

UN-HABITAT THEMATIC GUIDE

ADDRESSING THE MOST VULNERABLE FIRST

PRO-POOR CLIMATE ACTION **IN**

INFORMAL SETTLEMENTS

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Addressing the most Vulnerable First - **PRO-POOR CLIMATE ACTION IN INFORMAL SETTLEMENTS**

Nairobi, November 2018

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United Nations Human Settlements Programme (UN-Habitat)

P.O. Box 30030, 00100 Nairobi, Kenya www.unhabitat.org

HS Number: HS/091/18E

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ACKNOWLEDGEMENTS

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SUPPORTING ORGANIZATIONS:

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Design and Layout: **Freddie Maitaria**

Front & back cover photos: © **Shutterstock**

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LIST OF ABBREVIATIONS

ACCCRN	Asian Cities Climate Change Resilience Network
ACP	Africa, Caribbean and Pacific Group of States
ACVN	Association of Vietnamese Cities
CAP	Climate Action Plan
CBA	Community-based adaptation
CCCI	Cities and Climate Change Initiative
City-RAP	City Resilience Action Planning Tool
CO₂eq	Carbon dioxide equivalent
CRRP	City Resilience Profiling Programme
CSPS	Centre de Santé et de Promotion Sociale
DiMSUR	Disaster Risk Management, Sustainability and Urban Resilience
DRR	Disaster risk reduction
EBA	ecosystem-based adaptation
EC	European Commission
GDP	Gross domestic product
GEAG	Gorakhpur Environmental Action Group
GHG	Greenhouse gas(es)
GIZ	Gesellschaft für Internationale Zusammenarbeit
GPS	Global Positioning System
HoH	Hands on Homes
IPCC	Intergovernmental Panel on Climate Change
LED	Light-emitting diode
M & E	Monitoring and Evaluation
MoU	Memorandum of Understanding
NGO	Non-Governmental Organisation
PNC	People's Community Network
PSUP	Participatory Slum Upgrading Programme
RFA	Resilience Framework for Action
SDGs	Sustainable Development Goals
SPREP	Pacific Regional Environment Program
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Fund for Population Activities
UN-Habitat	United Nations Human Settlements Programme
VA	Vulnerability assessments

DEFINITIONS OF KEY TERMS¹

This section outlines the key terminology used in this guide. Many of the key terms relating to climate change adaptation have multiple definitions, and where appropriate, this Guide uses the definition provided by the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report² of 2014 as the benchmark, as this reflects current international scientific consensus (although other framings have been – and continued to be used).

Adaptation: The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. Adaptation therefore has a forward-looking aspect, as well as relating to actions that respond to current impacts of climate change.

Adaptive capacity: The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. Adaptive capacity has an element of forward-looking action, whereas coping capacity is an action taken to minimise the immediate impact of a climatic event, which does not also contribute to the ability to address potential future events.

Community-based Adaptation: Adaptation approaches based on the premise that local communities have the skills, experience, local knowledge and networks to undertake locally appropriate activities that increase resilience and reduce vulnerability to a range of factors including climate change.

Ecosystem-based Adaptation: The use of a range of opportunities for the sustainable management, conservation, and restoration of ecosystems to provide services that enable people to adapt to the impacts of climate change.

Exposure: The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.

Hazard: The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.

Informal (economic) sector: this encompasses economic and other activities which fall outside the purview of state regulation. The informal economy covers enterprises, workers and activities operating outside the legal regulatory framework, and the output they create.

Informal settlements are urban neighbourhoods that developed outside the formal system recording land ownership, land tenure and a range of regulations relating to planning and land use, built structures and health and safety.

Maladaptation: actions that are taken to cope with immediate shocks and stresses that may reduce the ability to deal with future challenges associated with climate change.

Mitigation: in referring to disasters, mitigation means actions taken to reduce the adverse impacts of physical hazards. In referring to climate change, mitigation means actions taken to reduce the concentration of greenhouse gases in the atmosphere, either by reducing their emission or by facilitating their removal (e.g. by reforestation).

Resilience: The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation.

Urban resilience is the measurable ability of any urban system, with its inhabitants, to maintain continuity through all shocks and stresses, while positively adapting and transforming toward sustainability.

Risk: The potential for adverse consequences where something of value is at stake and where the occurrence and degree of an outcome is uncertain. In the context of the assessment of climate impacts, the term risk is often used to refer to the potential for adverse consequences of a climate-related hazard, or of adaptation or mitigation responses to such a hazard, on lives, livelihoods, health and wellbeing, ecosystems and species, economic, social and cultural assets, services (including ecosystem services), and infrastructure. Risk results from the interaction of vulnerability (of the affected system), its exposure over time (to the hazard), as well as the (climate-related) hazard and the likelihood of its occurrence³.

Sensitivity: the degree to which a system or people are likely to be affected by the impacts of climate variability or change.

Shocks: potential uncertain abrupt or long-onset events, whose main consequence is shifting a system from its current state to a disturbed one.

Stresses: chronic and ongoing dynamic pressures within a system, whose cumulative impacts undermines the capacity for sustainability and resilience.

Upgrading: UN-Habitat understands Slum Upgrading in a broader sense that refers to improvements in housing and infrastructure, and also includes enhancements in the economic and social processes that can bring about such physical improvements.

Vulnerability: The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. When discussing vulnerability, it is important to be clear about *who* is vulnerable, to *what*.

¹ <https://unhabitat.org/books/planning-for-climate-change-a-strategic-values-based-approach-for-urban-planners-cities-and-climate-change-initiative/>

² <https://unhabitat.org/books/guiding-principles-for-climate-city-planning-action/>

³ IPCC (2018). *Special Report: Global Warming of 1.5 °C*



FOREWORD

UN-Habitat thematic guide on “Addressing the most vulnerable first - climate action in informal settlements”

Urbanization is one of the global mega-trends of our time, unstoppable and irreversible. In 30 years, two-thirds of the world's population will live in urban areas; 90 per cent of this urban growth will take place in less developed regions such as East Asia, South Asia, and Sub-Saharan Africa. These are regions where capacity and resources are already constrained, and development challenges are ever more complex and concentrated. Urbanization in such areas is largely unplanned, fuelling the continuous growth of informal settlements, the physical manifestation of urban poverty and inequality. Currently home to some 1 billion people, informal settlements are where the impact of climate change is most acute and where resilience must be strengthened.

Global challenges such as poverty, climate change and migration are effectively urban phenomena. Cities play a key role in mitigating and adapting to climate change. They are at the forefront of dealing with these constant shocks, bearing the brunt of the risks. When examining the issue of migration, for example, we should note that internal and international migrants typically make informal settlements their first home when arriving in a city. They join already large populations of urban poor, with stressed infrastructure, in unsafe areas under unsuitable conditions. These locations tend to be more susceptible to flooding, landslides and sea level rise. We must address climate resilience holistically, with informal settlements in mind.

“

UN-Habitat's vision of “**A better quality of life for all in an urbanizing world**” is bold and ambitious; one that challenges us to galvanize international and national efforts on urbanization.

When we look at the challenges of urbanization, therefore, if we do not adequately address the issue of building climate resilience in informal settlements, we will not succeed. Such challenges can thus be an opportunity, to see sustainable urban development as a transformative tool, a once-in-a-lifetime opportunity that has the potential to change the social, political and economic fabric of human settlements, from small rural communities and market towns, to intermediate cities and metropolises. UN-Habitat's vision of “A better quality of life for all in an urbanizing world” is bold and ambitious; one that challenges us to galvanize international and national efforts on urbanization. Successful climate change adaptation requires a renewed focus on the most vulnerable communities, to protect them from hazards.



With the generous support of the European Union and its individual member states, UN-Habitat has supported over 30 countries and 50 cities worldwide over the past decade to improve living conditions in informal settlements and address the climate challenge. Valuable lessons learned from our joint efforts highlight vulnerabilities of the urban poor to climate change, and the transformative role that climate action can have in improving living conditions in slums.

This is the first publication in a series of knowledge products aimed at supporting the global urban and climate community on building climate resilience in informal settlements. I hope it will help us better understand and act on this pressing issue, and equip national and local decision makers and practitioners with the tools necessary to understand, analyse, plan and act on making informal communities and settlements more resilient to climate change.

Ms. Maimunah Mohd Sharif
Under-Secretary-General and
Executive Director, UN-Habitat

EXECUTIVE SUMMARY

Promoting climate compatible slum upgrading: Addressing the most vulnerable first

One of the greatest challenges for climate change adaptation is how to build resilience for the billion urban dwellers who are estimated to live in what are termed informal settlements. These settlements have been built outside the 'formal' system of laws and regulations that are meant to ensure safe, resilient structures, settlements and systems.

Climate Risk and Vulnerabilities

Climate change is rapidly presenting additional risks for those living in already inadequate living conditions in informal settlements. Cities are facing an increasing frequency and magnitude of extreme climatic events such as floods, heatwaves, droughts, landslides, storms, wildfires, cyclones, coastal erosion and inundation, and sea surges, and informal communities are particularly vulnerable due to three underlying factors: (i) the **physical location** is often on

environmentally-fragile locations such as steep slopes, floodplains, coastal shores and river banks; (ii) the **socio-economic characteristics** of the residents, such as high levels of poverty and illiteracy, mean that these communities have low capacity to deal with climate impacts; and (iii) the **political and institutional marginalization** of these neighborhoods, stemming from non-recognition of informal settlements as part of the larger city fabric, often results in the absence of meaningful risk-reducing infrastructure.



Climate Action in informal settlements must begin with a detailed, in-depth and nuanced understanding of the physical conditions, the demographics and of the differentiated vulnerability in order to adequately plan interventions that are feasible and targeted.

Likely impacts from climate change on informal settlements

Projected changes	Examples of likely impacts	Implications for residents of informal settlements	Possible measures to adapt
Higher (and increasing) average temperatures,	Rise in mortality and illness from heat stress. Extended range and activity of some disease vectors	Density, little open/public space and often, iron roofs and poor ventilation lead to higher indoor temperatures. Lack of public health measures.	Improved building design; set up locally accessible health services; provide education. Investing in green space,
More intense precipitation events and riverine floods	Increased flood, landslide, avalanche and mud-slide damage resulting in injury and loss of life & property	risk of flooding with poor quality housing less able to withstand flooding lack of risk-reducing infrastructure.	Building and infrastructure designs & improvements
Wind storms with higher wind speeds	damage to buildings, power and telephone lines and other urban infrastructure	increases in wind speeds can damage buildings, informal utility services are likely to be damaged or cut	improve construction and design of houses and infrastructure.
Increased summer drying and associated risk of drought	Decreased water resource quantity and quality; soil quality; increased risk of fire; decreased crop yields and higher food prices	Informal settlement residents usually facing more water constraints and are more vulnerable to food and water price rises.	Addressing socio-economic factors & poverty; improve water infrastructure and affordability.
Sea-level rise	Coastal erosion, land loss, more floods from storm surges;	settlements close to the sea with poor housing and lacking infrastructure	Raise awareness, construct protective infrastructure or explore alternatives

Climate Action in informal Settlements

Climate Action in informal settlements must begin with a detailed, in-depth and nuanced understanding of the physical conditions, the demographics and of the differentiated vulnerability in order to adequately plan interventions that are feasible and targeted. Resilience-building requires a multi-pronged approach which addresses not just physical conditions, but also social, economic and political capacities, usually through a participatory process where local residents play an active part in planning, designing and implementing actions in four or more areas: (i) upgrading to more resilient housing, (ii) upgrading infrastructure, (iii) enhancing ecosystems, and (iv) supporting community capacities. Long term strategies need to complement the upgrading initiatives, addressing the three underlying barriers for resilience: the (i) **spatial barrier** recognising that informal settlements do not exist in isolation of the city around them, (ii) **the political barrier** includes national and local acknowledgement of the realities of informal urban development. And the (iii) **economic barrier** to resilience – investments in housing and infrastructure come at high cost. Access to financial products, including a bank account, remains out of reach for many living and working in the informal sector.

Given the low greenhouse gas emissions of many activities of low-income urban residents, pursuing mitigation in its own right in informal settlements would be targeting the wrong population group. However, it is clear that the current development deficit in informal settlements, in the form of services and infrastructure shortfalls, creates opportunities to 'leapfrog' to low or zero emission systems and structures. By leapfrogging directly to good practice options, it is possible to capture the benefit of new clean technologies, decentralized systems and avoid more polluting, less efficient development trajectories of high income countries. Building, water, energy and waste technologies, urban and community design for low-carbon development, neighbourhood level low-carbon development, and ancillary benefits from low-carbon technology for upgrading are opportunities that can be harnessed, and most importantly, climate finance might be supporting their deployment.

Climate Finance as an opportunity

Integrating climate action on adaptation and low-carbon development – into informal settlement upgrading is likely to require additional funding. Because the needs are directly linked to climate change, it is appropriate for these costs to be met by climate finance. and for insufficiently reaching the low-income groups who are most vulnerable to climate impacts. New mechanisms will be needed to link these formal climate finance mechanisms to the needs of informal settlements, which might include the bundling of projects, the development of new financial instruments, and the involvement of intermediary organizations.

Principles for Action

Based on UN-Habitat's experience in climate action in informal settlements, we propose nine key tenets that should be applied in considering and implementing climate change measures in informal settlements. These over-arching principles can be contextualized to different cities and neighborhoods, and can be the starting point for inclusive action, alongside the more board informal settlement improvement principles.

- Address development deficits with climate action mind and vice versa
- Downscale vulnerability assessments and responses to city and neighborhood level;
- Incorporate local knowledge in climate change responses;
- Strengthen education and training;
- Build capacity at the neighborhood level;
- Apply a balanced mix of adaptation options;
- Scale up action through co-production and collaboration between actors;
- Recognize the opportunities by integrating informality into adaptation and mitigation,
- Use recovery processes as an opportunity for low carbon and resilient development.





1

THE NEED FOR **CLIMATE RESILIENT** INFORMAL SETTLEMENTS

Climate change is rapidly presenting additional risks for those living in already inadequate living conditions in informal settlements. Cities are facing an increasing frequency and magnitude of extreme climatic events such as floods, heatwaves, droughts, landslides, storms, wildfires, cyclones, coastal erosion and inundation, and sea surges.

1.1 Introduction

One of the greatest challenges for climate change adaptation is how to build resilience for the billion urban dwellers who are estimated to live in what are termed informal settlements⁴. These settlements have been built outside the 'formal' system of laws and regulations that are meant to ensure safe, resilient structures, settlements and systems. But how is it possible to build resilience for those living outside the formal systems and usually working within the informal economy?

Urban areas today are home to 55% of the world's population (UNFPA, 2018), and this figure is projected to grow to 60% by 2030, and 70% by 2050 (UN-Habitat, 2014a). Urban areas also host over half of the globe's assets and economic activities (World Bank, 2010). At the same time, one billion people, or approximately one in seven people globally, live in informal settlements, which are often also referred to as slums (see Box 1). Fifty nine percent of the urban population in sub-Saharan Africa lives in slums, compared to 28 percent in Asia and 21 percent in Latin America and the Caribbean⁵. However, many more people in low-income countries live in urban settlements which lack critical services including water, sanitation and durable housing⁶. This period of urban growth coincides with a critical period for the global climate: the 2050 horizon is frequently used by the Intergovernmental Panel on Climate Change as a horizon for understanding both the systemic changes that are required to reduce global greenhouse gas emissions, and for identifying the impacts that climate change will have.

“

Climate change can therefore trap residents of low-income and informal settlements in a cycle of poverty and vulnerability, as each climate disaster results in loss of assets, life, injuries, and disruption of socio-economic activities and limits abilities to cope and adapt to future risks.



That latest IPCC report⁷ recognizes the need for rapid and far-reaching transitions in urban areas as a component of pathways to limit global warming to 1.5°C and specifically identify opportunities for renewable energy in informal settlements as a means to produce co-benefits.

While the past 15 years have seen an improvement of living conditions for many residents of slums and a reduction in the total slum population as a percentage, the absolute number of slum dwellers has increased. Slums play host to glaring inequalities, insecurity, poor living standards, and social exclusion, but also ingenuity, community, homes, and flourishing businesses.

Climate change is rapidly presenting additional risks for those living in already inadequate living conditions in informal settlements. Cities are facing an increasing frequency and magnitude of extreme climatic events such as floods, heatwaves, droughts, landslides, storms, wildfires, cyclones, coastal erosion and inundation, and sea surges. The latest Special Report⁸

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UN-Habitat has developed a wide array of materials dealing with slum upgrading, such as *A Practical Guide to Designing, Planning, and Executing Citywide Slum Upgrading Programmes*, *the Slum Almanac*, and several other quick guides

⁴ This opening paragraph is taken from a background paper prepared by the authors and colleagues for the IPCC Cities conference (Satterthwaite *et al.* 2018).

⁵ UN-Habitat (2016). *Slum Almanac 2015-16*.

⁶ New Climate Economy (2018). *Unlocking the inclusive growth story of the 21st century: accelerating climate action in urgent times*.

⁷ IPCC (2018). Special report: Global warming of 1.5°C.

⁸ Global Warming of 1.5 °C, an IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty

of the Intergovernmental Panel on Climate Change concludes that the adverse impacts of extreme events associated with climate change could affect areas with large informal settlements and other vulnerable urban populations.

As the effects of climate change are increasingly felt within urban areas, the low-income urban residents often experience the most severe impacts. Poor communities are disproportionately negatively affected for several reasons:

- The physical location of slums / informal settlements is often on environmentally-fragile locations such as steep slopes, floodplains, coastal shores and river banks which have a high exposure to climatic hazards such as flooding and landslides.
- The socio-economic characteristics of the residents, such as high levels of poverty and illiteracy, mean that these communities have low capacity to deal with shocks and stressors from climate-related disasters.
- The political and institutional marginalization of these neighbourhoods, stemming from non-recognition of informal settlements as part of the larger city fabric, often results in the absence of meaningful risk-reducing infrastructure such as storm water drains, proper roads, bridges, and water and sanitation facilities – thereby further reducing the climate resilience of marginalized neighbourhoods and their residents. This marginalization also jeopardizes that communities affected or displaced by climate disasters have limited guarantees that they can return to their homes and livelihoods after the recovery effort.

Climate change can therefore trap residents of low-income and informal settlements in a cycle of poverty and vulnerability, as each climate disaster results in loss of assets, life, injuries, and

disruption of socio-economic activities and limits abilities to cope and adapt to future risks. The increasing frequency of climate-related disasters and burdens has the potential to roll back gains made in the past, and to prevent gains from being made in the future.

A number of international agreements and processes seek to address both climate change and its impacts, and global development deficits, and many of these have direct relevance to cities. The Sustainable Development Goals (SDGs) are a set of 17 goals to end poverty, protect the planet, and ensure prosperity for all by the year 2030. SDG 11 in particular commits to make cities inclusive, safe, resilient and sustainable by ensuring access to adequate, safe and affordable housing and basic services for all by 2030, including by upgrading slums. The New Urban Agenda of 2016 is an urbanization action blueprint in support of implementation of the SDGs, particularly SDG 11. It calls for 'cities for all' where no one is left behind. Specifically in relation to climate change, the Paris Agreement of the UNFCCC seeks to hold the increase in global



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SDG 13 commits to take urgent action to combat climate change and its impacts by 2030.



The New Urban Agenda of 2016 is an urbanization action blueprint in support of implementation of the SDGs, particularly SDG 11. It calls for 'cities for all' where no one is left behind.

BOX 1

A note on terminology: slums or informal settlements?

Informal settlements are settlements operating outside of the formal legal and regulatory systems – including those recording land ownership and land tenure, and regulations relating to planning, land use, building standards and health and safety. These might be formal housing units that have been illegally sub-divided, or homes built without the necessary permissions.

Therefore, not all informal settlements are slums, as they can still have well-developed housing and services without being legally recognized. Meanwhile, not all slums are informal settlements, as they can be legal housing which has fallen into disrepair with poor provision of services. However, there is a significant overlap between the two categories, and therefore in this guide we use the terms 'slum' and 'informal settlements' interchangeably, to refer to settlements characterized by at least some of the following features: a lack of formal recognition on the part of local government of the settlement and its residents; the absence of secure tenure for residents; inadequacies in provision for infrastructure and services; overcrowded and sub-standard dwellings; and location on land less than suitable for occupation.

While the term slum usually has derogatory connotations, and can suggest that a settlement needs replacement or can legitimate the eviction of its residents, it is a difficult term to avoid. Some networks of neighbourhood organizations choose to identify themselves with a positive use of the term, partly to neutralize these negative connotations. In certain countries, there are advantages for residents of informal settlements if their settlement is recognized officially as a "slum" as this means they can access certain services and negotiate for investments.

average temperature below 2°C above pre-industrial levels, and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels. This would significantly reduce the risks and impacts of climate change. The Sendai Framework for disaster risk reduction is a global framework that seeks to minimise disaster risk and losses, and has an urban-specific campaign, 'My city is getting resilient'. Other international agreements and frameworks are also relevant, including the Addis Ababa Action Agenda on Financing for Development which acknowledges that reform of financial systems is necessary to achieve global and local development goals, the Aichi Biodiversity Targets from the Convention on Biological Diversity, and the World Humanitarian Summit's Agenda for Humanity.

Taken together, these global agreements are intended to reduce the extent to which cities and their residents are affected by climate change. *Poverty reduction, disaster risk reduction and climate change adaptation all share a focus on identifying and acting on local risks, even if they have different lenses through which to view risk.* However, it is often the case that residents of informal settlements are the least likely to benefit from any initiatives to reduce the impact of climate change in cities, despite the fact that they contribute minimally to greenhouse gas emissions, as they lack the political voice to influence planning decisions to ensure that their needs are met, and the economic resources and technical capacity to take risk-reducing measures on a sufficient scale. However, as this Thematic Guide demonstrates, there are many examples of low-income residents taking action to upgrade their living conditions and by extension reduce their exposure to climate change impacts, which could be built upon and scaled up with the support of local and national governments, the private sector and civil society.

1.2 Objective of the guide

This Thematic Guide is intended to be the first of a series of a resources⁹ for those with an interest in the opportunities for building resilience and addressing the challenges of informality hand-in-hand. It is not a step-by-step planning approach – while it does identify the need for certain specific methodologies to be developed further, planning tools for climate adaptation in cities already exist (see Appendix). Nor is it intended as a review of slum upgrading and its social and political outcomes, as this is amply covered elsewhere, but rather the potential that slum upgrading offers to integrate climate resilience-building.

The focus of the guide is therefore on the 'additional' risks posed by climate change to low-income and informal settlements and their residents, with the aim of helping the process of reducing risks and building resilience. This guide:

- Outlines the development deficits found in informal settlements, and the effects of these on different groups of residents within informal settlements, including women, the elderly, children and the disabled;
- Highlights the hazards faced by residents in informal settlements, with particular reference to climate hazards, and how development deficits may exacerbate the effects of these;
- Considers the social, economic and political factors which may be underlying drivers of vulnerability, while maintaining a clear orientation to the climatic threats that they intersect with;
- Discusses approaches to building resilience to climate change in informal settlements, including through upgrading, drawing on examples implemented by residents of informal settlements around the world;

- Outlines the opportunities for building resilience and addressing development deficits in a low-carbon way, while recognizing the limited contribution of low-income populations to carbon emissions;
- Explores the potential for building climate-smart livelihoods with particular reference to the informal tertiary sector, services and economy;
- Sets out key principles for action that summarise the key messages of the Thematic Guide, and highlighting existing toolkits and approaches that can be used to facilitate implementation.

The intention of the Thematic Guide is to demonstrate that effective responses to climate change for cities and towns in low- and middle-income countries can only be achieved if these include meaningful approaches to addressing the needs and priorities of people living in informal settlements and working in informal economies, including pre-existing development deficits. The Guide argues that informal settlement upgrading will only achieve its purpose if this is done in a way that takes into account current and future threats from climate change. It seeks to provide recommendations and entry points for action by decision-makers.

The core message is to highlight the inter-relationships between informal settlement upgrading and building urban climate change resilience, and to emphasise the need for underlying shifts in social organisation, participation and governance that will be required to address both of these urgent priorities. Additionally, the opportunities that low-carbon development can bring are identified and explored.

⁹ Other forthcoming resources include a practical guide for community assessment and action planning, and financing.

1.3 Target audience

This Thematic Guide is aimed at national and municipal government officials and civil society leaders in low- and middle-income countries. It will encourage them to make and implement policies and plans that tackle the challenges of climate change and development in informal settlements, in ways that are mutually supportive and that generate co-benefits wherever possible. This Guide will also be of value to a secondary audience of planners, practitioners and researchers with an interest in integrating climate resilience in processes to improve conditions in informal settlements.

For readers with more knowledge of informal settlements and their

upgrading, this Guide will provide the necessary background on climate change, its impacts, and the necessary approaches to reduce these in conjunction with upgrading.

For readers with a background in disaster risk reduction or building climate change resilience, this Guide will be useful for providing details of effective participatory strategies for upgrading of low-income and informal settlements that also addresses the related but distinct risks arising from climate change.

This Guide can be read alongside other UN-Habitat publications and tools, which are outlined in further detail in the following section.

1.4 Relevant UN-Habitat programmes and tools

UN-Habitat's remit is to work towards socially and environmentally sustainable urban development and the achievement of adequate shelter for all. UN-Habitat's support to cities has included work in related but distinct substantive areas: (i) addressing the effects of climate change, (ii) undertaking participatory slum upgrading, and (iii) Disaster Risk Reduction and building resilience.

Since 2008, this assistance has been provided to a substantial degree via the Cities and Climate Change Initiative (CCCI), and the Participatory Slum Upgrading Programme (PSUP), since 2008, the City Resilience Profiling Programme has been operating in several cities interacting with local authorities (Box 2). The implementation of these programmes has demonstrated the need for addressing these two issues in an integrated manner, and this is increasingly recommended by partners and donors alike. Experience has also shown that, while relevant knowledge is available, there is a lack of specialized tools and experiences to assist city actors to address the effects of climate change in low-income neighbourhoods.

BOX 2

UN-Habitat Programmes supporting action on climate resilience and informality

UN-Habitat has supported member states in addressing climate hazards in informal contexts for many years, with a range of valuable experiences, methodologies and tools based on our lessons and day-to-day operations in those programmatic contexts.

UN-Habitat's Cities and Climate Change Initiative has developed guidelines covering various areas for planning for climate resilience in urban areas, such as *Planning for Climate Change in Cities*⁵ and the *Guiding Principles for City Climate Action Planning*⁶ (Guide and Toolkit). Complementary to the present Thematic Guide, UN-Habitat is in the process of development for a Comprehensive Guide on Climate Change and Disaster Risk – A tool for community assessments and action planning, based on the in-depth experiences in Asia-Pacific, Africa and Latin America and the Caribbean. The analysis and planning methodologies are the critical inputs that have helped develop several large scale projects on climate change adaptation in informal settlement, linking national and local priorities with international climate finance.

The Participatory Slum Upgrading Programme (PSUP), a partnership between the European Commission (EC), the Secretariat of the Africa, Caribbean and Pacific Group of States (ACP) of States and UN-Habitat, has been working since 2008 to improve living standards of slum dwellers in cities of Africa, Caribbean and Pacific. The programme has adopted a participatory city wide slum upgrading approach to integrate slums and informal settlements upgrading to wider strategic urban development plans by mainstreaming the UN-Habitat human-rights based approach in incremental in-situ upgrading. PSUP has developed a wide array of materials dealing with slum upgrading, such as *A Practical Guide to Designing, Planning, and Executing Citywide Slum Upgrading Programmes*, *the Slum Almanac*, and several other quick guides, which are based on operational experience in 160 cities in 35 ACP countries.

Together with the Technical Centre for Disaster Risk Management and Urban Resilience (DIMSUR) in Mozambique, UN-Habitat has developed the City Resilience Action Planning Tool (City-RAP) that specifically focuses on empowering local authorities in sub-Saharan Africa on urban resilience, equipping them with participatory methodologies of planning for urban risk reduction (including climate change risks).

The City Resilience Profiling Programme (CRRP) was launched to build the capacity of local governments for improved urban resilience by formulating a comprehensive and integrated urban systems and management approach, and tools for measuring, profiling city resilience and proposing Actions for resilience to all types of shocks, stresses and challenges, including those related to climate change.

160

The number of cities in 35 countries, in which PSUP has operational experience



A small market at Mathare Valley Slum, Nairobi © UN-Habitat



2

INFORMALITY AND **RISK**

This chapter considers the conditions faced by residents of informal settlements, both in terms of their housing and their access to basic services and infrastructure. It considers the implications of informality for exposure and vulnerability to the impacts of climate change, including the differentiated vulnerability of different population groups and of similar groups living in different locations within the same settlements.

This chapter considers the conditions faced by residents of informal settlements, both in terms of their housing and their access to basic services and infrastructure. It considers the implications of informality for exposure and vulnerability to the impacts of climate change, including the differentiated vulnerability of different population groups and of similar groups living in different locations within the same settlements. Informal settlements develop because of inter-related economic and political factors. Unregulated land markets, driven by high demands for limited urban land, have resulted in land-values that are unaffordable to large segments of urban society. Policy failures to adequately enable urban growth and expansion together with inflexible housing policies, have resulted in inadequate provision of land for city development, for infrastructure, and for building affordable and quality housing. The perception of slums as illegal settlements has often resulted in either deliberate refusal by authorities to provide basic infrastructural services, or non-consideration of informal settlements during city planning and management processes. The results are growing slum areas whose buildings and residents are particularly susceptible to harm as a result of climate change.

2.1 Conditions in informal settlements as drivers and multipliers of risk

Location: The nature and location of informal settlements means that they are often exposed to a range of climate-related hazards. Many informal settlements are on sites that experience flooding and landslides. They may be on riverbanks, floodplains, coastal zones, hill slopes or besides garbage dumps. They may be on the outskirts of towns and cities, lacking paved roads for easy access, and far from hospitals and other essential services and public transport. These sites are chosen because they are less desirable to developers, and are

therefore more affordable, as well as being adequately located for their residents to undertake income-earning activities.

Building quality: Many housing structures in informal settlements are poor quality, built of recycled materials such as cardboard, tin sheets, mud or tarpaulin, because these are the most easily accessible and affordable materials. They may lack ventilation and lighting. Where structures are built of more durable materials, such as breeze blocks and concrete, they may have additional storeys which do not conform to building regulations. Structures in informal settlements are almost always unlikely to have been built with present or future climatic problems in mind, like extended heat (and cold) periods in mind, heavy rains, nor using seismic or storm-proof designs, all considerations that would increase their resistance to climate-change and natural disaster related impacts

Tenure security: The informal nature of the majority of slums means that the residents lack formal safeguards for their housing – whether it is legal protection for their tenancies by renters, or legal documentation showing proof of ownership for owners. While residents may sometimes have the agreement of the landowner to live on that site, they remain vulnerable to eviction if the land is required for other uses, and they may be unable to use their housing as an asset to secure other benefits (such as provision of social services, or access to formal banking). This lack of legality also creates difficulties in securing provision of public infrastructure and services which may require formal documentation for eligibility. As discussed below, there are also considerable differences in the experiences of ‘renters’ and ‘owners’ in informal settlements which can affect the quality of housing and the willingness to make improvements. As a consequence of tenure insecurity, residents are deprived of a key asset and have little possibility

or incentive to invest in improving their housing to increase its resilience to climate related hazards, whether by strengthening or adapting the structure.

Basic infrastructure and service

provision: Most of those living in informal settlements rely on informal providers of public infrastructure because of a lack of supply from formal providers such as the municipality or state utilities – for instance water purchased from tankers, vendors or kiosks and pay-to-use communal toilets because they have no piped water or toilets in their home. They may have electricity from illegal grid connections, with associated fire risks, while informal waste pickers may not be able to adequately deal with the scale and types of waste generated. This often comes at a higher price than charged by formal providers of utilities, and added time cost of queuing for supplies or using communal toilets. Informal settlements frequently lack public goods such as paved roads, sewage systems, storm drains or street lighting, which would normally be provided by the municipality, or where these goods are provided, they are not adequately maintained¹⁰.

Access to food and water: Food is often the single largest expenditure for residents of informal settlements, sometimes accounting for almost half of household expenses. Lack of food storage and cooking space means that residents often rely on purchasing cooked street food, or buying food items in small quantities at higher prices. Street vendors operating within slum settlements are exposed to the same food safety hazards as their customers: limited storage facilities, inadequate water and sanitation infrastructure and lack of solid waste collection. This can cause contamination of the food, putting at risk a population

¹⁰ However, it must be recognised that in many cities in Asia and Africa, coverage of these essential infrastructures is low across the city, due to the very limited resources available to municipalities.

already susceptible to malnutrition. At the same time, inadequate diets can make residents more vulnerable to infectious diseases which arise from lack of sanitation. Within informal settlements, climate change may increase the incidence of flooding and other disasters creating conditions for infection to spread. The effects of climate change on crop production may lead to rises in food prices, further restricting the affordability of adequate food for residents of informal settlements. Residents of low-income and informal neighbourhoods that lack formal piped water, also often pay a significant premium for drinking water which is provided from kiosks or by formal vendors.

Social and financial services: The nature of informal settlements means that residents usually do not have sufficient legal proof of address to qualify for services such as banking and insurance, which may also require evidence of regular income – the nature of informal labour means this is frequently impossible. Neighbourhood-level savings groups may offer some measure of financial security but may operate with particular objectives such as prioritising loans for small businesses or school uniforms. While services such as day care and health care may be provided, this will often be by local informal providers who may not have the necessary qualifications or appropriate facilities for the job. Taken together, the situation regarding legality, physical conditions and service provision in informal settlements, has implications for the quality of life and health of local residents. The conditions also represent basic development deficits, with consequences for the adaptation deficit facing informal settlements.

Policies and city-wide strategies and development plans: Slums and informal settlements are often left out of city-wide development plans and strategies. This is partly because policies and legal frameworks are not sensitive to and

ineffective for addressing conditions in slums. Changes to building regulations with the intention of making buildings more resilient to climate impacts are unlikely to make much difference in these settlements, as most housing is constructed without any reference to these regulations. Additionally, residents of slums are frequently marginalised and may lack the capacity and time to make demands from elected representatives and municipal officials. This results in low or no prioritization of slums and informal settlements in public investment decisions, and therefore the need for integration into city development planning is not addressed.

Awareness of climate change and access to information: Very few cities have readily-available access to accurate and localized analysis of climate impacts like local changes in rainfall patterns, changes in flood risk, change in mean and extreme temperatures, so called downscaled climate modelling, and even where this exists the information may not be widely disseminated amongst urban residents. The consequence is general lack of understanding of the concrete climate changes forecasted in a specific location. While residents may be living through the impacts of climate change already as they experience more hydro-meteorological extremes, they will also need to be considered alongside every day risks faced by urban informal settlement residents such as fire or the health dangers posed by lack of sanitation. Addressing these risks may create co-benefits for climate adaptation, and making information more easily available about likely future climate impacts can help to ensure investments with co-benefits. Means of communication can include TV shows or radio programmes, as well as printed media, and integrating climate change into school curriculums to educate younger generations. Early Warning Systems that reach all residents of cities – including those in informal settlements – are also essential to reduce climate risk.

2.2 Climate Hazards in informal settlements

The section above has highlighted the pre-existing deficiencies in many informal settlements. These have consequences for the exposure to risk of the residents – with the potential for cascading impacts. For example, the lack of storm drainage combined with the lack of solid and liquid waste management can lead not only to flooding, but to the flood water being contaminated with toxins that contribute to subsequent resultant health impacts. Table 1 outlines the likely impacts from climate change on the residents of informal settlements. The pre-existing conditions in slums will often exacerbate the impacts of climate change on local populations. As demonstrated in the table, in addition to destruction of physical dwellings and infrastructure, climate impacts can manifest themselves as impacts on health, as well as affecting prices of food, water and other essentials – with serious consequences for low-income households.

Climate change impacts in slums can be exacerbated by a range of external factors. For example, the location of slums in low-lying areas means that they will often become the recipients of flood-water diverted away from other locations – such as high-income housing built upstream. Slums built on hillsides are prone to landslides arising from deforestation further uphill. Other actions at city scale, such as lack of adequate solid waste management leading to blockages of drainage systems, or badly maintained and narrow access roads limiting interventions by emergency services, can also worsen the impact in informal settlements.

Sometimes informal settlements may be more directly affected, for example by large-scale infrastructure projects to address climate risk – such as sea walls or embankments - which end up displacing communities who are evicted

to make way for construction. If this eviction is done without due process of consultation and consensus-building with the affected households, including the joint identification of suitable relocation sites which still allow affected populations to maintain their livelihoods, this can have far-reaching negative consequences for those displaced.

Table 1: Likely impacts from climate change on urban populations living in informal settlements and working in the informal economy¹¹

Projected changes	Examples of likely impacts	Implications for residents of informal settlements and people working in the informal economy	Possible measures to adapt
Higher (and increasing) average temperatures, more hot days and heat waves, fewer cold days - over nearly all land areas	Rise in mortality and illness from heat stress in many urban locations. Extended range and activity of some disease vectors – including mosquito and tick-borne diseases. Increased water and energy demand.	Many informal settlements are very dense with very little open/public space and often with uninsulated corrugated iron roofs and poor ventilation that contribute to higher indoor temperatures. Lack of public health measures to control disease vectors. Largest impacts among groups particularly vulnerable – infants and young children, the elderly, expectant mothers, those with certain chronic diseases. Health risks for outdoor workers and informal workers may not benefit from health and safety regulations.	Improved building design to maximise natural ventilation; set up locally accessible health services; provide education about measures to reduce transmission of disease and reduce risk of heatstroke/cold exposure. Investing in green space, renaturation and tree planting.
More intense precipitation events and riverine floods	Increased flood, landslide, avalanche and mud-slide damage resulting in injury and loss of life, loss of property and damage to infrastructure. Increased flood run-off often brings contamination to water supplies and outbreaks of water-borne diseases	Many informal settlements concentrated on sites most at risk of flooding with poor quality housing less able to withstand flooding and a lack of risk-reducing infrastructure. Homes, possessions and income-generating assets are not covered by any public or private insurance. Transport infrastructure damaged affected workers.	Building and infrastructure designs that incorporate flood and landslide resilience; improve drainage infrastructure locally and city flood management practices and systems; innovate to identify suitable disaster insurance products.
Wind storms with higher wind speeds	Structural damage to buildings, power and telephone lines, communication masts and other urban infrastructure	Relatively small increases in wind speeds can damage buildings, particularly as many informal settlements are composed of temporary or semi-temporary housing. Also, informal utility services are likely to be damaged or cut due to extreme wind.	Improve housing design and construction to withstand winds; improve construction and design of infrastructure.
Increased summer drying over mid-latitude continental interiors and associated risk of drought	Decreased water resource quantity and quality; decreased soil quality and risk of soil erosion; increased risk of forest/bush fire; decreased crop yields and higher food prices	Informal settlement residents usually facing more water constraints and are more vulnerable to food and water price rises.	Addressing underlying socio-economic factors which affect poverty; improve water infrastructure and affordability.
Intensified droughts and floods associated with El Niño events in many different regions	Decreased agriculture and range-land productivity in drought-prone and flood-prone regions	Impact on food availability and prices in urban areas.	Promote rooftop or urban gardening to supplement food sources. Strengthen livelihoods to increase incomes.
Sea-level rise	Coastal erosion, land loss, more floods from storm surges; hundreds of millions of urban dwellers living in low elevation coastal zones	Many informal settlements close to the sea with poor quality housing and lacking drainage infrastructure	Raise awareness of storm surges; construct protective infrastructure or explore relocation in a participatory manner.

¹¹ Taken from *Responding to climate change in cities and in their informal settlements and economies*, by David Satterthwaite, Diane Archer, Sarah Colenbrander, David Dodman, Jorgelina Hardoy and Sheela Patel, 2018, <https://citiesipcc.org/wp-content/uploads/2018/03/Informality-background-paper-for-IPCC-Cities.pdf>

2.3 Differentiated vulnerability

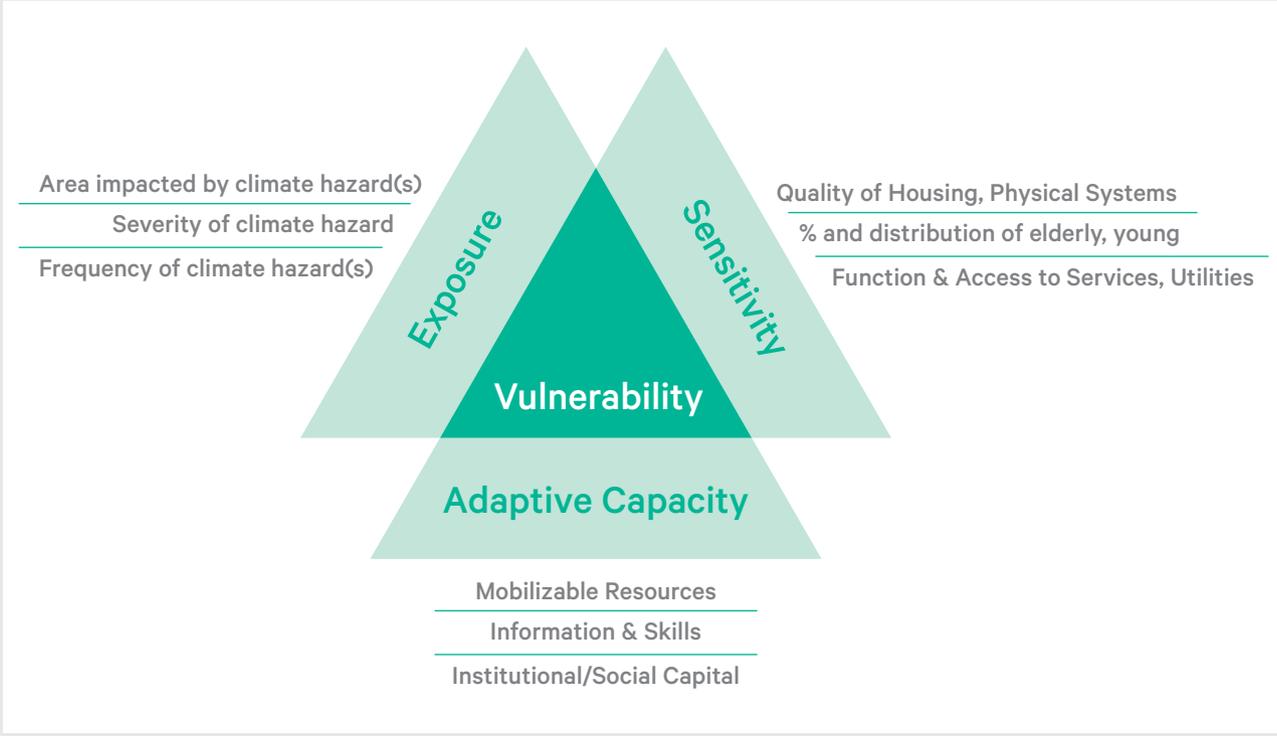
Table 1 outlines how residents of informal settlements may feel the impacts of climate change – and different population groups within informal settlements may be affected in different ways. It is important to recognise that the residents of informal settlements are not heterogenous. This applies both to households across a settlement, and within a household.

Within a household, age, (dis)ability and health, and gender, are major determining factors of how vulnerable a person will be to a specific climatic impact. For example, children and the elderly tend

to be more sensitive to prolonged periods of extreme heat. The disabled may be at special risk in the face of hazards that might require evacuation, such as flooding – if not aided when pathways are muddy or full of obstacles. Persons with chronic illnesses may be vulnerable to vector-borne or parasitic diseases which arise during floods. Gender may be relevant if cultural norms mean that women are expected to carry the burden of domestic and caring duties – this may mean that in the event of drought, they spend a greater portion of their time queueing for water, or more time cleaning up after floods. Gender also intersects with other factors such as age and disability and can compound vulnerability.

BOX 3

Factors shaping vulnerability (source: Climate change, vulnerability and risk: A guide for community assessments and action planning, UN-Habitat.



Understanding climate and disaster vulnerability at a community level requires an approach that looks at both the physical dimensions (external hazards and risks, as well as community infrastructure and material resources) and social dimensions (internal susceptibility and coping capacity of different groups) of vulnerability. Consequently, vulnerability is best understood as an aggregation of three components: exposure; sensitivity; and adaptive capacity. High levels of exposure and sensitivity equate to higher levels of vulnerability, with adaptive capacity counteracting the former attributes.

The vulnerability framework graphic (Figure 1) is simplified illustration of how vulnerability is a function of exposure to climate change, sensitivity to its impacts and adaptive capacity. Written as a basic formula, Vulnerability = (Exposure + Sensitivity) – Adaptive Capacity. As illustrated, where the two triangles representing exposure and sensitivity overlap creates vulnerability. While the ability of national and local actor to influence the exposure to climate change might be limited, they can sensitivity and increase adaptive capacity thus reducing overall vulnerability. The graphic is for illustrative purposes only and variations exist utilizing other terminology, the basic concept is always the same. There are many possible scenarios with both exposure and sensitivity (e.g. high exposure-limited sensitivity; limited exposure-high sensitivity), and adaptive capacity.

It is also important to distinguish between structure owners and tenants within a slum. Given the informal nature of the settlement, tenants may have very little security of tenure and lack the necessary bargaining power to ensure that their landlords make necessary repairs or upgrades to the housing in the face of hazards. Structure owners may be more willing to invest in improving their own housing, though the level of investment will be determined by the risk of eviction in that particular settlement – if there are no (formal or informal) agreements to allow them to stay on site, their willingness to invest in housing that could be taken away from them may be lower.

Income levels and security of livelihoods will also differ markedly across the residents in a slum. Those who work as day-to-day labourers will have less reliable income flows than those who have regular jobs in the formal sector or at-home enterprises. Food vendors and their businesses may be affected by fluctuations in prices during times of drought or flooding. Structure owners with multiple properties which they rent out may be relatively well-off compared to their tenants.

At the same time, factors such as social capital, education levels and access to information will affect the ability of individuals and households to manage the impacts of climate change. Membership of groups such as women's groups, savings groups or youth clubs can expose residents to more information in advance of climatic impacts, so they can better prepare themselves, whilst these social networks can also provide support in the face of hazards. More educated members of a settlement can access news reports, weather forecasts and information about preparation more easily.

As discussed in more detail below, slums are sites of informal employment, ranging from home-based piece work to micro-

enterprises such as corner shops or repair shops – however, these informal businesses will not be protected through private sector insurance products, putting their employees and owners at risk of financial loss in case of flooding or other disasters. Similarly, informal economy workers are unlikely to benefit from work healthcare or social security packages and have limited job security compared to workers in the formal sector, making them vulnerable to sudden loss of income if they fall ill or are unable to travel to work due to climate-related hazards. Traders or

vendors who rely on infrastructure such as piped water or electricity to run their business may see their trade negatively affected if these infrastructures are damaged due to climatic impacts – while drought may push up the price of water. Home-based workers or owners of home-based enterprises whose homes are affected by climate impacts may lose not only their home (which is most likely not covered by disaster insurance) but also their means of earning an income – and women more frequently fall into this category.

CASE STUDY

Informality and Risk in Montego Bay, Jamaica

The informal settlements lining the North Gully in Montego Bay demonstrate many of the ways in which conditions in informal settlements can be drivers of risk. The channel for this gully, which runs from the hills above the city into the Montego Bay Marine Park, is partly lined with concrete and in sections is choked with household and commercial waste. Many of the neighbourhoods along its length are accessible only by narrow footpaths, limiting formal house-to-house collection of solid waste. While many of the houses are built of wooden boards which are susceptible to fires, the area's residents have been reluctant to move elsewhere because of the proximity of livelihood opportunities generated by Jamaica's tourism industry.

A flood in November 2017, partly caused due to massive overflow of the gully, inundated the central business district of Montego Bay, destroying many homes and small businesses, and the city's economy came to a halt for several weeks. Reducing climate-related risk in the city will require improving the provision of services (including solid waste management), providing adequate housing on land that is both safe and conveniently located, and improving the structure of the gully itself. UN-Habitat has been working with the St James Municipal Corporation (the local government authority with responsibility for Montego Bay) to better understand these drivers of risk, and to support the Municipal Corporation in developing plans to reduce them. This will require strong engagement by the national government, supported by international organisations. It will also need to draw on the resources and understanding of civil society groups that have long been active in the city.



Thus, it is clear that residents of low-income and informal settlements are not a homogenous group, and their vulnerability to the impacts of climate change will be determined by social and political factors including income, education, social capital, by physical factors such as age and health, and cultural factors such as gender norms. They have different assets available, as well as different capacities to adapt to climate change. These differences will determine in which ways their resilience needs to be built, and how this can be achieved – through individual or communal action, or state-led interventions, to address different drivers of vulnerability. This is the kind of information which can be gathered

through a detailed, community-level vulnerability assessment, as well as through processes such as enumerations and mappings of settlements.

2.4 Data needs for understanding climate-related risk

There are a number of different methods that can and have been applied to gather the necessary data to assess vulnerability of individuals and settlements and plan a course of action in response to this. It is important to have a detailed, in-depth and nuanced understanding both of physical conditions and of the differentiated vulnerability within an informal settlement in order for the planned interventions to be feasible and to directly target the drivers of vulnerability.

Table 2: Data for understanding risk

Type of data	Possible sources	For what, to understand what	To do what
Demographic data	Census Demographic and Health Surveys	Changing size and composition of population	Identify particular groups that may be growing in size that are particularly vulnerable
Economic data	National economic and employment surveys Community surveys	Underlying socio-economic drivers of vulnerability	Identify locations and people with lower levels of adaptive capacity
Spatial data	Spatial plans Remote sensing data	Physical locations exposed to climate-related hazards	Develop spatially appropriate responses for investment in risk-reducing infrastructure
Climate data	IPCC and other assessments	Changing patterns of weather that are likely to generate future risk	Make long-term decisions that are more climate resilient



Membership of groups such as women's groups, savings groups or youth clubs can expose residents to more information in advance of climatic impacts, so they can better prepare themselves, whilst these social networks can also provide support in the face of hazards.

CASE STUDY

Participatory Data Collection in Fiji

During the analysis and urban profiling after the devastating effects of cyclone Winston in April 2016, the heightened vulnerability of informal settlements to climate change became evident, as the majority of affected households resided in those areas. As a consequence, the Fiji government invested in understanding and addressing the problem. A comprehensive situational analysis and mapping exercise was rolled out to all urban areas. The goal was to map, capture socio-economic data in order to better plan interventions. Another goal was to broaden the partnership between the government and civil society groups working in informal settlement contexts beyond implementation of projects. Especially helpful was the strategic partnership with the People's Community Network (PCN¹²) whose established community network and knowledge was particularly helpful during the mapping and settlement analysis.

Valuable lessons were learned from the many households that are already trying to adapt to climate effects by changing building methods to avoid the property damage associated with the regular floods, such as stilted 'safe houses' to protect household goods and occupants at times of flooding. Another lesson is the local mapping of the functioning of infrastructure. Flooding is a climate impact but the problem is exacerbated by inadequate maintained infrastructure, and the garbage and vegetation in drainage canals and inadequate culverts are a major factor reducing the capacity of 'adaptation' infrastructure.

¹² <https://pcnfiji.wordpress.com/>

In order to take physical measures to address the impact of climate change on a whole settlement, it is vital to have up-to-date maps of the settlement layout. This is a document which may not previously exist and will need to be created. The map can plot the dwellings, as well as existing infrastructure and services such as water points, communal toilets, health facilities, access roads, as well as other features such as rivers or train lines. This settlement map can be the starting point for a hazard map, which considers potential sources of hazards and maps the impacts of

previous events – such as heights of floodwaters and areas affected, or potential landslide zones.

The mapping of the settlement offers the opportunity to also carry out an enumeration – that is, identifying the number of residents in household, their age, gender, and other demographic characteristics. Participatory and community-led data collection has proven to be very efficient in the context of slum upgrading, for example providing the necessary evidence to negotiate for investments in their settlements.

There are a number of methods for carrying out mapping processes and they present opportunities for local residents to get involved in the process. GPS technologies can be used, to supplement satellite imagery, and these can be triangulated with hand-drawn maps created with the involvement of local residents, including qualitative data such as historical narratives of past events. The integration of local knowledge with scientific and technical knowledge offers the opportunity to improve climate change resilience of the slums.

CASE STUDY

Participatory Flood Risk Mapping in Gorakhpur, India

Local residents worked with the Gorakhpur Environmental Action Group (GEAG), a local NGO, to prepare a flood risk map. The NGO provided printed Google satellite imagery, and used GPS technology to gather 120 waypoints for the entire ward (covering 2.5 square kilometres). This was alongside a semi-structured questionnaire filled by residents at each way point. Residents' historical memories of past floods, and the impacts of these events, including depth and duration of water-logging, were gathered. The different types of data gathered were overlaid to produce a hazard map, showing the magnitude of flood risk, the extent of the exposure of vulnerable groups, and the threshold value between a hazard and a disaster. This has been used primarily to sensitise residents to the range of threats associated with climate change, but has the potential to help guide decisions that people make about where to locate their homes.



White River, Honiara, Solomon Islands © UN-Habitat/Bernhard Barth





3

INFORMALITY AND **CLIMATE RESILIENCE**

Resilience-building requires a multi-pronged approach which addresses not just physical conditions, but also social, economic and political capacities. External factors will play a role in determining the extent to which households are exposed to hazards – such as their location near hillsides which are being deforested, or large infrastructure projects elsewhere in the city which may displace certain hazards towards informal settlements.

In this chapter, the concept of climate resilience and how it can be built in informal settlements is considered in detail. This involves firstly recognising the different components of resilience, beyond physical resilience to also consider social, economic and political dimensions of individuals, households and communities which shape their resilience to climate-change related shocks and stresses. It will then examine some of the different ways in which this climate resilience can be built, in particular through processes of upgrading slums, in order to address development deficits alongside climate change risks.

Slum upgrading consists of the improvement to housing and infrastructure *in situ*, usually through a participatory process where local residents play an active part in planning, designing and implementing the upgrading. It can range from improving an element of infrastructure such as drainage systems or water supply, to partial re-alignment of the site layout (for example to widen access roads) which may mean some homes get re-built, to complete demolition of the site and reconstruction *in situ* of new homes and infrastructure.

While upgrading has rarely been done explicitly to build resilience to climate change, it can incorporate modifications or improvements to address the risks that climate change is exacerbating. Many elements of upgrading overlap with what is necessary for climate resilience: better quality housing, appropriate sanitation, piped water and storm drainage systems, reliable electricity supplies and solid waste management systems, and paved roads and footpaths. Upgrading is therefore an entry point for mainstreaming climate change resilience into the process. At the same time, discussions about climate change may provide the necessary trigger to implement upgrading within the informal settlement.

BOX 4

Informal work and risk

There is a considerable overlap between being poor and vulnerable, and working and operating in, as a means of survival in the face of limited formal opportunities. The informal economy covers enterprises, workers and activities operating outside legal regulatory frameworks. There is a great variation in the informal economy, ranging from unincorporated small and micro enterprises to informal employment as domestic workers, transport workers such as motorbike drivers, to low-end service occupations like cleaning and gardening. Informal employment means workers will not have formal payslips or work contracts which will limit their ability to access housing finance or secure rentals, with the consequence that informal housing is the only option available.

The informal economy can be demarcated by three legal aspects: legality regarding payment of taxes; legal recognition as a business activity, such as registration; and legality with respect to labour matters such as social security contributions. This means that those operating in the informal economy often face legal issues and may be viewed negatively by authorities. For example, street vendors may be barred from hawking their wares, and municipal authorities may be clamping down on street markets in favour of regulated food courts.

The urban informal economy is growing particularly rapidly where formal economic growth has not kept up with urban population growth. Generally, the higher the country's GDP, the lower the percentage of informal employment within the total non-agricultural labour force. Estimates from the World Bank between 1997-2009 show that the share of GDP coming from the informal economy was 38.4 per cent in sub-Saharan Africa, 36.5 per cent in Central Asia and Europe, compared to 13.5 per cent in high income countries¹³ – though the undocumented nature of the informal economy makes this hard to estimate accurately. The informal economy is likely to grow in response to global and national economic crises, and with the increasing feminisation of the workforce, as women increasingly shift into paid work. Access to livelihood opportunities in the informal economy is therefore a vital part of an individual and household's resilience.

Measures of the informal economy focus on income-generating activities, thus excluding the unpaid informal household care economy, in which women are more likely to operate. However, women are also more likely to find employment in the informal economy than men (see Figure 2) – it can offer more flexible and lower-skilled work opportunities, such as home-based piece work or street vending, and can be used to supplement income. This may mean that women are less able to seek shelter elsewhere in the face of climate-related hazards, or more likely to be adversely impacted by an event that affects their home – as many homes double as businesses, the effects of loss are compounded.



¹³ Schneider et al. 2010

3.1 Components of resilience – beyond the physical

Returning to the definition of resilience as “the capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation”, the concept can also be applied to individuals and households, as well as settlements. The resilience of individuals and households depends on a number of factors, including social, economic, political as well as physical factors. In order to build resilience, it is necessary to address each of these areas. While physical resilience may be the most straight-forward in terms of interventions, there are ways this can be built while also strengthening social, economic and political factors.

As resilience requires a capacity to adapt, learn and transform, it is a forward-looking concept. Therefore, the economic resilience of an individual or household is a vital determining factor. Does a person have savings to draw on in case of a disaster or loss of a job? Do they earn a regular income? Do they work in the formal or informal economy? How many dependents are there in the household? Can they access health insurance or home insurance? These are all factors which will determine the ability of a person or household to prepare for a shock, for example by investing in their housing, to respond to a shock and move on.

The social aspect of climate change resilience is also related to awareness and education. Resilience improves significantly in a context where the population is aware of, and understands the risks, its likely impacts and the actions necessary in such unexpected cases. One of the priorities shall therefore be not only to minimize or absorb an uncertain climate risk, but to prepare people for its likely occurrence.

BOX 5

The importance of participation and collective approaches

Residents of informal settlements and those who work in the informal sector may lack recognition by the formal legal and political systems, resulting in marginalisation which can deepen vulnerability against climate change. While many development projects claim to have employed participatory approaches, often this has been a somewhat limited form of consultations. However, meaningful mobilisation of populations towards collective, participatory approaches can help to counter political and legal disempowerment – for example through community-based organisations or other civil society organisations which provide strength in numbers. This puts members in a better position to negotiate and participate in decision-making with authorities, for example by providing inputs into development plans and contributing information gathered through enumerations and mapping processes. Collective approaches can allow different voices to have a say in decision-making for a more bottom-up, inclusive process that can better meet local needs.

Collective processes can be essential to physical resilience, through identification of priority areas for action. Upgrading of shared infrastructure such as drainage systems or roads requires the willingness of affected households to enable this – and in many cases the construction work can be done by residents themselves, at lower cost and more quickly than through contractors. The social cohesion arising from such movements is another vital element of social resilience by providing individuals and households with support networks to draw on in case of need. Participatory approaches can also be cost-effective – for example, the costs to households of individualised sanitation solutions such as septic tanks far exceed the costs of a sewer connection. At the same time, a single household improving their sanitation will not reduce health risks across the settlement unlike a networked sewage system as a public good.

However, the heterogenous nature of informal settlements means that certain voices may be more prominent than others – for example landlords and structure owners compared to tenants, who may be transient and have less incentive to engage in collective processes. Certain actors who control resources such as water points may leverage more power. For participatory approaches to be meaningful, they also need to ensure that the different perspectives of priorities of women and men, and of people of different ages, are adequately identified and acted upon.

Addressing settlement-level power imbalances is an important part of building social cohesion and thus resilience as well. Indeed, the latest IPCC Special Report concludes that addressing climate change will require governance that goes beyond notions of formal government or political authority, and integrates other actors including informal institutions and communities¹⁴.



Similarly, social norms are very important. Does a person belong to a community organisation, savings group or other social network, which could provide support in the event of a shock or stress? Ethnicity, gender, migrant status and other social and cultural factors may lead to certain population groups being marginalised and thus in a worse position for adapting to shocks. Political voice and participation is another key area to consider. The residents of informal settlements are often marginalised, and may lack voting power due to their informal living situation – and as a result will lack bargaining power when it comes to ensuring that their needs are prioritised by political and government actors. On the other hand, they may be used as pawns by politicians seeking votes by making promises which are not kept. If residents are politically empowered, including through processes of data collection as highlighted in section 2, this gives them power to negotiate for investments in their settlements.

3.2 Community-led initiatives for climate resilience

Resilience-building requires a multi-pronged approach which addresses not just physical conditions, but also social, economic and political capacities. External factors will play a role in determining the extent to which households are exposed to hazards – such as their location near hillsides which are being deforested, or large infrastructure projects elsewhere in the city which may displace certain hazards towards informal settlements. Upgrading housing and infrastructure to protect against such factors will be one way of limiting the impacts, particularly by taking in to account future climate change. Approaches such as ecosystem-based adaptation and community-based adaptation can also build on the existing assets and capacities in low-income settlements to build their resilience. In all approaches, it is also helpful to recognise

that measures at the individual, household and community level can be taken in the short-term to improve coping and adaptive capacity in response to immediate shocks and stresses, while a longer-term approach requires a citywide view, where participation and collaboration with local authorities in upgrading of settlements and integrated planning can ensure durable and forward-looking solutions to addressing development deficits with future climate impacts in mind.

3.2.1 Upgrading to more resilient housing in informal settlements

We have already seen that the poor quality of housing in informal settlements is a key factor driving the vulnerability of local residents to climate hazards, especially flooding, heat and wind – and therefore improving housing should be a key area of intervention in order 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 will be limited by a number of 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 most, 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. Even then, there are limits to what can be done by households.

In many cases, households already make use of various adaptation measures, or rather ‘coping’ mechanisms in the face of experienced climatic hazards – simple changes of behaviour such as storing their valuable assets and groceries in a raised loft or on top of furniture, and moving temporarily to safer locations. Examples of adaptation measures in individual homes, requiring more investment and a longer-term view, include building flood barriers at door thresholds, raising the plinth of homes, structural reinforcements, or having electrical and other utility connections on the second floor. Thus, retrofitting with adaptation measures is possible, though in most cases, households are more likely to invest their little resources if some form of tenure continuity exists, and therefore underlying socio-economical and socio-political factors are critical for enabling the application of climate-resilient housing improvements. Many households may adopt an incremental approach to improvements.

To avoid waste of scarce household resources, maladaptation in housing design and ensure most effective use of public resources, available climate science and related models applicable



To avoid waste of scarce household resources, maladaptation in housing design and ensure most effective use of public resources, available climate science and related models applicable to the geographic area should be made easily accessible to communities and households.

BOX 6

Savings processes that organise communities

Collective processes in low income settlements are often facilitated through the process of community savings. In many cases these act as 'piggy banks' as many members lack the necessary documentation to open formal bank accounts. However, the savings groups may grow in scale to the extent that they act as revolving loan funds, providing loans to members for livelihood activities, educational expenses or house repairs, for example – with loans collectively agreed on and managed. Increasingly, savings groups are federating, expanding the perspectives of members beyond individual needs to addressing communal needs, at the level of the settlement and the city, such as infrastructure needs. These federated savings groups can also leverage additional external resources from local authorities or donors, expanding the scale of action, for example to housing and infrastructure upgrading programs. These collective actions facilitate the beginning of negotiations with land owners and local authorities, changing relationships at the city scale. Savings groups leaders and members are often women, who develop their leadership skills and become empowered to take on further leadership roles within the community and ensure women's priorities are met. The enhanced ability of residents of low-income neighbourhoods to save and to manage funds is an important way of building their adaptive capacity through providing finance to implement risk-reducing measures in individual households and in neighbourhoods. The savings that are generated can also help individuals and households to respond more effectively when faced with unexpected shocks, including those associated with climate change.

to the geographic area should be made easily accessible to communities and households. Expert input by architects or engineers may be necessary, but designs should be developed in a responsive and consultative manner to ensure that local needs are incorporated, in order to maximise take-up. Architects and engineers should also be aware of climate projections to incorporate these in their designs, which may require professional training to build their understanding of local climate risks and interpretation of projections. Building and construction experts, architects and other professional disciplines must be sensitized to working in a participatory manner with local communities.

In informal settlements, a significant portion of construction is also carried out by individual households themselves, here community groups and civil society leaders must be sensitized to this crucial element in promoting the spread of resilient building techniques. These efforts combined can be considered essential in developing affordable and resilient designs in response to community needs, making use of

traditional building techniques, design elements, and local materials where appropriate. Some communities refer to such professionals as 'community architects', and evidence suggests such profiles play a role in combining the physical and social aspects of housing and neighbourhood design, with positive benefits for the wider dissemination of information on climate risks and for an inclusive discussion on the integration of climate considerations into housing designs and site layouts.

3.2.2 Upgrading infrastructure for more climate resilient informal settlements

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. This is due to a combination of factors, many of those settlements are not served by national, municipal or private suppliers, are outside of, or not considered by, city-wide infrastructure planning and development projects. Simply increasing the coverage of these essential services like water, energy, sanitation, waste disposal, transportation and

thus access to education, jobs, health and other, or telecommunication will improve the adaptive capacities of the communities and reduce the impact of climatic hazards. Priority shall be placed by improving coverage of, or access whether they are provided by municipal authorities, utility companies, private sector suppliers or the community residents themselves.

Public investment is needed in climate change adaptation relevant infrastructure. These investments must be planned, designed and constructed to withstand current, but more importantly future projected climate hazards, which requires long-term thinking, appropriate technical knowledge, and access to downscaled climate information and data. Whether it is the dimensioning of pipes and drains, demand and supply modelling, accounting for increasing or decreasing water levels of oceans or rivers, infrastructure build in the coming years will need to consider the climate conditions of the next 30-50 years, not an entirely unusual lifespan of some of even the most basic infrastructures as road drainage, bridges, promenades and sewage-pipes. Certain existing infrastructures need upgrading and re-dimensioning, and some more community-scale infrastructures are in need of connecting to city-wide systems or trunk infrastructures (if these exist) – and therefore require not only technical solutions, but also new collaborative approaches between local communities, suppliers, municipalities and national utilities working towards integration. Such collaborative approaches benefit everyone, as for example informal communities benefit from improved access to basic services, and society at large profits from the improved resilience of infrastructure systems as some key infrastructures run through, or have critical elements in or near informal areas, for example transport networks (Airports, Railways, Ports) energy and water distribution lines.

Infrastructure and services are at the core of climate-proofing informal settlements. Certain types of additional larger-scale infrastructure may be required to build climate resilience against specific climatic hazards – such as seawalls or retaining walls. However, investments in these should also integrate present and future climate risks and spatial vulnerabilities from the outset in order to ensure that risk of maladaptation are minimized, for example by displacing flood waters from one area of the settlement to another, or from the settlement to other areas of the city. Oftentimes due to the socio-political realities, such balancing decisions tend to negatively affect informal areas therefore setting back any meaning full resilience-building efforts. Such a balancing can be done through building partnerships with knowledge institutions such as universities, broader community engagement, and by having a clear understanding of the spatial components of climate impacts.

Questions of formality and informality, regularization of land and security of tenure will play a role in determining to what extent upgrading of hard infrastructure can take place, as for example private sector utilities and individuals need investment security, the public sector actors needs to comply with all regulations, and the willingness by community residents to pool their resources to invest in collective infrastructure depends on medium- to long term planning and decision making.

Last but not least, the positive externalities from infrastructure yield significant development co-benefits, and development benefits yield significant climate benefits. Improved access roads, while maybe not a priority evaluated through a climate-lens, may significantly improve evacuation routes and capacities of informal communities prior to disasters, and significantly improve the

access to health-care facilities, energy, housing, economic opportunities that with time result in the improvement of individual dwellings. Likewise, better drainage will reduce flood-risk, but may also yield positive benefits for sanitation and waste-water disposal, the restoration of ecosystems at vulnerable coastlines may unexpectedly yield economic opportunities. Oftentimes dense urban communities are through to cluster various challenges, but we often tend to forget the compactness also yields significant positive externalities with each interventions.

3.2.3 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 using 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. At the same time, they may inadvertently contribute to environmental degradation, due to reliance on charcoal for fuel or through the absence of appropriate sewage or solid waste management systems. They may therefore be more exposed to hazards such as flooding and landslides and suffer the consequences of environmental degradation, such as pollution of water sources, or conversion of natural areas into parks or recreation grounds which they may be excluded from.

However, 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 take ecosystem services and ecosystem-based adaptation (EBA) into account. 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, as well as the social and health benefits of having green space.

More broadly, EBA can consist of measures such as revitalisation of natural resources like water bodies, through garbage collection, filtering and cleaning of liquid waste before discharge, and planting reeds and other water-based plants to help clean the water. This can have additional benefits by creating a food source if edible plants are grown, and fish are revived. Similar approaches can be used to re-forest hillsides to prevent soil erosion and landslides. EBA thus offers opportunities to improve the well-being of the local residents as well as those of the city more widely, as well as creating co-benefits for livelihoods and health.

There is a growing number of examples showing these types of approaches in practice. In Manizales, Colombia, women have been employed as ‘slope guardians’ to maintain hillside slopes with plantations to prevent landslides. In Durban, South Africa, low-income households have become ‘treepreneurs’ growing seedlings for a municipal reforestation project, in exchange for schooling credits for their children, whilst others have been employed by the municipality in peri-urban areas in invasive alien plant control. In Surabaya, Indonesia, informal houses which encroached on rivers were voluntary moved back by residents to make way for a riverside path to facilitate dredging of the river by the municipality, improving the local environmental and reducing flood risk.

3.3 Supporting community capacities

For a high proportion of the households that live in informal urban settlements, household and community-based coping and adaptation is their only means of responding to risk. Residents of informal settlements have frequently demonstrated their capacity to adapt to their often-challenging living conditions. It is worth considering what assets and capacities individuals and households in informal settlements have in order to do so, and how these can be harnessed and

strengthened to deal with shocks and stresses (Table 3). However, even with these assets and capacities, the scale of the interventions will still be limited. They could be strengthened and broadened with the support of external actors – there is therefore an important role for government agencies (both national and sub-national) and NGOs and technical professionals to play, working with the communities, not just *for* them. Residents of informal settlements should not be expected to be able to address all risks themselves to a sufficient level.

Community-based adaptation (CBA) is one mechanism which can support community capacities to cope and adapt. CBA will be more effective if residents have community ownership of the process and the design – which also depends on the representativeness and inclusiveness of community leaders and their management capacity, and that of community organisations.

Community-based adaptation consists of initiatives that strengthen the capacity of local people to adapt to the identified impacts of climate change, including through creating adaptation strategies in a participatory manner. Community-based adaptation therefore has the potential to emerge naturally in settlements which already have collective initiatives to address development deficits, whether at the level of enumerations and mapping, or implementation of physical upgrading projects. The tools used in community upgrading processes can be supplemented with a climate change perspective for community-based adaptation – such as mapping climate hazards, transect walks, and historical narratives from community elders who may have experiences past climatic events. However, community-based adaptation requires a recognition from community members that climate change is a threat to be integrated into development concerns.

Community-based adaptation is a tested approach that may offer part of the solution. As the IPCC reports, “For a high proportion of households that live in informal urban settlements, household and community-based adaptation [to climate change] is their only means of responding to risk”. This approach can yield “important near-term adaptations”. However the IPCC authors go on to caution against relying exclusively on such approaches. As they point out: “Community-based responses

Table 3: Household and community assets and capacities that can be harnessed for resilience-building

Assets	How assets are used
Motorbike/bicycle	Transport to/from place of work; can be source of income, mobility, evacuation in disasters
Housing	Can be workplace and living place; if constructed appropriately in safe location can reduce risk from hazards.
Job skills	Livelihood opportunities that can strengthen adaptive capacity through increasing ability to invest in housing and risk reduction.
Solid waste	Can be source of income through recycling while simultaneously reducing risks from flooding (through blocked drains etc)
Social networks	Provide support during and after a shock; organize to upgrade housing and infrastructure; negotiate with authorities
Savings	Savings groups can provide loans for livelihoods, house repair; data collected by these groups can enable response to climate-related shocks
Capacities	How capacities are used
Collective capacity to organize (e.g. around savings processes)	To build social capital; to generate community assets for resilience or wider collective good, sensitization for climate change.
Community data (e.g. from enumerations and mapping)	Data generated can help in planning for resilience and responding to shocks and stresses.
Collective capacity to negotiate	To work with authorities for settlement upgrading.
Knowledge	Residents of low-income neighbourhoods often have significant knowledge of the particular threats that they face, which can ensure responses are contextually appropriate.
Collective labour	Skills and labour can be used to implement resilience infrastructure maintenance and/or upgrading when materials and specific expertise are provided from elsewhere.

are often reactive, addressing current more than future risks.... There are limits to what community action can do in urban areas. For instance, communities may build and maintain local water sources and toilets... or improve drainage..., but they cannot provide the network infrastructure on which these depend..., nor can they improve city-region governance” (IPCC).

As with all community-based approaches, flexibility is required to adjust the methods, tools and interventions to the needs, priorities and social contexts in each settlement. Informal settlements have heterogenous populations and it may not be possible to get all residents involved in community processes or committing their already scarce time or funds to collective upgrading initiatives, particularly if security of tenure is uncertain or if certain residents are tenants rather than structure owners.

3.4 Working with local communities for inclusive cities

Building the resilience of informal settlements requires a long-term approach, addressing not just physical adaptation to climate change, but also the social, political and economic elements of resilience. The effectiveness of community-based action to build resilience will therefore depend on the support and partnership of external stakeholders. It will also depend on the relation between community organisations and local government, and the capacity of community organisations to push for structural changes in the governance of cities – an underlying driver of vulnerability in informal settlements is their lack of recognition and legal status which means that they may be deprived of the services and investments which other residents of the city may be entitled to, leaving them politically and socially marginalised. But climate change adaptation planning presents an opportunity to redress this balance, through meaningful engagement between community actors and state actors.



Building the resilience of informal settlements requires a long-term approach, addressing not just physical adaptation to climate change, but also the social, political and economic elements of resilience. The effectiveness of community-based action to build resilience will therefore depend on the support and partnership of external stakeholders.

There are many examples of community organisations working collaboratively with local governments to address deficits in infrastructure and basic services and to improve housing through co-production. There is therefore the opportunity to integrate climate change adaptation into these initiatives. The more that informal settlements are recognised by municipalities as a legitimate and valuable part of the city, the more likely it is that they will be integrated into investments to build citywide climate change resilience, through improved access to infrastructure and basic services – and thus address some of the challenges imposed by their informal status. City authorities which commit to embracing ‘cities for all’ as targeted by the New Urban Agenda should ensure that cities and towns are planned, designed, financed, developed, governed and managed in an inclusive way.

Involvement by city-level stakeholders in community-led processes from an early stage, such as initial hazard mapping, can help to demonstrate to the external actors the importance of engaging informal settlers in city-level processes of adaptation planning as well as providing more instrumental benefits that arise from the inclusion of their knowledge. Integrating the risks faced by informal settlements into citywide processes of risk assessment and climate change adaptation planning, as well as city development planning,

will produce benefits on all sides for the long-term inclusiveness and sustainable development of the city – with local residents able to contribute their local knowledge and skills to the process.

While certain initiatives for city resilience will need to be decided on and implemented by government actors, particularly large-scale infrastructure programmes, ensuring the process of design is based on meaningful involvement of residents is essential to ensuring that negative effects on local informal settlements are minimised. The planning process can help to foster trust between all actors. Ultimately however, an essential component of resilience-building remains addressing fundamental gaps in infrastructure and service provision.

Local governments can also support community action in other ways. They can facilitate dissemination of the necessary scientific and technical knowledge for appropriate adaptation of housing and infrastructure. They may provide financial mechanisms to enable take-up of certain technologies, such as subsidies or micro-credit.

3.5 Addressing the barriers to building resilience

While the sections above have outlined what is already being and can be done by local residents of informal settlements, individually or collectively, or working with local governments, to build resilience

to the impacts of climate change, it is important to address some of the barriers they may face in this process.

The first barrier is a **spatial barrier** or one of scale: recognising that informal settlements do not exist in isolation of the city around them, and actions taken at the city-wide level may have positive or negative consequences for their resilience. For example, local residents may be able to put in their own infrastructure such as paved roads, piped water mains, sewer and storm drainage systems, but these need to be integrated to trunk infrastructure systems, which they cannot provide themselves. There are responsibilities which lie outside informal settlements, with the municipality and national utilities, which can contribute to the resilience of a settlement. The way in which land use is managed in a watershed area will affect the flood risk facing informal settlements, as will city development plans which determine where infrastructure developments take place.

The political barrier includes national and local acknowledgement of the realities of informal urban development. Policies and bye-laws that play a significant role in enabling or hampering resilience building at a local level. Many regulations, such as 'no build' zones leading to eviction or resettlement, may not consider why people have chosen to settle in a particular area despite the risks it may pose, such as along a riverbank. Resettlement which doesn't take into account these many factors – accessibility to jobs, healthcare, schools, existing social networks – risks further eroding the resilience of households.

Building codes are often unsuited to conditions in informal settlements, where affordability constraints mean minimum floor areas make housing unaffordable, and minimum road widths are impossible due to the density of settlements. There are opportunities for bye-laws to allow

exceptions in certain areas, with mitigating measures – such as smaller minimum road widths, as long as fire carts instead of fire engines are available, or smaller minimum floor areas that encompass certain safety requirements such as improved ventilation. By ensuring appropriate building codes, housing can remain affordable to residents and foster resilience.

Financial considerations can be a significant **economic barrier** to resilience – investments in housing and infrastructure come at high cost. Access to financial products, including a bank account, remains out of reach for many living and working in the informal sector. However, savings groups are a route to tackling poverty and marginalisation, acting as a financial service ranging from bank account to provider of loans, while also strengthening financial management capacities among local residents. The resilience of individual households will depend also on the economic opportunities that are available to them. Thus, accessibility to other parts of the city is a vital consideration – and this may require city-level measures such as extending affordable public transport to informal settlements, and adequate access roads similar to more other neighbourhoods. It is also important to recognise that many livelihoods are home-based, and thus ensuring that physical structures of homes are resilient can help people continue to earn an income rapidly after a shock.

Finally, it is important that there is no one-size-fits-all solution in informal settlements, given their inherent heterogeneity and diversity. Tenants and structure owners, men and women, children and adults and the elderly, the chronically ill and the disabled, will all have different priorities in terms of the needs that need to be addressed in order to build their resilience. Tenants in informal settlements will have little scope to make structural alterations to their housing, whilst structure owners may be reluctant to make substantial investments in their home if security of tenure remains uncertain, with the risk of eviction and their home being lost.

Women may be more likely to be employed in home-based industries, and thus the resilience of their home will also be vital to their economic resilience. Women may also hold the share of domestic duties, and if essential infrastructure such as water supply is damaged, they may need to spend a greater portion of their time sourcing water. Able-bodied adults may have very different needs to the elderly, children, or the chronically ill, who may be particularly at risk from extremes in temperature, and thus adaptation priorities for their home may be different. These are all important and relevant aspects which need to be identified through detailed processes of risk mapping and vulnerability assessment, informed by local knowledge, and taken into account in a participatory planning process.



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3.6 Financing resilience for informal settlements

Integrating climate goals – whether mitigation or adaptation – into informal settlement upgrading is likely to require additional funding. Ensuring that low-income neighbourhoods can cope not only with current climate shocks and stresses, but with those anticipated as a result of climate change, will require investment in upgrading of existing, and additional risk-reducing infrastructure, either new types of infrastructure, or infrastructure that is designed to withstand greater pressures. This may include additional costs for all-weather footpaths and roads, coastal protection whether ‘hard infrastructure’ or ‘green infrastructure’, or drainage. Individual homes will also need to be able to cope with issues including heatwaves and more severe weather events. These incremental costs should not have to be borne by the residents of low-income and informal neighbourhoods, as they have been caused by a process to which they have contributed very little.

Because the needs are directly linked to climate change, it is appropriate for these costs to be met by climate finance. Possible sources for this funding include domestic public funds, international public funds (i.e. from bilateral and multilateral agencies) or private finance. Long-term, low-cost finance will be key to support the investments needed. Informal settlement upgrading could also be integrated into larger financing proposals by municipalities, provinces or countries.

To date, however, climate finance has been criticised for inadequately addressing adaptation, and for insufficiently reaching the low-income groups who are most vulnerable to climate impacts. New mechanisms will be needed to link these formal climate finance mechanisms to the needs of informal settlements, which might include the bundling of projects, the development of new financial instruments, and the involvement of intermediary organisations. The Adaptation Fund is increasingly financing concrete adaptation projects delivering resilience building infrastructure to poor urban communities, and the Green Climate Fund has also recently approved its first projects targeting resilience building in informal settlements.

Climate finance could be used to deliver an integrated package of climate-compatible services and infrastructure in low-income and informal neighbourhoods, including some combination of improved water supply, sanitation, drainage, solid waste management and tenure. If this is done through meaningful partnerships between local governments and community-based organisations, it can build the resilience of vulnerable urban residents by reducing the impacts, frequency and intensity of climate-related shocks and stresses,

as well as improving public health, increasing local resources for productive investments and creating channels for communication with decision-makers. Access to climate finance would also enable local authorities and communities to draw on climate projections and other technical expertise to avoid maladaptive designs and construction practices.

Efforts to mobilise climate finance for climate-responsive informal settlement upgrading are currently at a very early stage. However, as the links between the two agendas become increasingly recognised, and as climate finance instruments become increasingly diversified, there is likely to be substantial interest and expansion in this area in coming years. UN-Habitat’s experience with matching community and city needs with international funds such as the Adaptation Fund are positive examples of the possibility for directing international climate finance to informal and poor urban communities. These processes require in-depth vulnerability analyses at community and city level, and participatory planning processes that reduce environmental, social and – to a certain extent – political risk for financiers and local governments.

CASE STUDY

Upgrading of Vulnerable coastal settlement and relocation of the most vulnerable in Saint Louis, Senegal

Saint Louis is a city of approximately 250,000 inhabitants and a UNESCO world heritage site. It is part of a wetland constituted of a myriad of islands. The city is highly vulnerable to climate hazards since it borders the estuary of the Senegal River delta and is threatened by the erosive action of the Atlantic Ocean. There is high urban density in certain areas, in particular in the Guet Ndar neighbourhood located in the sandy stretch separating the sea and the river. The neighbourhood is also suffering from severe erosion as housing construction takes place too close to the ocean and within the dynamic areas of influence of the waves especially during high tides. The largest island, Sor, is characterized by poor sanitation, a high water table and an inefficient drainage system, as well as accumulation of solid waste in several locations, particularly in the Diaminar neighbourhood.

The Municipality, together with UN-Habitat and with the support of the Government of Japan then carried out an in-depth analysis of the climate change related hazards and vulnerabilities of the city and

its population. The study determined that two poor neighbourhoods – seafont Guet Ndar and low-lying Diaminar – were particularly vulnerable to flooding and the impacts of climate change. More specifically they identified some 68 households as highly vulnerable and recommended immediate relocation.

UN-Habitat carried out a preliminary mission to Senegal in January 2011 to identify a proper resettlement site to build low-cost houses for the relocation of the most at risk in Diaminar and Guet Ndar. In April 2011 the Municipality carried out an affordability study in the two affected neighbourhoods, disaggregated by gender, including an assessment of the willingness and capacity to pay for the new houses to be received, and a socio-economic analysis on the impact of the resettlement, including livelihood aspects.

A resettlement site was eventually identified, not too far from the areas of origin, which is an important aspect to be observed in any relocation project due to the dependency of the targeted population on location-specific economic activities. The area was still in need of at least a 60-80 cm high land fill before construction could start. The Municipality was tasked with this activity. Hands on

Homes (HoH) Foundation was hired for constructing low-cost houses at the resettlement site.

The Prime Minister of Senegal visited the site in 2012 and expressed his satisfaction with the project, signalling a strong political will by the national government to support the completion of the project. UN-Habitat signed a MoU with the Mayor to transfer the responsibility for the management and administration of 68 completed houses to the Municipality of Saint Louis.

Social benefits that have and will accrue to beneficiaries include improved housing and secure tenure. Some 68 of the most vulnerable families were resettled. The project eventually will effect a transformational change by providing the beneficiaries with secure title to their property.

The environmental benefits include the establishment of an environmental buffer zone on the coastline and improved environmental conditions in the new relocation site. Plans for tree planting both in the new buffer zone as well as elsewhere in the city could yield ecosystem benefits.



CASE STUDY**Case Study: considering adaptation options in Lami, Fiji**

In Lami Town in South East Fiji, the intensity of tropical cyclones is projected to increase, with increased flooding and coastal erosion. As a follow up to an earlier, broader vulnerability assessment, a collaborative scenario comparison study was conducted in the town, by CCCI, UNEP, the Secretariat of the Pacific Regional Environment Program (SPREP) and Conservation International. This comparative study assessed a suite of four potential combinations of adaptation options for Lami Town, alongside taking no action at all. The adaptation options ranged from pure ecosystem-based adaptation, including maintaining and re-establishing mangroves, coral reefs, mud flats and seagrass meadows, to pure engineering-based options, such as improving current infrastructure and building sea walls, or a combination of both EBA and engineering options. For all four scenarios of adaptation options, implemented at suggested locations throughout Lami Town, estimated benefits ranged from FJ\$8 to FJ\$19.50 for every Fiji dollar spent on coastal adaptation. Results were based on a 20-year time horizon. The benefits included avoided damages in terms of health costs and potential damage to business and households, as well as ecosystem services maintained or enhanced.

CASE STUDY**Case Study: local organisations facilitating climate initiatives in Vietnam**

As part of the ACCCRN initiative, the Women's Union in Da Nang, Vietnam, made available low-interest loans for members to reinforce their homes against storms through a pilot program for 400 households. The Women's Union staff also received training on climate change and DRR, whilst local builders were trained in building and design of resilient low-income housing (Reed, 2013). Another project in Da Nang saw seed funding from GIZ in partnership with the city government and the Association of Vietnamese Cities (ACVN) for a community-level climate fund in Hoa Hiep Bac Ward. This fund was managed by the community for upgrading and strengthening housing, adaptation of income-generating activities, planting trees and purchasing shared back-up generators. Thus, local civil society organisations can be seen as key actors in facilitating the take up of climate initiatives. The resulting housing improvements will improve the resilience of households to adverse climate impacts and likely will result in less damage and therefore less resources spent in the aftermath of climatic events.

CASE STUDY**Case Study: Making the Capital of the Solomon Islands more resilient to climate change**

The Solomon Islands are experiencing the increasing effects of sea level rise and extreme weather events due to climate change, but the country has engaged in proactive adaptation strategies. Building resilience was made a top priority of the Solomon Islands Government, with a specific focus on the capital city, Honiara. Not only is the city already exposed to multiple natural hazards, but rapid urbanization is heightening community exposure and sensitivity to a range of climate and non-climate shocks and stresses. This is most visibly expressed through the growth of informal settlements in urban and peri-urban areas, now reaching approximately 40 percent of its population.

UN-Habitat is supporting the Government since more than 5 years to address the climate challenge. An initial vulnerability assessment was conducted just before the major 2014 Honiara flood, having identified some of the most vulnerable informal settlements which were then highly affected by the disaster. Analysis was followed by participatory neighborhood scale adaptation planning activities to identify key issues, and establish priority objectives for enhanced community resilience, culminating into the Honiara Urban Resilience and Climate Action Plan¹⁴.

This action plan which integrates climate change adaptation, disaster risk reduction and development goals, provided the foundation to access funding by UN-Habitat and the Solomon Islands Government through an Adaptation Fund¹⁵ grant of USD 4.4 million. The implementation will help reduce exposure and sensitivity to climate impacts at community, ward and city level by strengthening the capacity of poor communities through infrastructure development, ecosystem-based adaptation, awareness raising and trainings, targeting women and youth, strengthening the capacity of ward and city officials and institutional arrangements to improve climate change adaptation planning.

¹⁴ http://www.fukuoka.unhabitat.org/programmes/ccci/pdf/HURCAP_final_Endorsed.pdf

¹⁵ <https://www.adaptation-fund.org/project/enhancing-urban-resilience-climate-change-impacts-natural-disasters-honiara-3/>

CASE STUDY

Case Study: Accra (Jamestown and Ussher Town): Building resilience by using locally available materials

Jamestown and Ussher Town are connected with several alleys of which most were constructed in the 1930s. The poor state of the alleys had clogged the drainage thus making difficult for free movement of people and rendering the public spaces unusable. These alleys also got flooded whenever it rained thus making pools for mosquitoes to breed and attendant health hazards. Under Phase III of the PSUP the community prioritized it as one of the urgent projects to be tackled to sanitize the living environment. The project benefited the entire Ga Mashie or over 100,000 residents who live there.

Over 14,400 square meters of alleys were paved with cement blocks that were manufactured in the locality thus providing employment to over 250 community youth in the execution of the projects. The paving has not only sanitized the environment, but has also consolidated the alleys as public spaces for various social and economic activities. In particular, the alley paving and increased lighting has provided safer environment for women and youth. The alley paving process provided an opportunity for the community to quantify the cost effectiveness and sustainability of using the blocks as an alternative to concrete slabs as a means of improving drainage and sanitation in low income neighbourhoods. It has been established that the blocks are 1.5 times cheaper and in addition are manufactured locally and offer better opportunities for employment of local youth. This is an opportunity to upscale the project in the rest of the city neighborhood with little accessibility to improve accessibility and drainage as part of a citywide slum upgrading programme.



Figure X: Clockwise from top; Alley paving providing labor to local youth and results of alley block paving providing much needed public spaces. Sewer lines to improve sanitation were also rehabilitated (bottom right)



Coastal Asian fishing town. Poor slum town at risk from climate change and rising sea levels. © Shutterstock



4

INFORMALITY AND **LOW-CARBON URBAN DEVELOPMENT**

The residents of informal settlements generate fewer urban greenhouse gas emissions than middle and high income urban residents. They are less likely to own cars, and rely predominantly on non-motorized forms of transport such as walking and cycling, or public transport such as buses.

4.1 Recognising the low carbon footprint of informal settlements

The residents of informal settlements generate fewer urban greenhouse gas emissions than middle and high income urban residents. They are less likely to own cars, and rely predominantly on non-motorized forms of transport such as walking and cycling, or public transport such as buses. Slum dwellers are less likely to live in large houses requiring heating or cooling in multiple rooms, or to have multiple electrical appliances. They are more likely to reuse materials and minimise solid waste, and their homes will often be constructed of locally-available or recycled materials. The density of informal settlements helps to promote resource efficiency and minimise land cover change. Yet the residents of slums often face the harshest impacts of climate change in urban areas.

While there is very little data on the emissions of those living and working in the informal sector as compared to those in the formal sector, research from India has shown that the average greenhouse gas emissions of an Indian earning more than Rs. 30,000 per month are 4.52 tonnes CO₂eq per annum – more than four times as much as the 1.11 tonnes CO₂eq per annum generated by an Indian earning less than Rs. 3,000 per month¹⁶. While it is evident that emissions are correlated positively to income, it is important to recognise the potential for large differentials in per capita emissions between different urban residents, based on their type of housing, favoured mode of transport, and consumption patterns.

Given the low climate change impact of many activities of low-income urban residents, pursuing mitigation in its own right in informal settlements would be

targeting the wrong population group. However, it is clear that upgrading informal settlements will cause an increase in emissions, through use of concrete and other building materials, and increased energy use and consumption. Thus, the focus should be around identifying opportunities for limiting greenhouse gas emissions in the process of upgrading settlements and improving livelihoods, security, sanitation and health.

This chapter considers the ways that upgrading can offer co-benefits for low-carbon development, with a particular focus on the areas of direct relevance for resilience of informal settlements: housing, basic infrastructure, and livelihood opportunities. At the same time, the chapter will consider the ancillary benefits of mitigation for upgrading, which are the ‘monetized secondary, or side benefits of mitigation policies on problems such as reductions in local air pollution associated with the reduction of fossil fuels, and possibly indirect effects on congestion, land quality, employment, and fuel security’ (IPCC 2014). In the context of informal settlements, ancillary benefits are therefore the positive impacts derived from mitigation, other than that of reduced or prevented GHG emissions. It also explores the ways in which low-carbon development can be supported by the informal sector.

4.2 Upgrading with mitigation co-benefits

The current development deficit in informal settlements, in the form of infrastructure shortfalls, creates opportunities to ‘leapfrog’ to low or zero emission systems and structures. By leapfrogging directly to good practice options, it is possible to avoid the more polluting, less efficient development trajectories of high income countries. Examples would include low-carbon options for settlement and housing design, energy use, transport, and waste management. In the context of informal

settlements, this means re-imagining service and infrastructure provision in an affordable and low carbon way. The latest IPCC report strongly recognises the need for rapid and far-reaching transitions in urban areas as a component of pathways to limit global warming to 1.5 °C, and specifically identifies opportunities for renewable energy in informal settlements as a means to produce co-benefits such as improved indoor air quality, reduced fire-risk and reduced deforestation¹⁷.

4.2.1 Building technologies

In the construction or upgrading of individual houses, there are opportunities for housing designs and technologies to produce mitigation co-benefits. Housing designs that reduce the need for materials, such as row houses also have cost benefits. Designs that maximise natural ventilation will reduce energy consumption for heating or cooling systems, whilst architecture that allows for natural light can reduce energy demands for lighting. Rooftop gardening, greening roofs and walls can also support energy efficient as it helps insulation against extreme heat or cold, and may even contribute to growing vegetables and plants in an otherwise dense area. A loft can provide a layer of insulation under the roof, and serve as a storage space for valuables during flooding. Roofs that are solid enough to take solar panels can also enable household-level energy efficiency or generation, for example for hot water or powering electrical appliances.

4.2.2 Urban and community design for low-carbon development

There are clear climate change mitigation advantages to a compact urban form, with high population densities, mixed land use, and good connectivity. Most informal settlements are a combination of very high density and mixed land use, but they often lack good access roads. Upgrading can retain the advantages

¹⁶ Ananthapadmanabhan, G, K Srinivas and V Gopal (2007), “Hiding behind the poor: a report by Greenpeace on climate injustice”, Greenpeace India

¹⁷ IPCC (2018). *Special Report: Global Warming of 1.5 °C*

of compact urban form, benefiting from the economies of agglomeration and enabling off-grid energy solutions. However there is a need to address the gap in accessibility, infrastructure and services to ensure that the density does not come with high risks – whether the health risks from overcrowding, or the dangers of fire and lack of accessibility to emergency vehicles.

In order to enable climate-appropriate, low-cost designs, access to adequate information about appropriate technologies is required. This is a role that can be played by specialists trained in construction, who can facilitate community-level upgrading to maximise use of available space. If those community members are appropriately trained regarding possible local climate impacts and resilient architectural technologies, they can integrate these considerations in to their designs. Local masons and builders also need to be trained in appropriate construction skills to hazard-proof homes, such as wind-resistant roofs and cyclone resistant core rooms.

4.2.3 Neighbourhood level mitigation opportunities

There are opportunities to make use of the density of populations in slums to generate mitigation benefits – in particular through the solid waste generated by local residents. If solid waste management is not provided by the municipality, there may be local enterprises or individuals who collect waste at the community level. This offers possibilities for recycling and using the waste for other purposes. In Gorakhpur, house-to-house collection of organic waste by local residents is used to generate liquid fertilisers for community agriculture. Recyclable materials may be sold to generate income, or used in home enterprises to produce crafts which can be sold for an income. If sorting of waste can be carried out at source, this



The use of technologies such as biogas and biomass briquettes can help to reduce harmful emissions within the home, compared to charcoal or kerosene, reducing the occurrence of respiratory illness at the household level.

creates opportunities for reducing landfill waste and hence reduce emissions – this requires the necessary incentives and awareness raising.

Briquettes are an alternative fuel source made from waste, gaining popularity in Uganda. They are composed of commonly found organic household waste, such as husks and nutshells, and are compressed either by hand or by machine into small dense products that can be used in replacement of charcoal and/or excess amounts of wood harvested from nearby forests. These produce low carbon emissions and reduce the need for charcoal or wood, thus helping to preserve natural environments. Their production can also generate employment opportunities in local communities, and these briquettes are less expensive than charcoal.

During the climate action planning process focusing on resilience, UN-Habitat and the local government have jointly reviewed the plan according to the Guiding Principles for City Climate Action Planning and identified a simple low-carbon technologies like income-generating solid waste collection and recycling activities implemented by a community-based organization. Likewise some actions already planned can be implemented in a low-carbon manner, for example, the street lighting could be changed to LED or powered by solar when improving public lighting.

Another possibility for mitigation comes in settlements with collective sanitation facilities, or multiple households sharing sewage facilities, where there is the opportunity to generate biogas using human waste, or waste from livestock. This biogas can be used to power communal kitchens, as has been trialled in Kibera in Nairobi. However, experience has shown that there can be a reluctance to use such biogas for cooking – which can be addressed through awareness raising and education.

4.3 Ancillary benefits from low-carbon technology for upgrading

The use of technologies such as biogas and biomass briquettes can help to reduce harmful emissions within the home, compared to charcoal or kerosene, reducing the occurrence of respiratory illness at the household level. There are also safety benefits by reducing the risk of rapidly-spreading fires, which are a frequent hazard in very dense informal settlements. Similarly, improved solid and liquid waste management creates health benefits by reducing the possibility of infectious and parasitic diseases – particularly so during periods of flooding where flood waters may otherwise be contaminated.

Use of more efficient energy sources as outlined above, and solar energy, combined with house designs that allow natural ventilation and lighting, can lead to reduced household expenditure for energy, and important consideration for

low-income households. Better lighting and more thermally efficient homes also have benefits for health and productivity of residents. There are also opportunities for income generation through initiatives such as recycling, waste collection, and urban agriculture.

4.4 Low-carbon opportunities in informal livelihoods and economies

While the unregulated nature of the informal sector means that informal enterprises may not meet environmental regulations, the scale and nature of many informal economic activities mean that their contributions to greenhouse gas emissions are very low or negligible. However, workers in the informal economy may be exposed to environmental hazards. While environmental regulations tend to be centrally policed, there is growing evidence of the benefits of multi-stakeholder engagement and decentralised governance structures to manage this – which can be well suited to the strengths of organised informal communities. Pro-poor and participatory planning approaches can help build awareness of the need for climate action while taking into account the needs of those relying on informal economic livelihoods – thus improving the informal economy, without necessarily formalising it.

Informal settlements often feature significant industries in reclaiming, reusing and recycling waste materials – thus contributing to mitigation, with added benefits on health and environmental conditions from this solid waste management service. Upgrading of informal settlements also has the potential to offer job-creation opportunities in construction of housing and infrastructure, as do low-carbon technologies such as solar panels.

Employment opportunities also exist in environmental management, and can be targeted at particular population groups. There are opportunities to collaboratively develop further such schemes for those living in the informal sector, with benefits for the city as a whole.

CASE STUDY

Case study Rehabilitation of the local clinic with photovoltaic energy in Bissighin (Burkina Faso)

Built by the State of Burkina Faso (more than 10 years ago), the Bissighin Medical Center is the main and only health centre for the population of Bissighin, Bassinko, Yagma and Watinoma. Although private health centres do exist, the poverty level of the population is such that it is difficult for them to access them for health care. But the CSPS built in the Bissighin area lacks an electricity system that hinders its optimal functioning. Although the maternity ward in Bissighin receives an average of 100 births of children every month, health workers worked in precarious conditions (use of flashlights, mobile phone torches, candles, etc.) during delivery sessions. The promotion of the photovoltaic energy system by the PSUP in its current phase has enabled the CSPS to have electricity and put the dispensary building in working order, in addition of sensitizing the community to sustainable development and renewable energies through classes for youth.



CASE STUDY

Case Study: solar household systems in South Africa

Households in South Africa have been moving away from paraffin lamps or illegal electricity connections in favour of the cheaper and safer alternative provided by solar energy. In Ruimsiq community, 75 households have had solar home systems installed in their shacks, providing energy for lighting, radio, TV and cell phone charging, with support from the South African Federation. This initiative, once it reaches all households, will help eliminate the risk of fire in the settlement, ensure cleaner air inside the homes. Similar initiatives are taking place in Zambia, where unplanned settlements do not qualify for basic services from the government. Solar household systems help to eliminate energy poverty in a low-emissions manner while creating training and employment opportunities for local technicians to install and maintain the solar panels.



Boys running through a market during rain in Taveta, Kenya © Shutterstock

JA JEWELLERS



SREE BUDDHA
COLLEGE OF ENGINEERING
← Elavumthitta
Contact No: 9447087020 10 Km.

SREE BUDDHA
COLLEGE OF ENGINEERING
Pattoor, Nooranad →
Contact No: 9446614317 8 Km.





5

KEY PRINCIPLES FOR ACTION

Drawing together the contents of this Thematic Guide, this chapter proposes eight key tenets that should be applied in considering and implementing climate change adaptation measures in informal settlements and with the informal sector.

Drawing together the contents of this Thematic Guide, this chapter proposes eight key tenets that should be applied in considering and implementing climate change adaptation measures in informal settlements and with the informal sector. These over-arching principles can be contextualized to different cities and neighbourhoods, and can be the starting point for inclusive action, alongside the PSUP principles. The IPCC (2014, p.26) notes that 'adaptation and mitigation responses are underpinned by common enabling factors. These include effective institutions and governance, innovation and investments in environmentally sound technologies and infrastructure, sustainable livelihoods and behavioural and lifestyle choices'. This guide therefore recognizes the broad nature of the elements that underlie vulnerability, which must be addressed for sustainable adaptation to be achieved. Even with all efforts at climate action and building resilience, the risk of unforeseen climate disasters remains. As communities and governments begin the recovery process, disasters should be treated as opportunities for reducing weather- and climate-related disaster risk and for improving adaptive capacity in the reconstruction effort to build back better.



Address development deficits with climate change adaptation and mitigation in mind and address climate change adaptation and mitigation with development needs in mind.

Informal settlements face large deficits in provision of basic infrastructure and services and adequate housing that play an important risk-reducing role. Addressing these deficits as a priority, so that everyone has access to appropriate housing, infrastructure and services, will play a large role in building the resilience of local residents to shocks and stresses, including climate-related impacts. When addressing these deficits, the opportunities for climate action should be considered, in order to further reduce risks. This is particularly important in the case of slum upgrading – when this is done in with meaningful participation and fuller knowledge of the range of climate- change related threats, it will lead to a substantial reduction in the future climate risks faced by low-income residents. It is also critical in relation to planning for urban growth – if climate risks are taken into account when providing infrastructure and influencing urban expansion, then settlement in areas that will be increasingly hazard-prone in the future can be avoided. Where possible, adaptation measures that produce mitigation opportunities as co-benefits should be considered, such as using local materials and climate-appropriate designs in upgrading housing. Integrating opportunities for generating clean energy for lighting, cooking and small industry from waste, or renewable energy such as solar, can also have ancillary benefits for health and livelihoods.



Downscale vulnerability assessments and responses to city and neighbourhood level.

Each informal settlement has its own unique dynamics in terms of physical risk, socio-economic characteristics, assets and capacities. This means that while city-level vulnerability assessments (VAs) may broadly capture sub-regional issues, they will not be adequate to capture settlement-specific contexts. Downscaled VAs and risk mapping at the neighbourhood level, carried out with involvement of local residents, through both quantitative and qualitative methods, allows an in-depth understanding of local risks and opportunities. These assessments can be used to develop customised responses that meet prioritised community needs. Involvement of local residents in risk mapping, VA data collection and analysis, builds local awareness of risks and enables communities to self-assess future climate risks, and input strategically into local development and climate change plans. This approach is being shown in the Urban Community Resilience Assessment developed by the World Resources Institute, as well as in the UN-Habitat's upcoming Guide on Community-based Climate Change Vulnerability Assessment and Action Planning, which will be the second in this series of guidance materials, complementing with guidance for teams tasked with facilitating vulnerability assessments and climate change action planning processes at the community level, with emphasis on the household level and more importantly on the vulnerabilities and resilience needs of specific disadvantaged groups.



Incorporate local knowledge in climate change responses.

While developing climate scenarios requires technical expertise, local communities have historical knowledge and experience that can enrich scientific knowledge and models at a very local level. Communities often have already developed unique adaptation mechanisms that are practical and low-cost and can be the basis for scaling-up action. This local knowledge – which should draw on the experiences of women and men, and of people of different ages in the community – should be integrated with scientific knowledge for more technically-refined solutions that can supplement local action, and scientific knowledge should be made available in accessible forms to local populations.



Strengthen education and training.

Building resilience requires education and awareness raising. Providing quality climate change education for children (at both primary and secondary schools) can make a significant difference to their risk perception, management, response and adaptation. Training that reaches all members of the community can also help to increase their capacity to face a natural disaster with adequate knowledge and organisation. Mainstreaming risk reduction into urban management allow people to understand climate change phenomena, learn how to react to them, and to build community resilience.



Build capacity at the neighbourhood level.

Building resilience requires the active involvement of all stakeholders, including local residents themselves. However, barriers such as low literacy levels may exist among low-income communities, that can hamper their access to information about climate change and prevent them from engaging in decision-making. To build climate resilience, the capacity of local communities must be developed through awareness-raising, training and provision of information that allows them to effectively participate. This may involve translating scientific information into easily communicated messages disseminated locally, using local language or diagrammatic illustrations, community outreach through plays or community radio.



Apply a balanced mix of adaptation options.

Given the uncertainty in downscaled climate projections, strategies should be applied, that can provide social, economic and environmental benefits under all different climate scenarios. The priority should be to address existing development deficits in housing and infrastructure, but strategies can also include additional actions such as early warning systems, better education and awareness, development and enforcement of appropriate building codes, and sustainable land use management. An additional benefit of such strategies is that their outcomes resonate with the aims of the SDGs. Incremental approaches can be valuable in providing entry points for adaptation, particularly if these are designed with future expansion in mind.

However, hard engineering solutions may also be required in certain cases, and where these require the displacement of local settlements, the process of resettlement should be negotiated to ensure that resilience is not further eroded, for example by loss of livelihoods or destruction of social networks.



Scale up action through co-production and collaboration between actors.

While approaches to adaptation that are locally initiated will be well targeted to meet local needs, communities themselves may lack the ability to scale-up measures or integrate neighbourhood-scale action to citywide systems such as trunk infrastructure. This is because finances and political will are often housed at higher levels, be it the city and national government level. The latest IPCC Assessment Report points out: “There are limits to what community action can do in urban areas. For instance, communities may build and maintain local water sources and toilets... or improve drainage..., but they cannot provide the network infrastructure on which these depend..., nor can they improve city-region governance” (IPCC 2014). For this reason, the planning processes at community and city authority levels cannot operate separate from each other.

City authorities should be trained to understand the entire scope of climate challenges in informal settlements, and how these are compounded by development deficits, and this awareness will heighten incorporation of pro-poor components in future city plans. This will also help to integrate local planning processes into a citywide approach to upgrading and development, and city governments can also establish the relevant interconnections with national-level climate action, finance and others, as appropriate.



Recognize the opportunities offered by integrating the informal economy into adaptation and mitigation.

Adaptation and mitigation action in informal contexts targets large populations vulnerable to climate change, and therefore has a large positive impact. Using Low carbon solutions in slums, provides for crucial services –energy, water and mobility–to be delivered and shows great potential for avoiding future emissions. The informal economy offers an important back-up option for low-income households’ livelihoods, thus contributing to their resilience, particularly where social security mechanisms may not exist. It also offers the flexibility for households to generate income through home-based enterprises, particularly relevant for women who might have to balance caring duties. Jobs can also be created in the process of upgrading homes and infrastructure in a low-carbon way, such as by training local residents in solar energy installation or bamboo construction. In many cases, the informal economy fills gaps where state provision has failed, such as in solid waste management and water provision.



Residents walk across a flooding street in Grogol, Jakarta, Indonesia © Shutterstock

ANNEXES

ANNEX 1: LINKAGES TO UN HABITAT VULNERABILITY ASSESSMENT AND ACTION PLANNING TOOLKIT

Successful urban planning for informal settlements requires participatory approaches from conception to the end of the planning processes. Various tools have been developed on participatory planning, and one developed by UN-Habitat for the City of Sorsogon in the Philippines is particularly relevant (titled “*Participatory Climate Change Assessments: A Toolkit Based on the Experience of Sorsogon City, Philippines*”). This toolkit provides a concise guide for local government and other stakeholders to use in conducting climate change vulnerability and adaptation assessments. This is based on the experience from Sorsogon City, in the Philippines where such an assessment was completed in the beginning of 2010. This toolkit is particularly interesting as it introduces the component of ‘adaptation assessment’ that is not found in the other guides. In particular, this guide is relevant for cities with limited funding and limited understanding of climatic risks, a situation that is common in most developing countries.

Participation is also well incorporated within the process described in this guide. First, the local authorities are able to participate in assembling an assessment team (that includes relevant inter-disciplinary experts, academia, international development organizations and civil society) and in defining the scope of the exercise. Local communities are then mobilized and are incorporated into the data collection process. The public then participates in validation of the assessment findings further generating a sense of ownership while giving credibility to the results. The public also participates in identifying their priorities for adaptation to be used in the subsequent stage of climate action planning.

Several other toolkits provide relevant lessons for responding to climate change in low-income and informal settlements in cities:

Toolkit:	Lessons
Climate Change, Vulnerability and Risk: A guide for community assessments and action planning	<p>This document provides guidance for teams tasked with facilitating vulnerability assessments and climate change action planning processes at the community level, with emphasis on the household level and more importantly on the vulnerabilities and resilience needs of specific groups. Inform participatory action planning processes that lead to community driven and owned adaptation / resilience.</p> <ul style="list-style-type: none"> • Identify lower risk areas in which resilient infrastructure and housing could be constructed; • Develop early warning systems, trainings in environmental management and DRR, • community capacity building, and alternative livelihood strategies; and • Select, prioritize and design appropriate resilient infrastructure development options. • To minimize social and environmental risks of projects,
Planning For Climate Change Guide & Toolkit	<p>This tool is described as ‘a systematic, community-based decision-making process that incorporates local objectives to help determine priorities and allocate scarce resources (i.e., time, money, and skills) to achieve agreed-upon goals’. This toolkit adheres to four key tenets that would be relevant to formulation of a toolkit for marginalized neighborhoods:</p> <ul style="list-style-type: none"> • Strategic (making the best decision possible with the resources available) • Values-based (incorporating local community and city-wide objectives) • Participatory (engaging a broad variety of stakeholders) • Integrated (encouraging mainstreaming into city-level plans or processes) <p>One of the key themes in this guide is participation. The aim of this participation is to ensure that that support of local communities and other stakeholders is sought to ensure that local values, interests and priorities are captured. In particular, these guides (borrowing from the Vancouver Declaration 2006) points out inclusivity and pro-poor planning as key tenets of urban planning that must be incorporated.</p>

Toolkit:	Lessons
<p>Developing Local Climate Change Plans</p>	<p>This guide is tailored for cities in the developing world, most of which are plagued by high poverty levels, slums and informal settlements, a situation intensified by climate change. This tool provides local policy-makers and major stakeholders with a methodology to plan for climate change, addressing both mitigation and adaptation.</p> <p>The percentage of the population which is poor or lives in slums is explicitly outlined in this guide as one of the strong indicators of city vulnerability. This guide recognizes that for local climate change plans to be effective, a variety of stakeholders with a specific focus on the most vulnerable groups must be involved. In fact, the core planning team is expected to have representatives of civil society organizations that are familiar with local low-income community life and dynamics. Additionally, awareness building for the climate planning process must tailor messages to the different audiences which points to an attempt of inclusivity in knowledge sharing. The vulnerability assessment approaches include community hazard mapping and participatory vulnerability assessments which can stimulate discussion and encourage community members to articulate their understanding and ideas.</p> <p>However, as this is a city-level guide, participation described appears to largely be that of representatives of main stakeholder categories, rather than individual communities themselves. Additionally, in listing the main sources of knowledge about climate change information, local knowledge is omitted with the main focus being on scientific sources alone.</p>
<p>Guiding Principles for City Climate Action Planning</p>	<p>The aim of this tool is to provide a framework within which climate action planning for cities can be done with an aim to reduce emissions and embrace low emission trajectories (mitigation) while making the necessary adjustments to adapt to climate change and build resilience. This tool in particular highlights the inclusion of marginalized neighborhoods as a key principle in the planning for climate action in cities. In addition to inclusivity, this tool proposes that climate action planning be ambitious, fair, comprehensive, integrated, relevant, actionable, evidence-based, transparent and verifiable.</p> <p>This tool synergizes with the globally accepted participatory approach because it advocates for the inclusion of a wide range of stakeholders including local communities to ensure that solutions developed are relevant and generating a sense of ownership among beneficiaries and actors. The tool also acknowledges that beyond income, communities are themselves differentiated by additional variables such as age, gender, personal interests and perspectives.</p> <p>In particular, this tool highlights two key components of effective participation that the CAP process must incorporate:</p> <ul style="list-style-type: none"> • Arming participants with information that enables them to be meaningfully involved in, and influence both decision-making and implementation. • Incorporation of local knowledge into both the process and decision-making <p>The participatory component within this tool calls for inclusion of cross-sectoral government institutions, local communities, politicians and other stakeholders (such as academia, private sector, and civil society). This ensures that plans are anchored on verifiable research, integrated multi-sectoral solutions are adopted, political will is generated and decisions that are both inclusive and fair are made. For adaptation in particular, there is yet to be consensus on a standard approach to vulnerability assessment. For this reason, participation becomes crucial as assessments have to rely on local/ indigenous knowledge on risks and vulnerabilities.</p> <p>The planning process must be anchored on ambitious goals and informed stakeholders must participate in the selection and prioritization of actions to be proposed. This tool discourages the development of rigid engineering actions but rather embrace robust local/ traditional solutions (which further call for participation) or ecosystem-based approaches. Inclusion of a multi-sectoral array of actors in the process ensures that integrated solutions are developed that will bring about cross-sectoral co-benefits. At the M & E stage as well, participation is crucial and thus monitoring process (which must be transparent) must capture community feedback.</p>

Toolkit:

Lessons

Guiding Principles for City Climate Action Planning-Toolkit for City-Level Review

This toolkit is very specific on analyzing the level of participation in both the plan-making process and in the final plan output. In particular, the toolkit seeks to establish if participation through civil society, of women groups, poor urban neighborhoods, neighborhoods with climate disaster histories or those located on high climate risk areas, and any other marginalized groups. It also seeks to establish if local/traditional knowledge was incorporated in vulnerability analysis and in plan actions proposed.

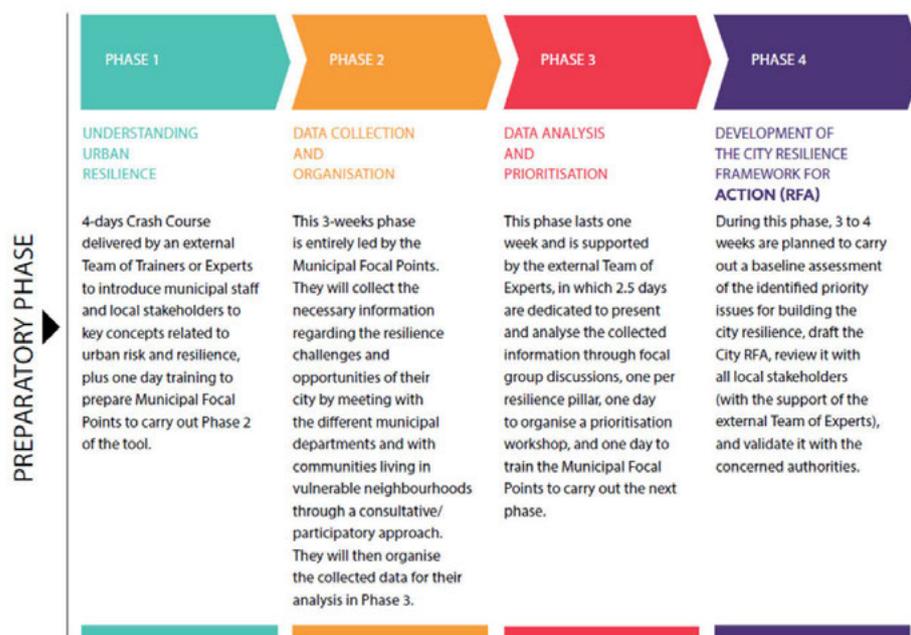
Unfortunately, the tool does not establish the level of participation (or its effectiveness). It does not query if sensitization of participants was done at the commencement of the process to enable them effectively participate and thus contribute to decision-making.

The City Resilience Action Planning Tool (CityRAP)

The City Resilience Action Planning (CityRAP) tool aims to enable local governments of small to intermediate sized cities, or neighborhoods/ districts of bigger cities or metropolitan areas, to plan and undertake practical actions to strengthen risk reduction efforts and enhance the resilience of their cities.

The CityRAP tool is an incremental participatory resilience planning methodology based on a bottom-up planning approach. The tool leverages local knowledge, and builds an inclusive process for the local government, a wide-range of stakeholders, communities, and urban dwellers to engage in activities such as risk mapping exercises, focus group discussions, and cross-sectorial action planning. The final product of the series of activities is the development of a City Resilience Framework for Action (RFA).

The implementation of the tool lasts approximately two to three months divided into four phases, as described below. A group of Municipal Focal Points are trained to lead the process at the city level, spearheading the CityRAP tool roll-out process by collecting data, supporting data analysis, facilitating discussions, ensuring effective communication with partners/stakeholders, actively engaging with communities through a participatory approach, and drafting the City RFA.



This tool was created by the sub-regional Technical Centre for Disaster Risk Management, Sustainability and Urban Resilience (DIMSUR), in partnership with UN-Habitat. It has been successfully implemented in Mozambique, Madagascar, Malawi, Ethiopia, Union of Comoros and Burkina Faso. To ensure that the tool reaches as many communities as possible, a Training of Trainers initiative has been established to train local actors to reproduce the tool in their own municipalities.

Toolkit:	Lessons
<p>A Practical Guide to Designing, Planning, and Executing Citywide Slum Upgrading Programmes (Slum Upgrading). (2015).</p>	<p>The guide draws on the wealth of knowledge and experience that has been accumulated during the last 50 years on how to establish and implement successful citywide slum upgrading programs.</p> <p>This Practical Guide is an integral part of a trilogy on the topic that includes other UN-Habitat studies, namely Streets as Tools for Urban Transformation in Slums: A Street-led Approach to Citywide Slum Upgrading and A Training Module for Designing and Implementing Citywide Slum Upgrading. These publications together present a UN-Habitat approach to slum upgrading, encouraging an approach that is both street-led and citywide. The trilogy unequivocally emphasizes the need for slum-upgrading programs to be synchronized with strategies such as National Urban Policies and Climate Change Resilience planning, which</p> <p>anticipate and plan for urban growth. The integration of slum upgrading programs with countrywide planned urban development is the sustainable way to make a difference in slum areas of cities. This Practical Guide provides an accessible tool for practitioners, leading them through UN-Habitat steps towards a successful citywide slum-upgrading program. The Quick Guide, which is included in the publication, provides an important reference tool that can be accessed quickly by practitioners in order to help address the most pressing problems and the most important</p> <p>considerations in slum upgrading.</p> <p>https://unhabitat.org/books/a-practical-guide-to-designing-planning-and-executing-citywide-slum-upgrading-programmes/</p>

ANNEX 2: FURTHER READING AND RESOURCES

Key Reference Documents

IPCC Fifth Assessment Report chapter on urban areas:

Revi, A., D.E. Satterthwaite, F. Aragón-Durand, J. Corfee-Morlot, R.B.R. Kiunsi, M. Pelling, D.C. Roberts, and W. Solecki, 2014: Urban areas. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 535-612. http://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-Chap8_FINAL.pdf

Background paper prepared for IPCC-Cities conference (2018):

David Satterthwaite, Diane Archer, Sarah Colenbrander, David Dodman, Jorgelina Hardoy and Sheela Patel (2018). "Responding to climate change in cities and in their informal settlements and economies". Background paper prepared for IPCC Cities conference, March 2018. <https://citiesipcc.org/wp-content/uploads/2018/03/Informality-background-paper-for-IPCC-Cities.pdf>

Collected papers from *Environment and Urbanization* journal addressing climate change in cities in low- and middle-income countries

<http://journals.sagepub.com/page/eau/collections/climate-change-papers>

UN-Habitat Publications

- Analytical perspective of pro-poor slum upgrading frameworks. (2006). Nairobi: UN-Habitat.
- Building urban safety: Through slum upgrading. (2012). Nairobi, NY: United Nations.
- Kioe Sheng, Y., Brown, A., & Gachie, G. (2018). Prosperity for all: Enhancing the informal economy through participatory slum upgrading. Nairobi / Cardiff: UN-Habitat / Cardiff University.
- The Participatory Slum Upgrading Programme. Retrieved 2018, from <https://unhabitat.org/urban-initiatives/initiatives-programmes/participatory-slum-upgrading/>
- Participatory Slum Upgrading Programme. (2018). QUICK GUIDE for participatory, city-wide slum upgrading: Participation for inclusive, city-wide slum upgrading. Nairobi.
- <https://unhabitat.org/quick-guide-for-participatory-city-wide-slum-upgrading-participation-for-inclusive-city-wide-slum-upgrading/>
- Slum Almanac. (2016). Nairobi: UN-Habitat. Participatory Slum Upgrading Programme (PSUP)
- Slums of the world: The face of urban poverty in the new millennium? (2003). Nairobi: UN-HABITAT.
- UN-Habitat. (2015). Habitat III issue papers: 22 – informal settlements [Brochure]. New-York: Author. <https://unhabitat.org/habitat-iii-issue-papers-22-informal-settlements/>
- Guiding Principles for City Climate Action Planning (2015) Nairobi: UN-Habitat.
- Sustainable Urbanization in the Paris Agreement (2017) Nairobi: UN-Habitat.

Addressing the most Vulnerable First -
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