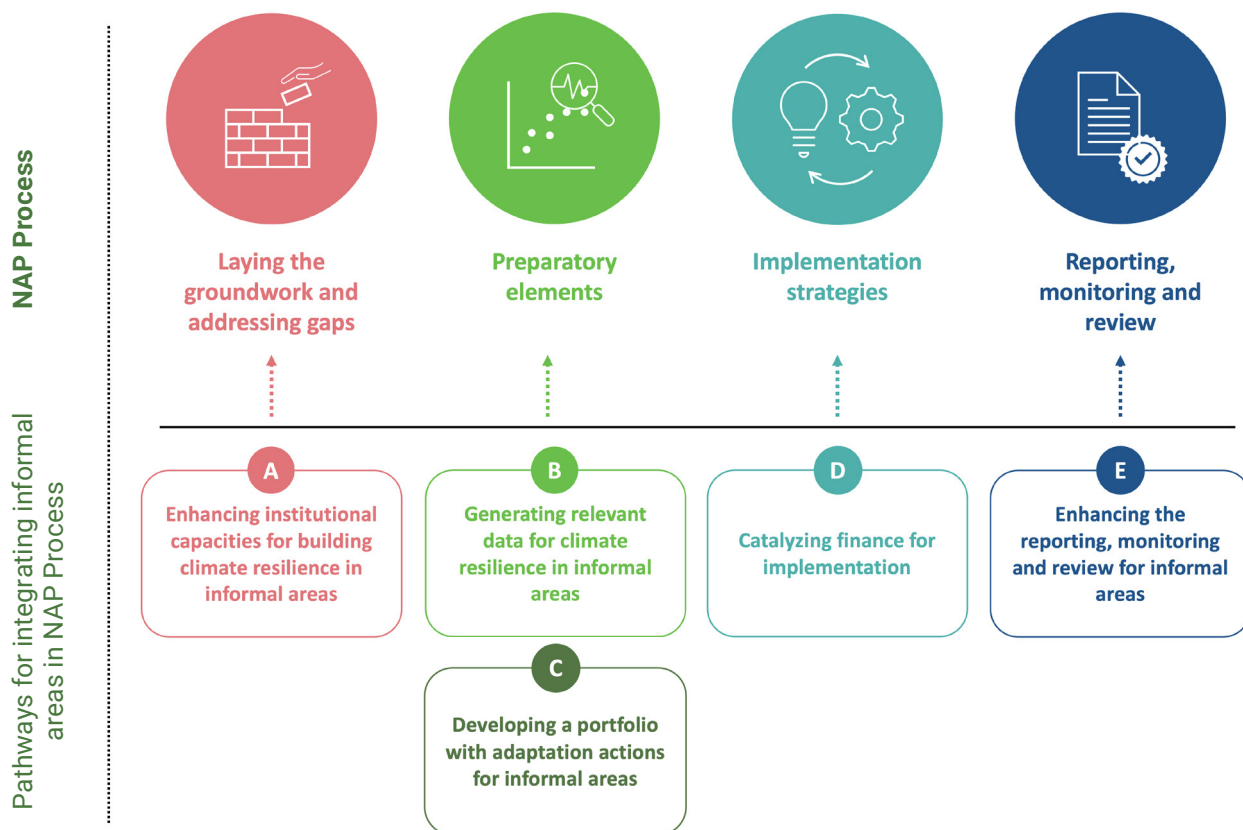


Figure 5. Pathways for integration of informal areas in the NAP process.

While NAPs are unlikely to guide adaptation processes on a city-by-city basis (which is instead the role of each individual town or city’s adaptation plan), it is important for NAP focal points to be aware that NAP goals, targets and priorities will be reflected in city-level adaptation plans. For this reason, vertical coordination and integration is required, between NAP focal points and urban stakeholders. This will help to ensure that the various sector issues critical to urban adaptation are captured in the NAP, and that NAP both reflects urban adaptation priorities in the country while also providing sufficient macro-level guidance to city-level adaptation plans. Figure 6 illustrates potential entry points for integrating NBS and informal settlements as part of the pathways.

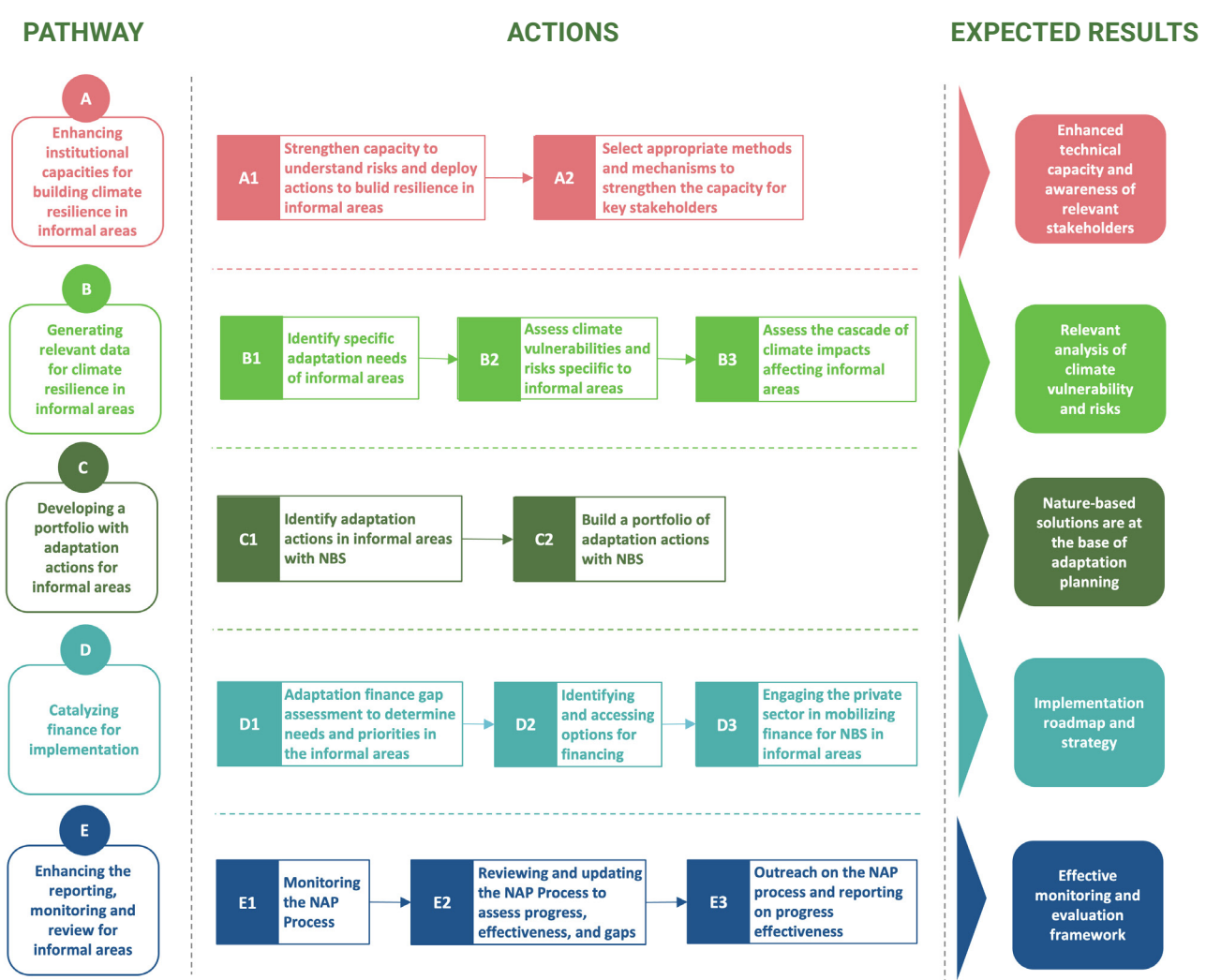


Figure 6. Potential entry points for integrating NBS and informal settlements as part of the pathways.

A. ENHANCING INSTITUTIONAL CAPACITIES FOR BUILDING CLIMATE RESILIENCE IN INFORMAL AREAS

KEY MESSAGES

- **Recognizing the role of institutions**
Strengthening institutional capacities is a cornerstone for enhancing climate resilience in informal areas through NBS. Institutions play a pivotal role in facilitating effective planning, coordination, and implementation of NBS strategies.
- **Tailored approaches for informal areas**
Institutional capacity-building should be context-specific, considering the unique challenges and opportunities of informal settlements. This entails understanding the social, economic, and environmental dynamics to design NBS interventions that align with the needs of these communities.
- **Long-term commitment**
Building climate resilience in informal areas with NBS requires sustained efforts. Institutions should commit to long-term engagement, supporting the gradual transformation of informal settlements into resilient communities.

Building climate resilience requires the involvement of diverse stakeholders, yet capacity and institutional barriers often hinder their participation. But with proper support and capacity building, these obstacles can be overcome, allowing for inclusiveness and effective engagement of informal communities during the planning, implementation, and monitoring and evaluation of adaptation strategies.

Local governments and other stakeholders are critical in building climate resilience in informal areas. The local governments have the authority

and responsibility to engage in urban planning and infrastructure development. In many cases, however, local governments need more capacities and knowledge of climate resilience. Strengthening their capacities helps integrate climate resilience considerations into urban planning processes, land-use regulations, and building codes. It enables local governments to develop resilient infrastructure that can withstand climate-related hazards, including drainage systems, roads, and housing. And more importantly, this will ensure that informal settlements are included in broader citywide adaptation strategies and development plans.

Additionally, local governments are closest to the communities living in informal areas. They better understand the local context, including these areas' specific challenges and needs. Strengthening their capacities empowers them to develop tailored strategies and interventions that address the unique climate risks informal settlements face. They can establish effective communication channels, engage with the community, and implement timely and appropriate climate resilience measures.

Strengthening local governments' capacities can influence higher-level policies and regulations that impact informal settlements. By strengthening their capacities, local governments can advocate for policies that prioritize climate resilience in informal areas and ensure the inclusion of these areas in national and regional climate change strategies. Strengthened local governments can actively engage in policy dialogue, share best practices, and advocate for the needs of informal settlements, thereby mainstreaming climate resilience into broader governance frameworks.

PROPOSED ACTIONS

A range of actions can be proposed for identifying and building institutional capacity, and is an integral part of the NAP process. Below are two key actions that demonstrate how capacity can be assessed and strengthened to build resilience in informal areas.

A1. Strengthen capacity to understand risks and deploy actions to build resilience in informal areas.

Capacity strengthening should prioritize a comprehensive understanding of the interaction between urban growth, climate change, and the exposure and vulnerability of informal areas. This entails developing strategies encompassing hard and soft actions to promote climate resilience by designing and implementing inclusive policies. As NBS emerge as a novel approach to urban system resilience, particularly in the context of informal areas, it becomes imperative to foster awareness and technical proficiency in identifying, designing, and implementing NBS specifically tailored to informal areas.

While the responsibility of city officials does not include downscaling climate models or conducting climate vulnerability and risk assessments, they should actively collaborate with specialists to comprehend the data generated by climate models, recognize the potential implications of climate risks, and effectively utilize this information for urban development-related decision-making. Such collaborative efforts will generate benefits and enhance resilience in informal areas. This collaborative approach necessitates a thorough understanding of the potential impacts of climate-related shocks and stresses, an assessment of available assets, skills, local knowledge, and social relations to mitigate their effects and an evaluation of varying levels of risk among different groups of people. This comprehensive assessment enables the prioritization of action to address climate risks effectively.

Planning for climate adaptation and resilience will be new for many organizations and institutions in the public sector and in informal communities. They will all need to develop new skills and capacities if they are to contribute optimally. To gain a good understanding of the specific technical and institutional capacity needs of the stakeholders, it is important to conduct a rapid capacity assessment and where possible build a profile for each of the stakeholders with high

influence and importance. For example, the profile for local government administrations will need to cover staff size, skills and competencies on climate risks and adaptation planning, budgets, and administrative and decision-making flows.

Once the technical and institutional capacity needs are identified, a capacity enhancement plan can be developed, that may consist of any of the following:

- Increasing skills (e.g. through training and on-the-job technical assistance focused on specific aspects of design, planning, management, and implementation of adaptation actions and NBS in particular).
- Improving organizational processes (e.g. through the application of new techniques, reorganization, management, and technical assistance).
- Increasing resources (financial, physical, human, organizational, and the ability to manage funds, multiple projects, and financial reports).
- Adapting policy (to allow the new skills, processes, and resources to be utilized effectively).

A2. Select appropriate methods and mechanisms to strengthen capacity.

Building technical and institutional capacity is a highly context-specific set of actions; each country will need to develop its capacity-building approach based on its needs in the informal areas. Examples of approaches to enhance capacities include:

- **Technical support:** Although adaptation encompasses a variety of tasks, certain areas demand specialized expertise that may not be accessible to local officials or urban residents, such as satellite mapping or advanced engineering. In such cases, national governments and global organizations may need to supply these

resources. Wherever possible, however, it is preferable to promote local knowledge and technical abilities, as the capacity of local actors and institutions to perform these functions will be critical to their ability to withstand shocks and pressures.

- **Training and education:** Many urban poor communities are unable to develop their skills due to a lack of resources and marginalization. This leaves the potential of informal settlements behind and the informal workforce untapped. However, NGOs and agencies have proven that community workshops and training can enhance local capacity and lead to resilient communities and cities.
- **Participatory platforms:** In many cities, the impoverished urban population is

highly organized and has established various savings groups, CSOs, and other forums. Nevertheless, there is often a disconnect between their efforts and the official decision-making structures of the local government, even if residents themselves bear the expenses in the long term, especially within the informal sector. By forming national or regional associations, such as revolving loans, communities can receive small sums for upgrading, which are gradually paid back over time. This provides a visible platform to represent themselves to other stakeholders, creating a stronger link between community-level activities and citywide or even global resilience strategies.

Box 9. Key resources

UN-Habitat (2014), *A Practical Guide to Designing, Planning, and Executing Citywide Slum Upgrading Programmes*. Available at: <https://unhabitat.org/books/a-practical-guide-to-designing-planning-and-executing-citywide-slum-upgrading-programmes/>



Shangtian Village in Songyang, China 2019 UN-Habitat Julius Mwelu

B. GENERATING RELEVANT DATA FOR CLIMATE RESILIENCE IN INFORMAL AREAS

KEY MESSAGES

- **Ensure effective data collection and analysis:** Gather relevant climate and non-climate data, both qualitative and quantitative, to inform the assessment. Analyse the data to identify trends, patterns, and priority areas for intervention.
- **The climate vulnerability and risk assessment** is a strategic tool to integrate informal areas in NAPs.
- **Consider context-specific socioeconomic vulnerability factors:** Assess the socioeconomic vulnerabilities in informal settlements, such as poverty, unemployment, lack of access to basic services, gender inequality, and inadequate housing conditions. Recognize that these vulnerabilities can amplify the impacts of hazards and disasters.
- **Adopt a multi-hazard approach:** Consider a wide range of hazards, including natural disasters (e.g., floods, earthquakes) and human-induced risks (e.g., fires, social conflicts). A comprehensive assessment helps identify interdependencies and potential cascading effects, leading to more holistic risk reduction strategies.

Climate change will impact the assets and performance of a wide range of interdependent urban sectors (water and sanitation, electricity, housing, natural resource management, and transportation); delivery of basic urban services; and emergency management-related functions of a city government. If any component that forms part of a sector's larger system fails, it could have a domino effect on the remaining urban systems. For

instance, failure in the power grid due to a tropical cyclone can disrupt water supply and transportation. Moreover, such impacts will be felt differently in various sections of the urban population, with informal areas being most at risk because of their preexisting socioeconomic vulnerabilities.

To effectively guide climate resilience actions in informal areas, gathering and utilizing data, information, and knowledge about the exposure of natural and physical elements and the social and economic vulnerabilities of individuals and assets in the face of climate change-related shocks and stresses is essential. This data transcends administrative boundaries, sectors, and timeframes, encompassing insights into previous events and performance, ongoing trends, and future forecasts regarding climate change and urban expansion. Integrating this information makes identifying suitable paths toward climate resilience for informal areas possible, which can be incorporated into routine urban development processes while ensuring the data is collected, shared, and regularly updated.

In addition to utilizing data and information from public sources, cities possess significant human and intellectual capital that can be harnessed to generate information relevant to climate resilience in informal areas. One approach is to involve local communities in data collection efforts, particularly those with limited adaptive capacity but extensive knowledge about their subjective resilience and experiences with past climate-related hazards. This inclusive approach enables the incorporation of concerns from more vulnerable groups that may be overlooked in top-down planning processes. It also helps establish information networks that assist municipal governments in effectively targeting resilience-building initiatives.

Municipal officials can identify and leverage existing community-based development initiatives and organizations to access their accumulated knowledge, enhance data collection capacity, and keep up-to-date information.

Technological advancements offer cost-effective opportunities to collect and update data. For instance, mobile technologies, widely used in urban areas, provide a means to efficiently, economically, and participatory gather local perspectives on climate change resilience. Communities can actively participate by using mobile phones to collect geo-referenced data on asset locations and characteristics, such as public and private schools and hospitals. Engaging communities in this manner empowers them as co-creators of data and facilitates the regular updating of local-level information on vulnerability and exposure.

PROPOSED ACTIONS

Understanding climate risks is the foundation for evidence-based planning and investment in managing and reducing climate change impacts, especially for informal areas. This requires comprehensive information on all dimensions of risks, including hazardous events, exposed assets (people, buildings and critical infrastructure, environment, cultural heritage), vulnerability factors, and capacities. The proposed actions include:




B1. Identifying specific information needs of informal areas

As a first step, along with information on climate variables (temperature, precipitation, and changing hazard pattern), it is critical to collect information on factors that would contribute to the exposure and vulnerability of the population and assets to the potential impacts of climate change. Such information would include socioeconomic data, geographical characteristics of the area (preferably beyond immediate administrative boundaries), land records, characteristics of various physical assets (e.g., size, shape, occupancy, age, and construction type of public buildings), urban growth pattern, environmental data, and location of the vulnerable population.

Below are several recommendations on data collection in urban areas that focus on understanding risks at an informal community level:

- **Household-level data** on access to infrastructure and services in informal settlements (e.g. solid waste management, fuel mix, transport patterns). Together with geographic information systems (GIS), data findings can identify structures at risk.
- **Socio-economic conditions and characteristics** on the number of residents, their age, sex distribution, and household composition, number of women-headed households, people with disabilities, members of different ethnic and religious groups, etc.; residents' income levels; how many households have domestic infrastructure connections; safety and security for women, type, location, and number of social services and facilities (the need for their improvement).
- **Policy, legal and regulatory frameworks** identify the support residents need in regularizing their plots (e.g., obtaining security of tenure or land title). A crucial aspect to consider is the evaluation of land tenure status and the potential impediments to implementing adaptation measures and consolidating settlements in their current locations. It will include an analysis of land, development, and planning codes; design and construction standards (including which building materials can be used); and infrastructure and service standards.
- **Neighbourhood-level data on green infrastructure**, quality of roads/footpaths, maintenance of drainage and water/sanitation networks, fire outbreaks, and access to emergency services.
- **Past impacts of extreme weather** (e.g., floods, heatwaves, water scarcity, landslides) with attention to health, livelihoods/assets, and gendered burdens whilst identifying any particularly vulnerable groups.

Table 1. Summary of key information needs for adaptation planning in informal areas.

Topic	Specific information needs
 <p>Policy, legal and regulatory frameworks</p>	<ul style="list-style-type: none"> • Land tenure situation in target settlements. • Local governance systems and laws that strengthen or provide a legal basis for the programme. • By-laws applicable to building materials and construction. • Planning and environmental laws. • Legal rights and obligations of residents and state agencies.
 <p>Socio-economic conditions and characteristics</p>	<ul style="list-style-type: none"> • Demographic profiles of settlements: population numbers, age, sex, family and household composition of residents. • Overall quality, size and types of houses and their tenure: rental, ownership, shared, etc). • Location and number of social services and facilities. • Number of persons belonging to specially targeted groups: pre-primary children, the elderly, refugees, etc. • Level of service provision; whether households are connected to different utilities (electricity, water, sewerage).
 <p>Technical and environmental options</p>	<ul style="list-style-type: none"> • Density of settlement (people per hectare, housing per hectare, street index, site coverage/floor area ratio, etc.). • Residents' domestic access to infrastructure and services (with attention to the specific problems faced by women and girls). • Quality of housing (size, age, structure, materials). • Main risk factors for households (hazardous location, physical design, etc.). • Topography, green areas, ground conditions. • Accessibility, availability and location vis-à-vis public transport and basic urban services.
<p>Institutional capacity</p>	<ul style="list-style-type: none"> • Profiles of local government administrations relevant to the informal areas (authority and powers, staff size, skills and budget). • Provisions of current local (area) development plans. • Role of NGOs and CBOs in local / community administration. • Role and capabilities of federations of the urban poor/ community savings groups. • Role and capabilities of faith- based organizations.

Source: Adapted from UN-Habitat, 2014.

B2. Assess climate vulnerabilities and risks specific to informal areas.

To understand how informal areas could be affected by potential impacts of climate change, data are needed on past patterns and future projections of climate characteristics – temperature, precipitation, intensity and frequency of climate hazards, sea level rise, etc. Such data collection requires looking beyond immediate urban administrative boundaries and close collaboration with a wide range of stakeholders with diverse perspectives, including government agencies responsible for climate information, research institutions, universities, and local experts, encouraging an integrated approach.

- **Adopt an appropriate scale for risk and vulnerability assessment.** Informal areas exist within larger urban systems and are influenced by multiple scales of governance and decision-making. A multi-scale

approach recognizes that vulnerabilities in informal areas are not isolated but are interconnected with broader urban, peri-urban, and landscape scales. Informal areas are part of larger landscapes or watersheds and are influenced by the environmental conditions and ecosystem functions within those systems. Climate risks can occur at site, neighbourhood, city or province, and landscape scale as shown in Figure 7. By assessing vulnerability at the landscape or watershed scale, the systemic interactions and feedback loops are visible between informal settlements and their surrounding environments. This includes factors such as hydrological patterns, land use changes, ecosystem services, and climate-related hazards that can affect the vulnerability of informal areas. By considering different scales, from the local to the regional, the assessment can capture these interdependencies and provide a more holistic understanding of vulnerability.

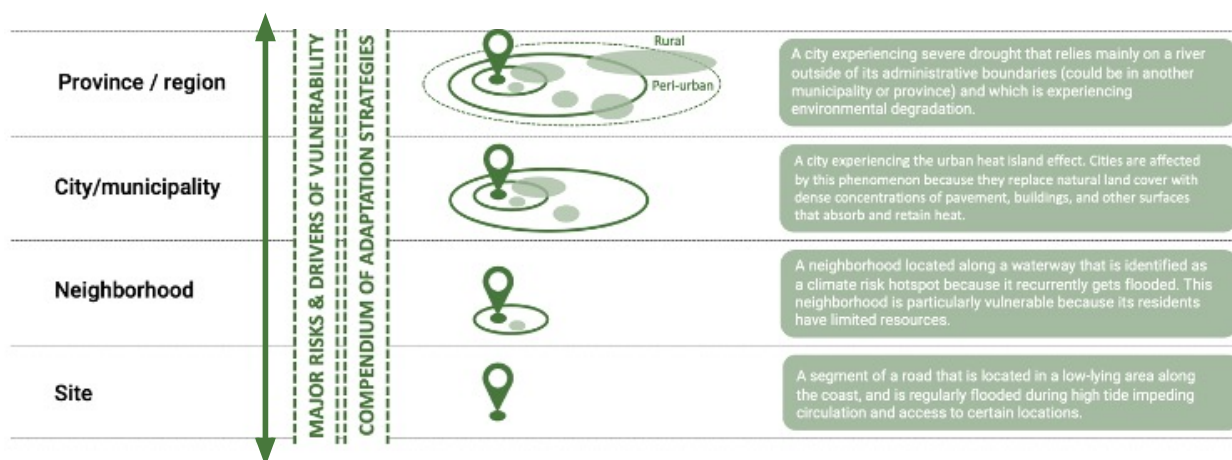
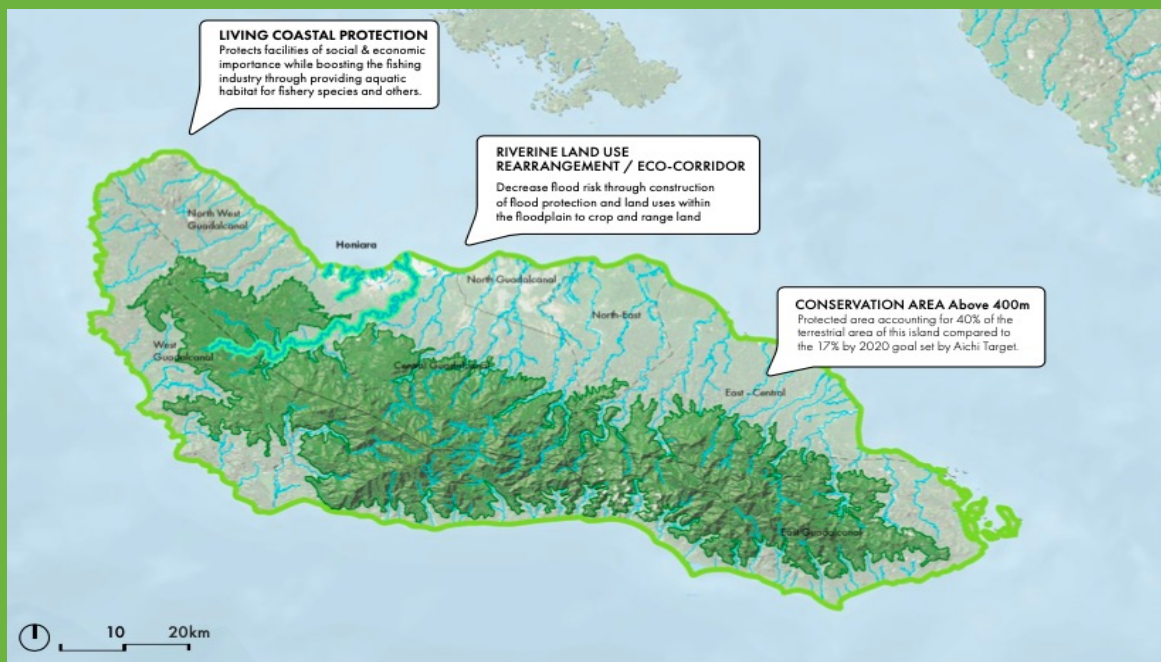


Figure 7. Multi-scale climate risk assessment for informal areas.

- **Assess exposure of people and assets.** In addition to data on climate variables, data on informal settlements' characteristics and growth are required as presented in B1 – topography, changes in land use, characteristics of the urban population, location and characteristics of formal and informal housing, location and characteristics of public assets, infrastructure, and economic activities, location of natural ecosystems, and location of vulnerable communities. The climate data are laid over the data on urban characteristics and growth to analyse which aspects of the city's urban system are most likely to be negatively affected. Exposure data can support in making crucial decisions on enhancing climate resilience in informal areas by understanding how climate-related shocks and stresses will interact with demographic trends and spatial growth strategies of the urban area. Since the projections are based on uncertain socioeconomic futures, the timing, magnitude of potential impacts, and the locations of the most affected by climate change cannot be determined with high precision.

- Assess socioeconomic vulnerability.** Socioeconomic vulnerability factors include household income, livelihoods, gender, age, race, ethnicity, literacy, education, access to basic services, financial services, and migration. Combined with scientific information on climate change variables and exposure data, vulnerability information can convey various facets of different groups' capacities. Robust climate risk and vulnerability assessments (CRVAs) require wide consultations with the local community living in the informal areas to capture local knowledge and capacities to adapt, thereby encouraging an inclusive approach.
- Combine information on climate change variables, exposure, and vulnerability.** Combine information collected on climate change variables, exposure, and vulnerability of people and assets to undertake CRVA. Such assessment should conceptualize cities as complex systems with their reach beyond administrative boundaries and demonstrate the importance of sharing information collected from different sectors for enhancing overall resilience. One approach is to establish a common information platform (preferably geographical information-based systems) accessible to all relevant city stakeholders to enable sharing, using, and updating of information across sectors for integrated planning and defining priority investments.

Box 10. Case study: Multidimensional Vulnerability Hotspots Mapping in Honiara, Solomon Islands



Source: UN-Habitat. *Multilayered Vulnerability Assessment Tool - Tested in Honiara. 2022.*

B3. Evaluate the sequence of climate-related consequences impacting informal areas

The section above has highlighted the pre-existing deficiencies in many informal settlements. These have consequences for the exposure to the risk of the residents – with the potential for cascading impacts. For example, the chain of climate-related impacts on informal areas: inadequate storm drainage, coupled with deficient solid and liquid waste management, can result in flooding, where the floodwaters, contaminated with toxins, may subsequently lead to adverse health effects. Table 2 outlines potential adverse climate change impacts on informal settlers. As demonstrated in the table, in addition to the destruction of physical dwellings and infrastructure, climate impacts can manifest themselves as adverse impacts on health and affect prices of food, water and other essentials – with serious consequences for low-income households.

Table 2. Examples of adverse climate change impacts for informal settlements.

Projected changes	Examples of potential adverse impacts	Implications for residents of informal settlements and people working in the informal economy
Higher maximum temperatures, more hot days and heat waves	Rise in mortality and illness from heat stress in urban locations.	Many urban informal settlements can be densely populated with little open/public space, lack of insulation, corrugated iron sheet roofing, and poor ventilation that contribute to higher indoor temperatures. This increases health risks for outdoor and indoor activities.
Lower minimum temperatures: increased cold days, frost days and cold waves	Increased cold-related human morbidity and mortality. Extended range and activity of some disease vectors – including mosquito- and tick-borne diseases.	Most informal settlements are without public health measures and basic services to control or remove disease vectors and without health care systems that provide needed responses. Infants and young children are particularly vulnerable.
Higher precipitation events and riverine floods	Increased flood, landslide, avalanche and mudslide damage resulting in injury and loss of life, loss of property and damage to infrastructure. Increased flood runoff brings contamination to water supplies and outbreaks of waterborne diseases.	Many informal settlements are concentrated on sites most at risk of flooding and landslides, with a lack of risk-reducing infrastructure and poor-quality housing less able to withstand flooding. Homes, possessions and assets for generating income are not covered by insurance.
Windstorms with higher wind speeds	Structural damage to buildings, power and telephone lines, communication masts and other urban infrastructure.	Corrugated iron roof sheets blow off during high winds; they are not nailed down because they can be sold if needed and the price is lower if they have nail holes.
Increase temperature and changes in rainfall distribution leading to increase risk of drought	Decreased water resources and quality; increased risk of forest/bush fire; decreased crop yields and higher food prices.	Informal settlement residents (including home-based enterprises) face water scarcity and vulnerable to food and water price rises.
Increased tropical cyclone peak wind and precipitation intensities	Increased risk to human life and damage to property and infrastructure; risk of infectious disease epidemics; increased coastal erosion and damage to coastal ecosystems.	Informal settlements (including their enterprises) are located on sites most at risk, having poor-quality housing and lacking risk-reducing infrastructure and early-warning systems.
Intensified droughts and floods associated with El Niño events	Decreased agriculture and rangeland productivity in drought-prone and flood-prone regions.	Impact on food availability and prices in urban areas.
Water availability	Reduced water availability in many locations – with obvious impacts on agriculture and on cities where freshwater availability declines significantly.	In cities facing constraints or shortages of freshwater supplies, it is likely that low-income areas will be the most affected (and least able to afford alternative sources). There will be difficulty in accessing water for informal livelihood activities.
Sea-level rise	Coastal erosion, land loss, more floods from storm surges, and increased vulnerability of urban dwellers living in low elevation coastal zones.	Many informal settlements close to the sea have poor-quality housing and lack drainage infrastructure that will be impacted by salinization.

Source: Mitlin, D and D Satterthwaite 2013; IPCC, 2022.

Impact chains can be used to understand better the interlinked and cascading climate impacts affecting informal areas. Impact chains are an analytical approach that enables an understanding of how climate hazards create risks through impacts. Specifically, impact chains represent the interlinkages between climate hazards, exposure, and vulnerability, determining climate risks. Ensuring the inclusion of informal areas in these impact chains will clarify the interlinkages between informal areas and other aspects of climate risk. Impact chains are a useful tool to clearly show these interlinkages and communicate climate risk to various stakeholders. They can also be used to verify the outputs of CRVA's with these stakeholders and to broaden the discussion around informal areas and key sectors. Figure 8 demonstrates an example of an impact chain highlighting the key climate vulnerabilities and impacts in human settlements in Thailand.

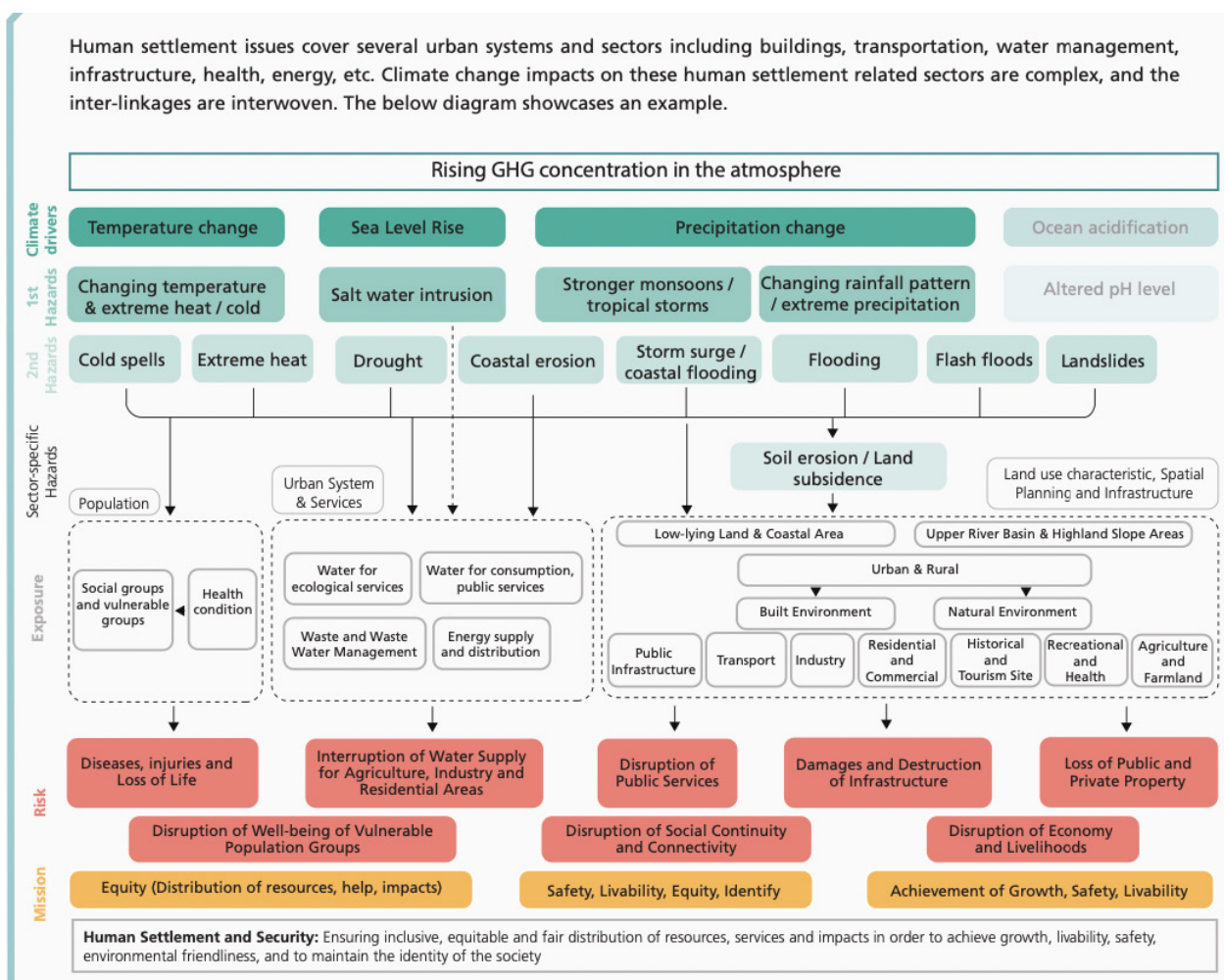


Figure 8. Climate impact chain for human settlement in Thailand. Source: Office of the Natural Resources and Environmental Policy and Planning (Thailand) and GIZ Thailand (2016).

After conducting an analysis of exposure and socio-economic vulnerability there will be a comprehensive data on the locations, individuals, institutions, and sectors that are most susceptible to risk in the informal areas. It is desirable for this information to be specific, incorporating quantitative data and maps. Based on these findings, there is a need to focus on identifying the primary sectors, areas, or individuals that should be prioritized for adaptation measures as described in Pathway C.

Box 11. Key resources, tools and data

Resources

- [Pro-Poor Climate Action in Informal Settlements – Thematic Guide \(UN-Habitat, 2019\)](#)
- [Locally Led Planning: A Guide for Building Resilience in Urban Informal Settlements \(Global Center on Adaptation, 2022\)](#)
- [Climate Change Vulnerability and Risk: A guide for Community Assessments, Action Planning and Implementation \(UN-Habitat, 2020\)](#)
- [Addressing Urban and Human Settlement Issues in National Adaptation Plans \(UN-Habitat, 2019\)](#)
- [Realising the Multiple Benefits of Climate Resilience and Inclusive Development in Informal Settlements \(C40 Cities Climate Leadership Group, 2019\)](#)
- [Building Resilience to Climate Change in Informal Settlements \(IIED, 2020\)](#)
- [Climate Change Vulnerability Assessment Manual \(UN-Habitat, 2017\)](#)
- [Transformative Adaptation to Climate Change and Informal Settlements in Coastal Cities \(UN-RISD, 2020\)](#)
- [Pro-Poor Urban Climate Resilience in Asia and the Pacific \(UN-Habitat & UNESCAP, 2014\)](#)

Data

- [Climate Information Platform \(CIP\)](#)
- [World Bank Climate Change Knowledge Portal](#)
- [ThinkHazard](#)
- [Data Portal for Cities](#)
- [UNFCCC NAP Portal](#)



Reconstruction of a house in Bagh, Pakistan. 2007. © UN-Habitat

C. DEVELOPING A PORTFOLIO WITH ADAPTATION ACTIONS IN INFORMAL AREAS

KEY MESSAGES

- **Actions should reduce vulnerabilities:** Adaptation actions should be targeted at reducing the vulnerabilities identified in the vulnerability and risk assessment and build on existing experiences, recognizing that informal communities may already be engaging in adaptive actions.
- **Scale:** Scale is important in the design of adaptation measures for informal settlements: individuals or households (and their homes, assets, and livelihoods), neighborhoods, settlements, settlement-city links, and settlement-city-regional links. Evaluate the sequence of climate impacts on informal areas, considering a variety of measures at each scale to forecast, mitigate, adapt, and recover, all designed to benefit vulnerable communities..
- **Timeframe:** Longer-term approach requires a citywide view, where participation and collaboration with local authorities in integrated planning can ensure durable and forward-looking solutions to addressing development deficits with future climate impacts in mind.
- **Shortlisting actions:** Criteria used to shortlist actions should include the economic, ecosystem, and social costs and benefits; time frame; whether the option would have political buy-in; the sustainability of the option; whether it brings co-benefits; and whether there would be a possibility for unintended (positive and negative) impacts as a result of implementing the adaptation option.

Adaptation efforts in informal areas may take different forms where participation and collaboration with local authorities in upgrading settlements and integrated planning can ensure durable and forward-looking solutions to addressing development deficits with future climate impacts in mind. Typical adaptation measures fall into the following three categories⁵⁹:

- **Upgrading to more resilient housing in informal areas:** As previously discussed, poor quality of housing in informal settlements is an underlying factor for the vulnerability of residents to climate hazards, especially flooding, heat and wind – and therefore improving housing should be a key area of intervention to reduce disaster risk, facilitate post-disaster recovery and build resilience to climate change. However, the extent to which housing can be made climate resilient is limited by several factors, including affordability, ownership status, technical and scientific knowledge, and underlying factors such as location and security of tenure which will determine the extent to which residents will want and be able to invest in their housing. For many, if not all, residents of informal settlements, the cost of building resilient housing from scratch will be prohibitive – so retrofitting or upgrading existing housing with resilience in mind is the most likely option.
- **Upgrading infrastructure for more climate-resilient informal areas:** As outlined, infrastructure and basic services can play an essential risk-reducing role – but in many informal settlements, these infrastructures and services are strikingly absent. Increasing the coverage of these essential services like water, energy, sanitation, waste disposal, transportation and thus access to education, jobs, health, or telecommunication will improve the adaptive capacities of the communities and reduce the impact of climatic hazards. Certain existing infrastructures need upgrading and re-dimensioning. In addition, several community-scale infrastructure

59 UN-Habitat, Addressing the most vulnerable first: Pro-poor climate action in informal areas, 2018

require connecting to city-wide systems and therefore require technical solutions and new collaborative approaches between local communities, suppliers, municipalities and national utilities working towards integration.

- **Enhancing ecosystems to build resilience and protect communities:** Low-income urban residents often depend on ecosystem services to meet part of their needs, such as gardening for fruits and vegetables, and sourcing fuelwood, water and food from urban forests, lakes and wetlands, as their settlements may be in peripheral areas of cities. Ecosystems and nature-based solutions can also play a part in building the resilience of informal settlements, and investment in 'green and blue infrastructure' can therefore help to address climate change impacts, through approaches that incorporate ecosystem services and ecosystem-based adaptation. This can include actions at the household level, such as rooftop gardening or growing vines on walls and roofs. On a larger scale, this can extend to community gardening and preservation or creation of green, communal spaces in the settlement, contributing to temperature regulation and the social and health benefits of having green space.

PROPOSED ACTIONS

Identifying and selecting adaptation measures is the key output of the NAP and a necessary pathway for integrating the dimension of adaptation in informal areas and is aligned with section 3.A of the LEG/ UNFCCC NAP Technical Guidelines.

Building on the identified climate risks and vulnerabilities faced by informal systems (including ecosystems, people, infrastructure, etc.), planning for adaptation requires identifying actions (C1), building a portfolio of adaptation actions (C2), Integrating the adaptation portfolio in the NAP (C3).

C1. Identifying adaptation actions in informal areas with a Nature-based Solutions focus

An initial step in this process is compiling a long list of potential adaptation options with a focus on NBS, which will be the foundation for developing the ultimate short list of prioritized options (C2) that will be integrated into the National Adaptation Plan's urban component or elements.

The vulnerability and risk analysis provides a basis for identifying a long list of adaptation options. The results from the vulnerability analysis should form the basis of this step to provide inputs on the particular livelihood systems, ecosystems or social or ethnic groups, and other characteristics of the informal areas. Identifying options should build on existing experiences, recognizing that informal communities may already be engaging in adaptive actions (consciously or unconsciously), for example, through local development investments, adjustments to livelihood strategies, and efforts to improve the sustainability of natural resource use and management.

Enabling climate adaptation in informal areas requires a multipronged approach that addresses physical conditions and social, economic, and political capacities. Upgrading housing and infrastructure to protect against floods and landslides and ensure water security will be one way of limiting the impacts, particularly by considering future climate change.

The degree to which adaptation actions that target urban, and specifically, informal areas risk and vulnerabilities are identified, will be based on whether informal areas are a specific sector, sub-sector or cross-cutting theme of the NAP. In the development of the long list of adaptation actions, (which is likely to include a review of strategic documents and assessment of ongoing/planned interventions, with a wide range of stakeholder engagement,) informal areas will need to be highlighted and prioritized where possible. For example, during stakeholder engagement with governmental and non-governmental actors, risks

identified from the CCVRA associated with informal areas should be highlighted and specific actions on informality, including those that incorporate NBS elements, should be scoped out. They need to be identified at this initial stage to ensure they can be included in the adaptation actions long-list, which will be taken onto the next shortlisting stage.

Considering scale is critically important when it comes to the design and implementation of adaptation measures in informal settlements. Many of the challenges facing informal settlements, such as flooding, landslides or heat stress, are connected to ecological processes that operate at various scales – watershed, floodplain. In all approaches, it is also helpful to recognize that individual, household, and community adaptation measures are short-term responses to improve coping and adaptive capacity in response to immediate shocks and stresses. In contrast, a longer-term approach requires a citywide view, where participation and collaboration with local authorities in integrated planning can ensure durable and forward-looking solutions to addressing development deficits with future climate impacts in mind. For instance, a settlement might be prone to flooding, which originates at a location within a larger watershed. Generally, informal areas benefit from and rely on their surrounding ecosystems, which may be within or beyond administrative boundaries. Therefore, understanding these ecological dynamics and considering a multi-scalar approach can be crucial for designing effective adaptation measures (Figure 9).

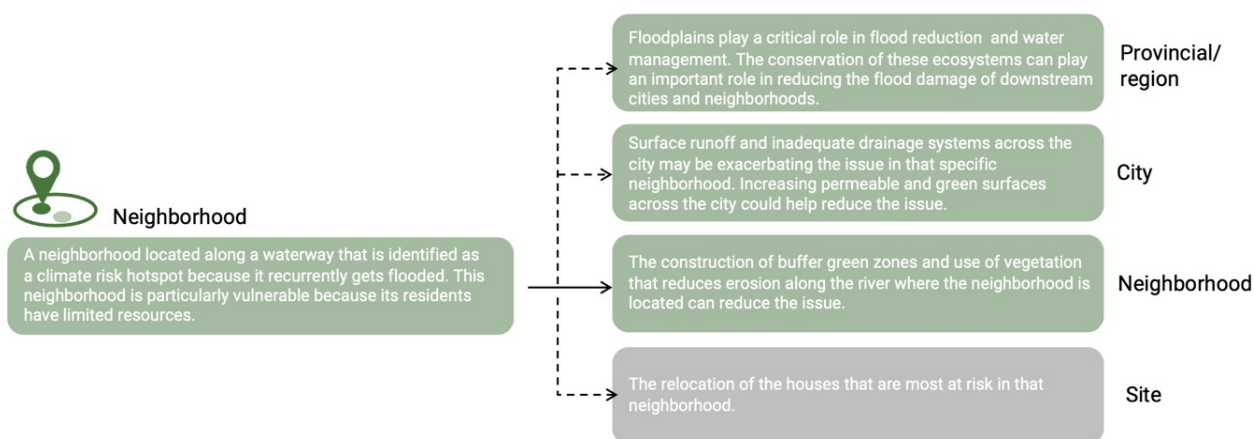


Figure 9. Taking a multi-scalar approach to adaptation in informal areas (Source: UN-Habitat).

To begin creating a long preliminary list with adaptation actions, it is essential to revisit the vulnerability and risk assessment conducted in the previous pathway to ensure that any identified adaptation action can directly reduce the identified risks. When developing preliminary options, building on what is known about the informal areas' exposure, sensitivity, and adaptive capacity is essential.

For informal settlements, there is a need to enhance climate resilience at different scales and with a range of different measures. The different scales are individuals or households (and their homes, assets, and livelihoods), neighbourhoods, settlements, settlement-city links, and settlement-city-regional links. For each of these scales, mixes of measures to anticipate, reduce, accommodate, and recover exist to serve vulnerable groups.

The settlement-city-region links are especially important because resilience to many climate-change impacts within informal settlements depends on city-wide infrastructure. For instance, flood control and management within a settlement can depend on infrastructure outside settlement boundaries.

Land-use management in and around the city scale also has relevance to associated informal settlements.

Most of the measures needed to build city resilience to climate change are within the responsibilities of their governments. But in cities with infrastructure deficits and a substantial proportion of their population in informal settlements, risk and vulnerability are often highly concentrated in these settlements; many are on floodplains alongside rivers or on steep slopes. These are settlements to which city governments have not extended risk-reducing infrastructure and services relevant to resilience. Here it falls to individuals, households, and community organizations to address these issues without external support.

Informal-settlement upgrading developed well before the recognition of climate-change-related risks, but most of what upgrading provides also reduces climate-change-related risks (and disaster risks). Upgrading is also anticipatory in that it builds resilience to future disasters. What needs to be added to upgrading schemes is a resilience lens that accounts for likely current and future climate-change impacts.

Infrastructure, such as water supply and sanitation, transport, and energy, is critical for the social, environmental, and economic sustainability of urban areas. With the rapid growth of urban areas in Asia, large investments in infrastructure and services are expected over the next several decades. Such infrastructure has a long design life, requires a long-term

planning horizon and operation and maintenance commitments, and locks in investments for decades. Moreover, such infrastructure comprises large and diverse networks made up of many different interdependent components, crossing diverse geologic conditions, and interruption caused in any part may result in interrupting the performance of the entire system. Thus, it is important to plan such infrastructure in a robust manner to ensure that climate-related shocks and stresses are factored in the planning, design, construction, and maintenance processes associated with the infrastructure.



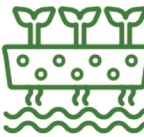

Good-quality and functioning infrastructure can reduce vulnerability. A growing body of evidence demonstrates how regular provision of basic services can reduce socioeconomic vulnerability and thus enhance the ability of a system to function in times of shocks and deal with stresses. For example, making sure water and sanitation systems have redundant capacity—i.e., the collapse of one section of the system does not lead to complete breakdown—or building energy systems using the principle of flexibility so neighbourhoods have decentralized grids will help urban residents continue to receive life-supporting services during times of upheaval.

Another benefit of these initiatives is that they can produce co-benefits, where a positive impact in one sector can have advantages elsewhere. For instance, urban agriculture can provide residents a source of livelihood, improve health, diversify diets, provide an urban flood barrier, and create more green space.

Table 3. Interconnected sectors in NAPs and opportunities for mainstreaming the perspective of informal areas and NBS.

Interconnected sector	Entry points for integrating the dimension of informal areas
<p>Basic services and infrastructure</p>	<p>Mainstream disaster preparedness and resilience planning: Implementing simple and affordable community-level design and flood protection measures can help ensure essential infrastructure such as roads and schools remain safe and operational during disasters. This includes using appropriate locations where the environmental risk is lower.</p> <p>Adopt a ‘last first’ perspective on service delivery: A key factor in the absence of services in many poor communities, particularly slums, is their exclusion from urban planning and decision-making processes – including necessary investment. Cities should prioritize these areas by focusing on the resource and rights gaps, which undermine affordable access.</p>
<p>Health</p>	<p>Address the underlying and changing determinants of urban health: Health outcomes are determined by a range of conditions, from housing and food security to clean water and sanitation. Cities should identify which areas are the most important and use these as entry points. Environmental upgrading, for example, such as drainage and waste disposal, can reduce the spread of disease.</p> <p>Focus on extending service coverage to vulnerable areas: Conventional care systems often fail to reach the most marginalized due to financial, institutional or legal constraints. These can be addressed through targeted subsidies, affordable pricing and community-based service delivery. Health systems can also benefit from local participation, such as the use of trained community workers, and community education – especially in relation to prevention.</p> <p>Examine public system capacity and protocols in relation to projected changes: Some cities have dengue detection and prevention programmes as well as other activities to reduce risks of malaria. However, if these programmes are not timed to correspond with changes in mosquito and other vector breeding cycles, then the resources will be poorly deployed.</p>
<p>Food security and urban agriculture</p>	<p>Promote urban agriculture: Households in informal areas can become more resilient by growing at least part of their own food consumption. Authorities can support these activities by providing credit assistance and training, as well as providing underutilized urban land for farming. Urban policies to ensure a minimum percentage of staple crops relevant to the locality are produced within the greater urban system can help reduce the impacts of price shocks if these staples face shortages or price fluctuations.</p>
<p>Ecosystems</p>	<p>Develop effective environmental planning, including enforcement for sensitive ecosystems: Enforced zoning and planning restrictions can prevent degradation of ecosystem services through inappropriate development. These can be combined with awareness raising on their benefits and positive incentives, so communities have a clear stake in their protection.</p>

Table 4. Example of a list of NBS at community, streets, and plot scale for informal areas.

Nature-based Solutions	Hazard(s) Addressed	Benefits (Environmental and social)	Limits in application in informal settlements
Terraces and slopes 	Pluvial Flooding Erosion & Landslides	Increases penetration and filtration of water in the soil Increases retention of runoff water, protecting from flooding Provides better-quality soil for farming Aquifer replenishment Enhancing biodiversity	Not convenient for high-density spaces Not applicable in all soil types and occupancy conditions
Bioretention swales and rain gardens 	Pluvial Flooding Extreme Heat Erosion	Prevents rainfall runoff from causing erosion and flooding downstream Vegetated areas reduce heat island impacts Provides microscale habitat, biodiversity and ecosystem benefits Aquifer replenishment Provide leisure and aesthetics	Can collect trash and fail if not maintained Requires space for implementation Overgrown vegetation can provide habitat for pests or cover for illicit activities
Biofiltration Planter 	Pluvial Flooding Applicable in areas where infiltration of stormwater is not conducive, where existing soil conditions limit infiltration, adjacent to steep slopes (>4%), or in areas with contaminated soils	Provide water and soil quality treatment Peak flow rate reduction Provides microscale habitat and ecosystem benefits Reduction of urban heat effect	Can collect trash and fail if not maintained Requires space for implementation Overgrown vegetation can provide habitat for pests or cover for illicit activities
Infiltration basins/trenches 	Pluvial Flooding	Peak flow rate reduction Flooding management Aquifer replenishment	Requires space for implementation Periodic maintenance is required Overgrown vegetation can provide habitat for pests or cover for illicit activities

Source: UN-Habitat, 2022. *Nature-based Solutions to build climate resilience in informal areas.*

C2. Building a portfolio of adaptation actions with NBS

Once the adaptation long list has been developed, including a range of actions that are aimed to target vulnerabilities and risks of informal areas, utilizing a range of strategies, including NBS, the NAP will need to shortlist and prioritize the actions to ensure the most effective distribution of resources to tackle these risks and vulnerabilities. Developing this portfolio of adaptation actions requires selecting an appraisal methodology and criteria against which the adaptation options can be appraised. The UNFCCC NAP Technical Guidelines list some common appraisal methodologies that could be equally applicable for evaluating adaptation options for informal areas. Regardless of the selected approach for prioritization, the context-specific character of informal areas and NBS should be reflected in identified selection criteria, perceptions, and local values. Criteria could include the economic, ecosystem, and social costs and benefits; time frame; whether the option would have political buy-in; the sustainability of the option; whether it brings co-benefits; and whether there would be a possibility for unintended (positive and negative) impacts as a result of implementing the adaptation option. Before making final decisions and integrating the adaptation priorities into the NAP, it is important to verify the final results of the ranking exercise with stakeholder groups, including men and women, local communities and vulnerable people.

As some NAPs are already in an advanced stage of design and there will be limited or no possibility to integrate the perspective of informal areas in the vulnerability and risk analysis or the preliminary identification of adaptation options in the prioritized sectors, a comprehensive portfolio with NBS will guide opportunities for integration in the NAP. Based on the prioritization process, a portfolio with suitable NBS options for informal areas can be designed, including information

on technical design, expected impacts, relevant sectors, scale and timing⁶⁰:

- **Scale:** building off community-based maps and “hot spot” maps, use specific locations of concern, such as areas prone to flooding, water shortage, considering the relevant scales – site, neighbourhood, city, watershed, etc.
- **Sector:** considering the relevant sectors for informal areas include infrastructure, health, water, and urban. This could build off the Vulnerability Assessment and the identified sectoral categories of interest (e.g., water and sanitation, economy and livelihoods, health, ecosystems).
- **Timing:** Some adaptation actions may need to be staged. For example, before building flood control structures, it will likely be required to update and modify settlement zoning/land use designations. It is often helpful to further organize actions into short-term (1-2 years), medium-term (3-5 years) and long-term (6+ years) categories. This is particularly critical when assessing larger infrastructure projects.

Table 5 shows an example of organizing potential actions by sector, scale and time.

60 UN-Habitat, *Planning for Climate Change, A Strategic, Values-based Approach*, 2014

Table 5. Example of a portfolio with NBS for informal areas

Project	Sector	Scale	Timing	Reference
Malawi: Tree planting campaign	Ecosystem	National	Short term	Link
Kenya: Nairobi River Rehabilitation Initiative	Ecosystem	Regional	Medium term	Link
Honiara: catchment management, reforestation, land-use controls, protection of wetlands and soil conservation, flood management through climate-resilient public space (e.g. using floodplains as sports areas), bush gardens, and tree planting	Ecosystem Infrastructure	Local	Medium term	Link
Lao People’s Democratic Republic: forest rehabilitation, watershed management, small-scale community-based water infrastructure, a dam to preserve water for usage during the dry season, gravity feed systems, irrigation systems and rainwater harvesting with a roof or underground catchments, and small-scale community-based waste-water treatment systems to reuse the treated water in agricultural production	Ecosystem Water Infrastructure	Regional	Medium term	Link
Fiji: construction and improvement of on-site drainage, flood resilient sanitation, the construction of flood and cyclone resilient housing (e.g., stilted safe rooms), an upgrade of water supply sources and diversification of storage types, and hydroponic urban farming.	Water Health Infrastructure Housing Food systems	Local	Medium term	Link

Box 15. City Water Resilience Approach

[City Water Resilience Approach](#) is a sector-specific approach. It seeks to bridge the rural and urban divide by focusing on water. In this case study, the users of a water system are mapped as a whole irrespective of geopolitical boundaries. It was an initiative funded by Germany, in partnership with WRI and has been used in 30 cities in Africa as a NBS tool to bridge geopolitical structures.

D. MOBILIZING RESOURCES FOR IMPLEMENTATION

KEY MESSAGES

- **Tailor financial solutions:** Financing for adaptation in informal areas should be tailored to these areas' unique characteristics and needs. Customized financial solutions should consider informal communities' vulnerabilities, socio-economic conditions, and capacities.
- **Foster local ownership and empowerment:** Financial initiatives should prioritize local ownership and empowerment. This involves engaging communities in decision-making processes, involving them in project planning and implementation, and ensuring they have a voice in how funds are allocated and utilized.
- **Encourage innovative financial schemes and strategic partnerships:** Innovative financing mechanisms should be encouraged to mobilize resources for adaptation in informal areas. This could involve exploring crowdfunding platforms, impact investments, and climate-focused blended finance models. Innovative approaches can attract new sources of funding and unlock untapped financial opportunities.

A key aspect of NAP implementation is mobilising adequate financing for adaptation measures, as lack of finance is often listed as one of the most prominent barriers to adaptation in general. As such financing is a significant challenge faced by national and local governments in implementing (or planning to implement) their NAPs. Developing a mobilisation and financing plan will help ensure the successful implementation of key prioritised adaptation measures for informal areas, which are identified in the NAP process. It will ensure that the conditions to ensure financing of adaptation of informal areas are in place beyond the establishment of the action plan.

⁶¹ UNEP, *State of Finance for Nature*, 2021

⁶² Ibid.

⁶³ UNEP, *State of Finance for Nature*, 2021

It is essential to consider mobilizing finance early in the NAP process, as there is often a long "lead time" (i.e., the time between applying for finance and receiving funds in the bank). As a starting point, there is a need to determine the financing gap for adaptation, particularly NBS in informal areas.

PROPOSED ACTIONS

Mobilizing finance is critical to successfully implementing the informal areas' priorities in the NAP. Building on the previous pathways and with the identification of the adaptation actions portfolio for informal areas, it is essential to conduct an adaptation finance gap assessment to determine the needs and priorities (**D1**), identify options for financing (**D2**), and engage the private sector to mobilize finance (**D3**).

D1. Adaptation finance gap assessment to determine needs and priorities in the informal areas

Approximately USD 133 billion/year currently flows into NBS (using 2020 as the base year), with public funds making up 86 percent and private finance 14 percent.⁶¹ Of the public funds, which total USD 115 billion/year, over a third is invested by national governments into the protection of biodiversity and landscapes.⁶² Nearly two-thirds is spent on forest restoration, peatland restoration, regenerative agriculture, water conservation, and natural pollution control systems. Private sector finance of NBS amounts to USD 18 billion/year, which includes biodiversity offsets, sustainable supply chains, private equity impact investment and smaller amounts from philanthropic and private foundations. Looking to the future, investment in NBS needs to triple by 2030 and increase four-fold by 2050 if the world is to meet its climate change, biodiversity and land degradation targets. This acceleration would equate to cumulative total investment of up to USD 8.1 trillion, and a future annual investment of USD 536 billion.⁶³ Forest-based solutions

alone would amount to USD 203 billion/year, followed by silvopasture with USD 193 billion/year, peatland restoration USD 7 billion/year, and mangrove restoration USD 0.5 billion/year.⁶⁴

An Adaptation Finance Gap Assessment involves evaluating the financial requirements and other resources that are necessary to implement the prioritized adaptation measures. To initiate this assessment, stakeholders from the informal communities as well as other highly vulnerable groups should be engaged to determine adaptation needs. Relevant experts need to be brought in to gain an in-depth understanding of the current adaptation gaps, responsive adaptation solutions, and the resources required to finance them. This step needs to be highly participatory, encouraging input and insights from a diverse range of stakeholders, to ensure community voices are heard and their concerns and knowledge are captured, and to get a clear analysis of the financial resources currently allocated to adaptation efforts in informal areas.

This should also include assessing funding from national and local government sources, international donors, and private sector investments. A comprehensive review of existing policies and strategies related to adaptation should also be conducted to identify any gaps or inefficiencies. By scrutinizing the financial inflows and outflows, as well as the policy landscape, the NAP can pinpoint areas where additional funding is required and where adaptation priorities should be focused. Ultimately, this step serves as a vital tool in creating a national adaptation plan tailored to the most vulnerable to climate change, such as informal areas, ensuring that there is a baseline understanding of the key financing gaps which will support the next step of identifying and accessing, and mobilizing financial resources.

64 Ibid.

D2. Identifying and accessing options for financing

The public sector plays a fundamental role in creating opportunities and demand for investment in NBS. First, the public sector brings forward policies and regulations that create a strong and stable revenue stream for NBS activities and assets. Governments and public international organizations can also contribute to an enabling environment for project development and scaling up. The opportunity for NBS to become a formal cross-cutting modality of investment is clear, benefiting from a formalized strategic plan and associated resource allocation.

Across the world, the burden of adapting to climate change will be felt most strongly in urban areas. According to one estimate by the World Bank, as much as 80 percent of global adaptation costs will be borne in urban areas. However, at present many cities need help to fund these needed investments. Those most vulnerable to climate change are also those least able to access and effectively utilize available finance. Decentralization has made this more complex, as many national governments have transferred key responsibilities to local authorities but often without the resources necessary to undertake them. Traditional funding models have become increasingly inadequate. As finance is often one of the key challenges facing local authorities, there is an urgent need to better resource local governments to meet climate change challenges. For local governments, the need to generate local revenue and tap into external opportunities has never been more essential.

The financial case for adaptation, including NBS, has been increasingly supported and evidenced. Ecosystem services delivered by biodiversity, such as crop pollination, water purification, flood



RISE UP workshop on multilayered vulnerability assessment in Antigua and Barbuda. 2023. © UN-Habitat.

protection and carbon sequestration are worth an estimated USD 125-140 trillion per year, i.e. more than one and a half times the size of global GDP. The investments for resilient infrastructure have shown a 4:1 return on investment. NBS are 50 per cent more cost-effective than grey alternatives and deliver 28 per cent more added value. The present median benefit value from urban trees in 10 megacities in the world can be estimated as USD 482 million/year due to reductions in CO, NO₂, SO₂, PM₁₀, and PM_{2.5}, USD 11 million/year due to avoided stormwater processing by wastewater facilities, USD 0.5 million/year due to building energy heating and cooling savings, and USD 8 million/year due to CO₂ sequestration.⁶⁵

Adaptation finance needs to reach the municipal and local level where it is needed the most. Initiatives like the Loss and Damage Fund demonstrate an increasing understanding of this need and the financial case for adaptation.

However, this is only the first step. The operationalization of the fund and other financial instruments need to be urgently implemented. In addition, communities need to make use of the co-benefits of adaptation solutions like NBS to get buy-in for investments. Fifteen years ago, when cities needed to be mobilized in terms of climate change, the “selling point” was not to achieve climate change goals like reduction of GHGs but clean air and better transportation. In this sense, the agenda when implementing NBS can include as a “selling point” co-benefits like improving health conditions and creating jobs, and in terms of informal areas, providing services to those communities and improving local economy.

Despite constraints, local authorities have considerable opportunities to develop more innovative approaches to urban finance in collaboration with international institutions, the private sector, and other stakeholders.

65 Endreny, T., Santagata, R., Perna, A., Stefano, C.D., Rallo, R.F. and Ulgiati, S. (2017). Implementing and managing urban forests: A much needed conservation strategy to increase ecosystem services and urban wellbeing. *Ecological Modelling* 360, 328-335. <https://doi.org/10.1016/j.ecolmodel.2017.07.016>

Table 6. Summary of approaches to financing adaptation in informal areas.

Challenges	Opportunities
<p>National governments: In most developing countries the bulk of public resources is still controlled by the central government – but opportunities for cities have increased in recent decades through decentralization processes.</p>	
<p>Many countries have been slow to prioritize urbanization in their national budgets and also, despite some level of decentralization, lack an effective system of financial transfer to local authorities.</p> <p>As adaptation falls within multiple sectors, lack of coordination can be a problem if there is little integration between different departments – this can make resource sharing and leadership very difficult.</p>	<p>Some governments are developing ambitious national urbanization strategies, in some cases informed by successful city level initiatives, with a strong emphasis on urban resilience.</p> <p>Well managed decentralization and the increasing autonomy of cities within some national structures offer the possibility of more targeted urban interventions with central financial support.</p>
<p>Urban authorities: Local governments are often best placed to deliver low cost and locally appropriate solutions, as well as reach out to other stakeholders for partnerships and collaboration. While financial decentralization has been less complete, there are still ways in which local governments are strengthening investment resources for resilience.</p>	
<p>Many cities are already overstretched with little access to central budgets, particularly in smaller urban areas. This means they face serious resource shortages and may prioritize other issues over adaptation.</p> <p>Authorities are struggling to mobilize resources locally. Besides lacking the capacity to raise funds or access international credit, many cities struggle to leverage assets such as public land.</p> <p>Many cities are unable to develop an adequate tax base. In addition to resource shortfalls, large sections of the population are not registered on tax systems.</p> <p>City authorities often lack the resources to provide universal services. This can mean informal settlements and slums in particular are excluded.</p>	<p>Well managed decentralization and the increasing autonomy of cities within some national structures offer the possibility of more targeted urban interventions with central financial support.</p> <p>Authorities can improve revenue through more effective land use planning. Levies such as sales tax can also provide income.</p> <p>Local governments can explore alternative pricing models. Cross-subsidies and variable service fees enable authorities to balance cost recovery with pro-poor delivery.</p>
<p>Local communities: Resilience is impossible without the involvement of the urban poor communities themselves. Communities can develop low cost, innovative solutions themselves, or in partnership. In fact, as communities and CSOs have become better at securing support from different sources, urban authorities could benefit from collaborating on jointly financed programmes.</p>	
<p>The urban poor communities typically have limited assets due to low incomes, informal employment and a lack of secure tenure. Most are also, due to their lack of legal title, unable to access formal credit. This directly affects their ability and willingness to invest in resilience measures themselves.</p> <p>Communities are frequently excluded from public services and information such as early warning systems, particularly when located in informal or peri-urban settlements outside formal city boundaries.</p>	<p>The urban poor have pioneered a variety of innovative financial mechanisms, such as community savings and revolving loans which have provided them with access to affordable and reliable credit to undertake a range of resilience measures.</p> <p>Community involvement can provide excellent value for money because the urban poor have learnt to achieve impact with limited resources. Participation also allows them to contribute their skills and knowledge to upgrading.</p>

Source: Adapted from UN-Habitat, 2014

Box 16. Community upgrading funds.

Community upgrading funds are bottom-up mechanisms that work as catalysts in slum upgrading through the provision of 'strategic support for community-initiated housing and infrastructure projects that have the potential for scaling-up' (Habitat for Humanity, 2008). Cities Alliance Community Upgrading Fund (CUF) is a mechanism that provides financing for small infrastructure projects selected by the communities themselves, helping residents see tangible progress quickly while the longer-term objectives of the programme unfold.

The CUF contributes to enhancing community engagement and ownership on the design and implementation of projects by responding to the needs of the residents with their proposed ideas. It acts as a mediator between the informal settlements and local governments which would, otherwise, hardly communicate and collaborate. The small size of the infrastructure assets ensure that communities can see rapid and concrete results which act as a driver for further participation and socio-economic development.

In Liberia, for example, Cities Alliance established the CUF in 2016, across informal settlements in Greater Monrovia. Since then, projects have benefited over 350,000 people.

Box 17. Bottom-up approaches for finance

The South African Federation of the Urban Poor (FEDUP) has helped more than 150,000 squatters, the vast majority of whom are women, to pool their savings. FEDUP has reached a critical mass consisting of some 1,500 autonomous savings and credit groups whose size range from a minimum of 15 to a maximum of 500 members. The network was able to lobby the government for direct access to the housing subsidy programme and influence low-income housing policy. By securing these entitlements from the national government, the Federation was able to deliver 12,000 housing units, incremental loans for 2,000 houses, infrastructure for 2,500 families, land tenure for 12,000 families, hundreds of small business loans, three parcels of commercial land, eleven community centres, among others.

Source :Dobson, Skye (2018). *Women Transformers: More Than Meets the Eye*. SDI.
Available at: <https://sdinet.org/2018/03/women-transformers-meets-eye/> (accessed on 25 October 2023)

D3. Engaging the private sector in mobilizing finance for NBS in informal areas

NBS pose an opportunity for private sector investment in pursuit of sources of revenue, to reap the benefits of increased resilience, to reduce costs and to enhance reputation and purpose. As businesses become more sophisticated in their understanding of NBS opportunities, there will be a role for financial de-risking products, such as guarantees and insurance, to create attractive risk-return profiles for large, mainstream investors.

Using the right safeguards and principles, the private sector can become an important vehicle to implement and finance NBS for adaptation. The private sector could contribute to closing the financing gap for ecosystem-based adaptation through public-private partnerships.

Private-sector engagement in NBS can contribute to corporate climate and reputational risk management, boost productivity and profitability and lead to various co-benefits for society and nature. Furthermore, companies can indirectly support NBS initiatives by sharing climate risk data and assessments, information, and knowledge, and supporting capacity-building for various stakeholders. The private sector is already engaged in climate action; however, currently, most corporate initiatives focus on mitigation rather than adaptation.⁶⁶ Companies could become key players in financing and implementing ecosystem-based adaptation strategies by mainstreaming NBS for adaptation in their activities and building more adaptation-related products and services into their portfolio – including those related to natural resource extraction, housing, infrastructure construction and maintenance, and basic services provision.

To increase effective and impactful private sector involvement in NBS, a multitude of drivers have been identified which can be grouped into the following strategies:

1. Policies and regulations to incentivize innovation and engagement of corporations in NBS, including awareness-building campaigns, the integration of the private sector in NDCs, the recognition of NBS in coming climate agreements like comping COP treaties, and policies that enable the engagement of companies in NBS, e.g., by reducing financial risks.
2. Financial and economic instruments, such as insurance schemes to enable adaptation and resilience building, particularly for smaller and medium-sized enterprises. Such instruments can increase confidence and risk acceptance of private actors to enter the NBS space and enable private capital investment through co-financing or insurance schemes that increase the willingness of corporations to invest and thus the overall finance flowing in the sector. (Crick et al., 2018; African Development Bank, 2021; WUF11, 2022; Global Center on Adaptation, 2021);
3. Collaboration and capacity building that focuses on actors with limited resources and enables a growing number of partnerships and coordinated approaches to NBS. This should especially incentivize the participation of small and micro enterprises that play an important role in production and employment but are frequently less engaged in climate adaptation due to a lack of awareness, capacity and international attention in partnerships that traditionally focus on larger, more known private actors with established Environmental Social Governance (ESG) Plans. (Schaer & Delani Karuppu, 2018; Dougherty-Choux, 2015; Global Center on Adaptation, 2021);

⁶⁶ Dale, T.W., Gao, J., Avashia, V.K., Konrad, S., and Garg, A (2021). "Private sector adaptation reporting as a source of input to the Global Stocktake"

4. Information and data sharing and provision, both from the government to companies and horizontally and vertically across the supply chain. Sharing more climate-related knowledge can help companies and other stakeholders reduce uncertainty, and guide planning and decision-making by businesses (Global Center on Adaptation, 2021);

5. NBS framing and awareness of business opportunities in NBS can be improved through clear communication that promotes local entrepreneurship and a clear vision of the role corporate actors can play in advancing resilience through NBS in profitable and efficient ways (WUF11, 2022; Global Center on Adaptation, 2021; Hale et al., 2021).



RISE UP workshop on multilayered vulnerability assessment in Antigua and Barbuda. 2023. © UN-Habitat

E. ENHANCING THE REPORTING, MONITORING AND REVIEW OF INFORMAL AREAS AND NBS MEASURES

KEY MESSAGES

- **Data is key:** to monitor and report on measures in the NAP, data and information on the impact and effectiveness of NBS measures will ensure an evidence-based approach to monitoring and reporting on NAP measures. However, lack of data doesn't need to prevent these processes from occurring, a range of qualitative or quantitative data can be used, from a range of sources to fit the given context, such as remote sensing data to community surveys. Working with informal communities to identify and collect data on climate vulnerabilities and adaptation successes is usually required for effective M&E.

- **Multiple ways to assess the success/progress of NBS measures in a NAP:** such as their continued relevance, their impact - especially with regards to the costs of implementation - and their ability to be accepted by the communities of the informal areas.

- **Importance of outreach:** During M&E, especially at the review stage when NAP measures may be changed, it is important to continue high levels of outreach and engagement with stakeholders from the informal areas where the measures are being implemented. These activities should be integrated into the design of the NAP to ensure these stakeholder activities are factored into the implementation stage.

Monitoring, reporting and review are of paramount importance, especially for adaptation projects centred on NBS in informal areas. These mechanisms serve as the backbone of effective decision-making and will allow the

NAP to systematically track and assess the progress and impact of its measures. It allows stakeholders to assess the effectiveness of NBS interventions, ensuring that they are achieving their intended objectives. Furthermore, it offers a platform for learning and adaptive management. Given the dynamic nature of climate change and the unique challenges faced by informal settlements, it is essential to continuously gather data and feedback to adjust strategies as needed. Monitoring, reporting and review allows for informed decisions based on real-time information, allocating resources where they are most needed and optimizing the use of limited funds.

Monitoring and Evaluation (M&E) plays a pivotal role in bolstering the case for long-term investments such as NBS to build climate resilience. NBS, often involving ecosystems, such as mangrove forests, may initially entail higher capital expenditures than traditional grey infrastructure solutions. However, they tend to have a lower operational expenditures over time and their ability to appreciate in value rather than depreciate. Through robust M&E, we can capture the enduring successes of NBS, showcasing how they not only reduce costs over the long term but also appreciate in ecological and economic value. This evidence can be instrumental in making the compelling case for continued investments in NBS as a sustainable and cost-effective solution to build climate resilience in informal areas.

Additionally, by engaging with local communities in this process, it fosters inclusivity and empowers residents to take an active role in shaping the adaptation efforts that directly affect their lives. Establishing a M&E framework is key for the NAP process, and there is already a lot of guidance and material on how to conduct M&E effectively for adaptation planning. Therefore, this section will focus on the key elements which should be considered to ensure that M&E captures and accounts for NBS measures in informal areas.

PROPOSED ACTIONS

The monitoring of the NAP process (E1) involves a range of data which will then feed into the review and updating of the NAP process based on progress and effectiveness and merging gaps (E2). This information will need to be communicated and acted on, which is where outreach on the NAP process and further reporting (E3) is required.

E1. Monitoring the NAP Process

Ensuring that the M&E structure is inclusive and comprises an array of qualitative and quantitative data that can be utilized and effective in monitoring NBS interventions in informal areas is critical due to the - often common - lack of data.

As each of the adaptation measures are being developed, they should include a range of metrics/indicators that can be used to monitor and evaluate their performance, and these should be included for each option that is developed. Ideally baseline data for each metric will be captured at the start of the NAP from which the measures can be monitored against. For NBS measures it is critical to have the following metrics for each measure:

- **Process and Input Metrics:** these metrics focus on the actions taken, the resources invested and efficiency and inclusivity of the process. These should be included as it will help ensure sufficient local representation and engagement in the measures. For example, the number of stakeholders from informal areas engaged or the number of capacity-building events delivered.
- **Output and Outcome Metrics:** these metrics measure the direct outputs and the subsequent outcomes. For NBS, these indicators could include number of trees planted in a defined area, area of land restored or rehabilitated, decrease in air pollution.

- **Impact Metrics:** while many of these metrics may only be measurable after the adaptation measures have been implemented, for the purpose of national adaptation planning, these metrics are key to help the programme focus on the result and overall benefits and changes brought about by the NBS interventions. These could include the decrease in flood related damages/injuries/deaths, improved mental health, increment in jobs availability.

By incorporating a range of metrics into the framework, it will allow the NAP to monitor and measure progress outcomes and impacts of NBS measures in informal areas across the timeframe of the NAP, this is crucial for effective decision making.

Data to support M&E can be particularly scarce in informal areas. However, there are a range of tools and data portals that can be used to identify what data is available and how it can contribute to effective M&E in the NAP process. The UN-Habitat 'Multi-layered Vulnerability Assessment Tool' overlaps vulnerability data related to climate change, biodiversity loss, and urbanization and identifies hotspots of multilayered vulnerabilities. Thus, the tool can provide the evidence-base to identify responsive and multi-facet resilience solutions such as NBS in data scarce environments. In addition, lots of data is collected by the communities themselves, which can support adaptation planning and implementation. Slum Dwellers International have developed a portal of data collected by local communities, called Know Your City. Both geospatial as well as disaggregated socio-economic data are required. Most of the data will be obtained at the municipal, national, and local levels, and stakeholders at those levels will need to be engaged.

E2. Reviewing and updating the NAP Process to assess progress, effectiveness, and gaps.

Reviewing the NBS interventions in a formal and prescriptive way, is essential to ensure that the measures are effectively reducing the vulnerabilities of informal areas, avoiding any maladaptive elements, and having the impact it set out to achieve.

These review activities, which will be taken intermittently throughout the NAP process, perhaps on an annual basis, will enable the NAP coordination team to make evidenced-based decisions and allocate resources to NBS effectively. Different stakeholder groups could and should be engaged to verify the findings of the review and to see how NBS can be optimized. Additionally, if the solutions have not been implemented or their implementation has been problematic, having an inclusive review process that seeks to listen and consider a wide range of perspectives can help get the solution back on track.

In some cases, it might be decided that wide ranging changes need to be taken or possibly the solutions found should no longer be continued. This might arise due to several reasons, such as:

- Ineffectiveness – NBS measure not achieving the desired outcomes and outputs
- Temporal relevance – Solutions found at the beginning of the project might be no longer relevant when implemented. As climate continues to change, solutions might need to be adapted to these new impacts.
- Limited resources and limited financing – the cost of the measure may escalate, or resources may be reallocated, these can occur.
- Lack of community acceptance – successful implementation of NBS relies on community acceptance, and if a review identifies that either there is limited community involvement and/or acceptance it may necessitate corrective adjustments or termination of the measure. This is because there is a higher risk of maladaptation and a lower chance the measure would be successful in achieving its metrics.

Once the review is conducted the NAP may need to be updated to reflect any changes and decisions.

Box 18. Green gentrification as an unintended negative consequence of NBS

Green gentrification is a process in which by implementing green infrastructure and amenities, the costs of nearby properties increase, attracting a higher-income population. This causes current residents that can no longer afford the prices of their rent to move away from that area with many consequences like losing their social network. This is especially important to consider in informal areas given their pre-existing vulnerabilities. When implementing NBS in informal areas, it is essential to understand them as the primary beneficiary. To guarantee that the planning process does not have unintended consequences, the approach should be integrated by focusing on the most vulnerable, inclusive by assessing the risks during the decision-making process and transparent by identifying possible conflicts of interest when the private sector participates in the implementation and trying to mitigate any negative implications to foster a just transformation.

E3. Outreach on the NAP process and reporting on progress effectiveness.

Whatever changes have been made to the NAP at the review stage, it is important to continue high levels of outreach and engagement with stakeholders from the informal areas where the measures are being implemented. They should be involved throughout the NAP process and empowered to reach out to the NAP coordination team to express their opinion and concerns. As such, a detailed plan will need to be formulated at the development of the NAP to ensure these activities are factored into the implementation plan.

Activities may include dissemination of NAP documents, reports and related outputs to stakeholder groups, to ensure they are included in communications. Lessons learned could also be shared with a wide range of stakeholders who may be interested in delivering NBS in informal areas in different contexts/regions/countries. As NAPs are a national planning tool, showcasing where NBS measures have been effective in reducing the vulnerability of informal communities to climate change can lead to scaling up of a specific measure to other cities and regions, thereby increasing the impact and the NAPs ability to build resilience across the country.

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