



CHAPTER 10: HUMAN SETTLEMENTS

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Different human settlement types and locations with varying vulnerabilities and capacities will experience the hazards associated with climate change to an unequal extent. Poor communities will experience the most severe setbacks from the impacts of climate change; eroding their adaptive capacity and threatening their resilience.

10.1. Introduction

Human settlements with their high concentrations of people, economic activity and infrastructure are arguably one of the most significant stages on which climate change will play out (Smith, 2009). Settlements in southern Africa are confronted with many complex development dilemmas at various levels, some of which are legacies, but many challenges are entrenched or created by current market forces and planning practices. Settlements are not all equally vulnerable to the impacts of climate change. The vulnerability of settlements in southern Africa is impacted by various and complex socio-economic processes related to the cultural, political and institutional contexts and demographic pressure, as well as specific high-risk zones susceptible to flash floods, sinkhole formation or landslides (Oliver-Smith, 2002; Niang et al., 2014).

As urbanisation challenges collide with the impacts of climate change, a 'strange new urban world' (McClellan 2010, p.8) develops in which settlements are becoming progressively more vulnerable but less able to deal with the risks (ICLEI, 2010).

Resilient cities are able to sustain themselves by coping with, or adapting to climate change threats, whereas cities vulnerable to climate change are to varying degrees unable to cope with the adverse effects of climate change, and experience some form of harm when a hazard occurs (UNFCCC, 2010). Vulnerability precedes disasters, contributes to their severity, and persists afterwards. The multidimensional impacts of climate change on human settlements in this region compound the challenges, going far beyond cities' experience and capacity to adapt and respond to climate change, causing major setbacks in hard-won economic

and social development that increasingly hinder efforts towards sustainable development. Ultimately, poor and vulnerable communities experience the most severe setbacks from the impacts of climate change, eroding their adaptive capacity and threatening their resilience (Parnell et al., 2007; Faling, 2010; Roberts et al., 2012; Niang et al., 2014).

This chapter describes some of the key drivers and processes of vulnerability and risks in human settlements in southern Africa that pose considerable challenges, but also opportunities, for climate change adaptation. Data for the whole of southern Africa (excluding Mauritius and Seychelles) are provided for two of these key processes, namely urbanisation and informality. The potential climate risks and their consequences for settlements in the SADC region are discussed. The chapter concludes with a number of response measures that address both hard and soft adaptation options for cities, but, more importantly, the underlying key processes that drive risk and vulnerability.

10.2. Key drivers and processes of vulnerability and risks within settlements

“The vulnerability of human settlements to climate change is understood as an outcome of their exposure to environmental risks and changes resulting from climate change, and the extent to which the adaptive capacity of affected communities and households is reduced by social vulnerability. These factors are location specific, related to particular local climate, topology and human settlement patterns.” (Department of Environmental Affairs 2014b, p.6).

Urban settlements across Africa are experiencing immense changes at a swift rate. Much of this change is causing urban populations to become and remain vulnerable to numerous risks such as the impacts of climate change. The key drivers and processes causing these changes include urbanisation, natural population growth within cities, informalisation of the city, growing inequality, increasingly youthful



urban populations, smaller household formations, industrialisation, and growth and decline in the economy and employment opportunities (Todes et al., 2010; African Development Bank Group, 2012; Freire et al., 2014; UN Economic Commission for Africa, 2014). Two of these key processes and their associated challenges are discussed below, with reference to the situation in SADC countries.

10.2.1. Urbanisation

Urbanisation is a necessary catalyst for economic prosperity. Cities and towns generate the majority of national GDP, and urbanisation, if managed well, can be a powerful process for leveraging transformation and economic growth (UN-Habitat, 2014). As colonial and apartheid regimes in Africa started to break down, urbanisation rapidly increased. It is estimated that the urban population in Africa has grown from 15% in 1960 to 40% in 2010 and is expected to continue growing to more than 60% by 2050 (UN-Habitat, 2015). The main drivers of this urbanisation are natural population growth, rural-urban migration (including climate change refugees), circular and seasonal labour migration, international migration, conflict and war, changing and decaying rural landscapes, land reform, and a perception of plentiful economic opportunities, housing and services in the cities (Todes et al., 2010; Niang et al., 2014; UN-Habitat, 2014; United Nations ESA, 2014). However, urbanisation in most of Africa occurred with little change in the economic structure and insufficient investment in the built environment and human capital to harness the process for sustainable and inclusive growth (Todes et al., 2010; Freire et al., 2014). The United Nations calls this “urbanisation without development” (UN Economic Commission for Africa, 2014).

Figure 10.1 shows the level of urbanisation for the SADC countries. South Africa is the most urbanised at an estimated 64%, followed by Botswana (57%) and Namibia (46%). The least urbanised countries are Malawi (16%), Swaziland (21%) and Lesotho (27%). Figure 10.1 also illustrates the population density per square kilometre, as well as the urban agglomerations with more than one million people and their expected

populations in 2025 (projections sourced from UN ESA, 2014 and UN-Habitat, 2014). Currently, of the estimated 311 million²⁰ people who live in SADC countries, 126 million live in urban agglomerations. The largest urban agglomerations are the Gauteng city region in South Africa, Kinshasa in the DRC, Luanda in Angola and Dar es Salaam in Tanzania. Urban agglomerations in the SADC region provide housing and livelihoods to 41%²¹ of the SADC population and are expected to continue to grow as African cities have among the fastest growing populations (UN-Habitat, 2015).

The main challenges associated with urbanisation in Africa are low economic growth and growing poverty that contribute to the “urbanisation of poverty”, inadequate infrastructure and lack of services, degradation of the environment, the absence of clear policies on land ownership, unsustainable consumption of resources, a laissez-faire approach to urban management, and limited capacities at local government level (UN Economic Commission for Africa, 2014; UN-Habitat, 2014). The result is that much of the urbanisation is unplanned and informal, located in undesirable spaces that are exposed to multiple and complex hazards. Many settlements in the SADC countries are consequently becoming home to an increasingly vulnerable urban population, to climate change in particular (Pelling et al., 2009; Roberts et al., 2012; Niang et al., 2014).



²⁰ Figures exclude Mauritius and Seychelles.

²¹ CSIR calculations based on latest census figures of each SADC country (projected figures used in case of missing census data, e.g. Angola). Urbanisation rates used as reported by UN ESA (2014). Calculations exclude Mauritius and Seychelles.

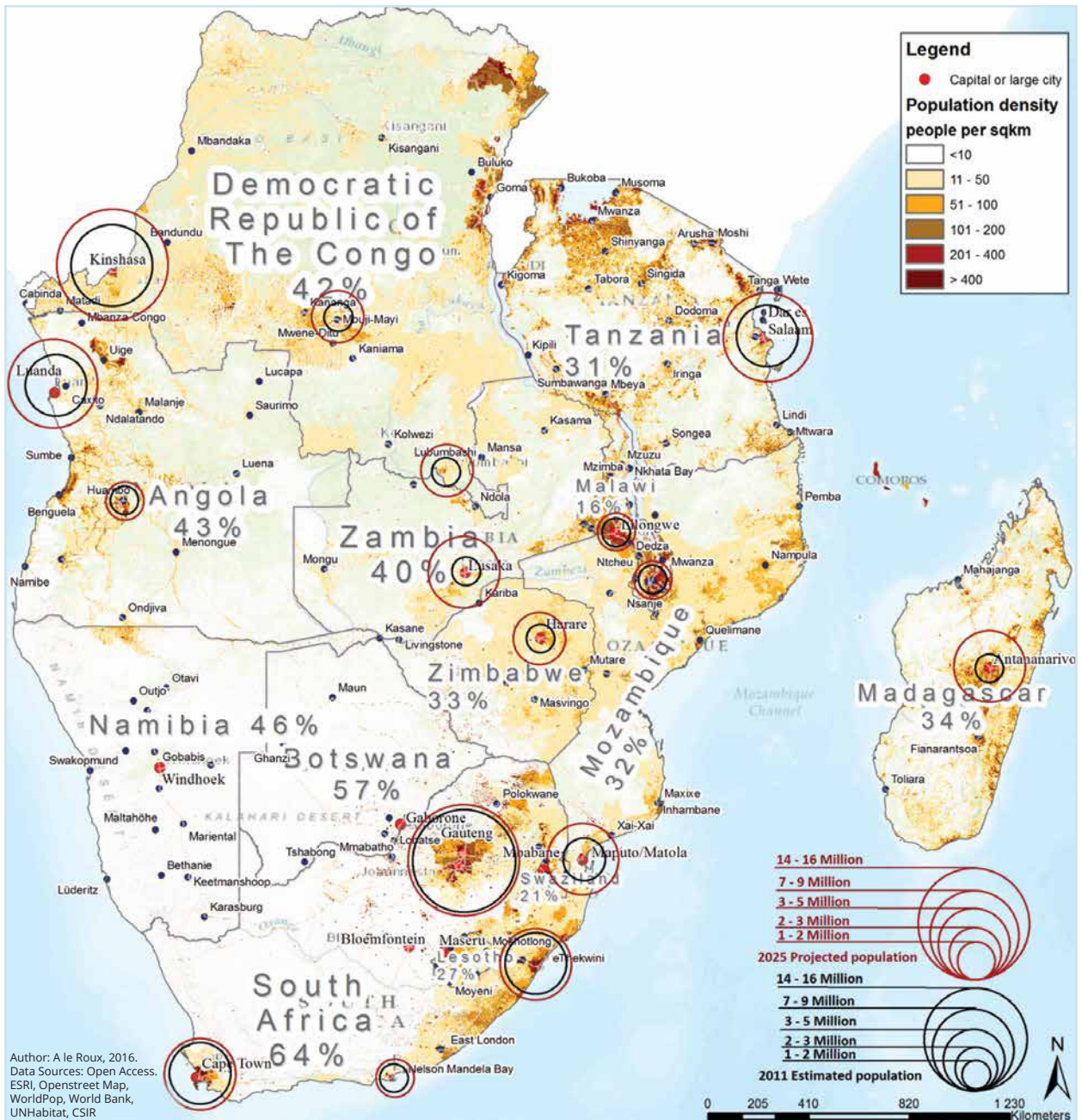


Figure 10.1: SADC population distribution and density, proportion of urban population and projected growth of cities.

10.2.2. Informality and inequality

The proliferation of informality, particularly urban slums, is one of the most prominent phenomena of SADC settlements, and potentially one of the most pressing future challenges. Factors contributing to the development and growth of urban slums are the sheer number of people that need to be housed and provided with services and a lack of formal employment, but also mainstream urban policy that fails to address issues of informality or appreciate the cumulative consequences of poverty. Urbanisation has mostly failed to bring about inclusive growth. Rising inequality is thus another prominent characteristic of cities in the SADC region. With an average Gini coefficient²² of 0.58 (well above the 0.4 average), African cities are the second highest unequal cities in the world. The way settlements develop generates exclusion and segregation by reflecting and reinforcing a pattern of

wealth accumulation that only benefits a few. Informal settlements self-locate on the periphery of settlements at distances far from economic opportunities, with low or no potential to make a living. Informal employment and youth unemployment have become everyday features of African cities that cause a lot of distress to households (African Development Bank Group, 2012; Van Niekerk, 2013; UN Economic Commission for Africa, 2014; Rajab, 2015).

Table 10.1 shows the current estimated percentage of urban slum dwellers (UN-Habitat, 2013) in cities. The highest prevalence of urban slum dwellers (as a percentage of total urban dwellers) is found in Madagascar at 76%. Second is Malawi at 69%, followed by Angola (66%), Tanzania (64%) and the DRC (62%). Zimbabwe (24%) and South Africa (23%) have the lowest percentage of urban slum dwellers.

The inhabitants of informal settlements in SADC countries often live in life-threatening conditions and face extensive risks on a daily basis that make them vulnerable to various hazards. Inadequate access to basic municipal services such as water, sanitation, electricity and waste removal creates unhygienic environments and increased pollution that can cause serious health threats. It is also a major cause of increasing service delivery riots. The lack of affordable and effective public transport places an undue economic burden on the poor. Where people live in high densities close to the city centre, there are conflicting interests and actions competing for scarce land and opportunities, and infrastructure is overwhelmed by the demand. Other challenges include tenure insecurity, a lack of land-use management and building regulations, lack of access to safe drinking water, and the use of highly flammable material to construct dwellings combined with the use of flammable sources of energy (Van Niekerk, 2013; UN Economic Commission for Africa, 2014; Rajab, 2015). These trends place enormous pressure on the ability of governments to respond effectively to, and mitigate risks associated with climate change (Le Roux et al., 2016 – in press).

Table 10.1: Percentage of urban slum dwellers in southern Africa

SADC country	% urban dwellers living in slums
Madagascar	76
Malawi	69
Angola	66
Tanzania	64
DRC	62
Zambia	57
Lesotho	54
Namibia	34
Zimbabwe	24
South Africa	23

10.3. Potential climate risks and their consequences for settlements

The future climate of southern Africa is generally expected to be characterised by increased temperatures and changes in rainfall. The projected climate changes will expose people and the built environment to hazards such as severe weather events, drought, water shortages, floods, sea-level rise, heat waves, vector-borne diseases, coastal erosion, storm surges, cyclones and sinkhole formation. These events are likely to cause injury and death to many people and severe damage to the built environment, which would have knock-on effects on economic development and negatively impact service delivery and sustainable development in the areas of greatest need. Arguably the biggest threat facing many urban agglomerations would be the reduced access to fresh water and concerns around food security (UN-Habitat, 2011; UN-Habitat, 2013; Department of Environmental Affairs, 2014b). Table 10.2 expands on some of these possible threats and their consequences for human settlements.

Looking to future risks, Figure 10.2 shows population density and those SADC coastal settlements with populations above 200 000. Eleven percent²³ of people in southern Africa live in coastal settlements below

22 The Gini coefficient measures the deviation of the distribution of income among individuals or households within a country from a perfectly equal distribution. A value of 0 represents absolute equality, a value of 100 absolute inequality (<http://hdr.undp.org/en/content/income-gini-coefficient>)

100 m above sea level. Mozambique is particularly vulnerable, with 39% of its people living below 100-m elevation, followed by Madagascar (27%), Angola (15%), South Africa (12%), Tanzania (11%) and Namibia (6%).

Coastal cities in southern Africa are densely populated, have made huge investments in infrastructure such as ports, power stations and oil refineries, are home to threatened ecosystems, and play a vital role in the economies of the SADC countries. Coastal cities are, however, at great risk of severe impacts from hazards such as storm surges, flooding and sea-level rise, owing to the dense population concentrations and the accumulation of assets, for they produce the majority of the GDP on relatively small areas. Specific risks in some of these countries include:

- Mozambique is arguably the SADC country most vulnerable to climate change. Thirty-nine percent of its population live in coastal areas below 100-m elevation, and climate projections indicate potential increases in the number of cyclones, in flooding and storm surges as well as in drought events (UN-Habitat, 2013; UN-Habitat, 2014). Since agriculture is largely based on subsistence farming, droughts and shifts in rainfall patterns can lead to severe food and water insecurity. Mozambique is a country with a history of conflict and insecure land tenure and this is likely to lead to resource conflicts.
- Luanda (Angola), Dar es Salaam (Tanzania) and Kinshasa (DRC) are among the top five fastest growing cities in Africa (KPMG, 2012). Luanda and Dar es Salaam are both coastal settlements that are megacities in the making (UN-Habitat, 2013; UN-Habitat, 2014; United Nations ESA, 2014), while Kinshasa, the capital of the DRC, is already a megacity and located on the banks of the Congo River where it is vulnerable to flooding.
- The capital cities of Antananarivo (Madagascar) and Lilongwe (Malawi) suffer from inadequate and lacking infrastructure and services to cope with the effects of climate change impacts (UN-Habitat, 2014).
- Coastal cities in Angola have seen tremendous growth and in-migration (Luanda grew from 141 000 in 1950 to over five million in 2010, Benguela/Lobito grew from 8 500 in 1950 to 365 000 in 2010) and this trend is expected to continue for the next decade. Currently 15% of Angola's coastal population are located below 100-m elevation, and extreme poverty, inadequate shelter, lack of land use and disaster management are reducing people's ability to cope with current and future climate-related events. Much of the growth has been absorbed in high-risk environmentally sensitive land in river basins, coastal swamps and low-lying areas. Flooding tends to be the biggest concerns for these cities, for it displaces people (e.g. 10 000 displaced in January 2016 in Benguela/Lobito), affects service delivery of safe water, and results in continuous outbreaks of cholera (e.g. 35 000 cases in 2006 [Cain et al., 2015]).
- The DRC picture is grim, as natural resource looting, failing government structures, continued armed and social conflict, corruption and poverty will render attempts at mitigation insufficient (UN-Habitat, 2013; UN-Habitat, 2014).



23 CSIR calculations based on Worldpop 1 sq km population grid and 30m World DEM.

Table 10.2: Possible impacts of climate change phenomena on human settlements (Niang et al. 2014; Department of Environmental Affairs, 2014b; Engelbrecht et al., 2016 – in press)

Climate change phenomenon	Consequences for human settlements
General warming – less intense and fewer cold days and nights, more frequent and intense hot days and nights	<ul style="list-style-type: none"> • Intensified heat island effect. • Increased energy demand for cooling. • Declining air quality in cities. • Reduced energy demand for heating. • The incidence and geographic range of vector- and water-borne diseases could change due to changes in the mean temperature.
Extreme weather – heat waves and droughts	<ul style="list-style-type: none"> • Increased water demand compounded by present strain from overexploitation and degradation. • Resource conflicts. • Declining water quality, water stress and pressure on water-supply systems. • Surface water evaporation. • Increased risk of heat-related mortality, especially for the elderly, chronically sick, very young and poor. • Reduction in quality of life for people without appropriate housing. • Drought stress will be exacerbated in drought-prone regions. • Susceptibility to environmental degradation for rural settlements in particular. • Reduced crop productivity, increased pests and diseases, which could have implications for local livelihoods, food-system infrastructure and urban food security. • Undernutrition could have lifelong impacts on development and health. • Increased risk of wild fires.
Extreme weather – heavy rainfall events and violent storms	<ul style="list-style-type: none"> • Adverse effects on quality of surface and groundwater, contamination of water supply. • Increased risk of deaths; injuries; infectious, respiratory and skin diseases; water- and food-borne diseases; and post-traumatic distress disorders. • Unplanned informal settlements are particularly susceptible to floods, offering poor accessibility for emergency services. • Disruption to commerce. • Damage to or destruction of bulk and critical infrastructure. • Disruption to transport systems and traffic. • Flash floods and mudslides could destroy or damage assets, force people from their homes, or lead to deaths. • Large displacement of people (who may return to the area), or distress migration to urban informal areas. • Pressure on urban and rural infrastructure, including power outages, disruption of public water supply and transport. • Loss of property and withdrawal of risk coverage in vulnerable areas by private insurers.
Sea-level rise and storm surges	<ul style="list-style-type: none"> • A threat to coastal settlement, disrupts transport systems, infrastructure and public services, especially in informal settlements. • Decreased availability of fresh water due to salt-water intrusion. • Harmful impacts to marine and estuarine environments. • Increased risk of deaths and injuries by drowning in floods and migration-related health effects. • Increased migration, which can result in human suffering, human rights violations, conflicts and political instability. • Loss of property and livelihoods, particularly in marine fisheries and tourism, and the withdrawal of risk coverage in vulnerable areas by private insurers. • Damage to real estate, decreased value of beachfront properties and decreased tourism. • Permanent erosion and submersion of land. • Costs of coastal protection versus costs of land-use relocation and damage to natural infrastructure – potential requirement for movement of populations and infrastructure.

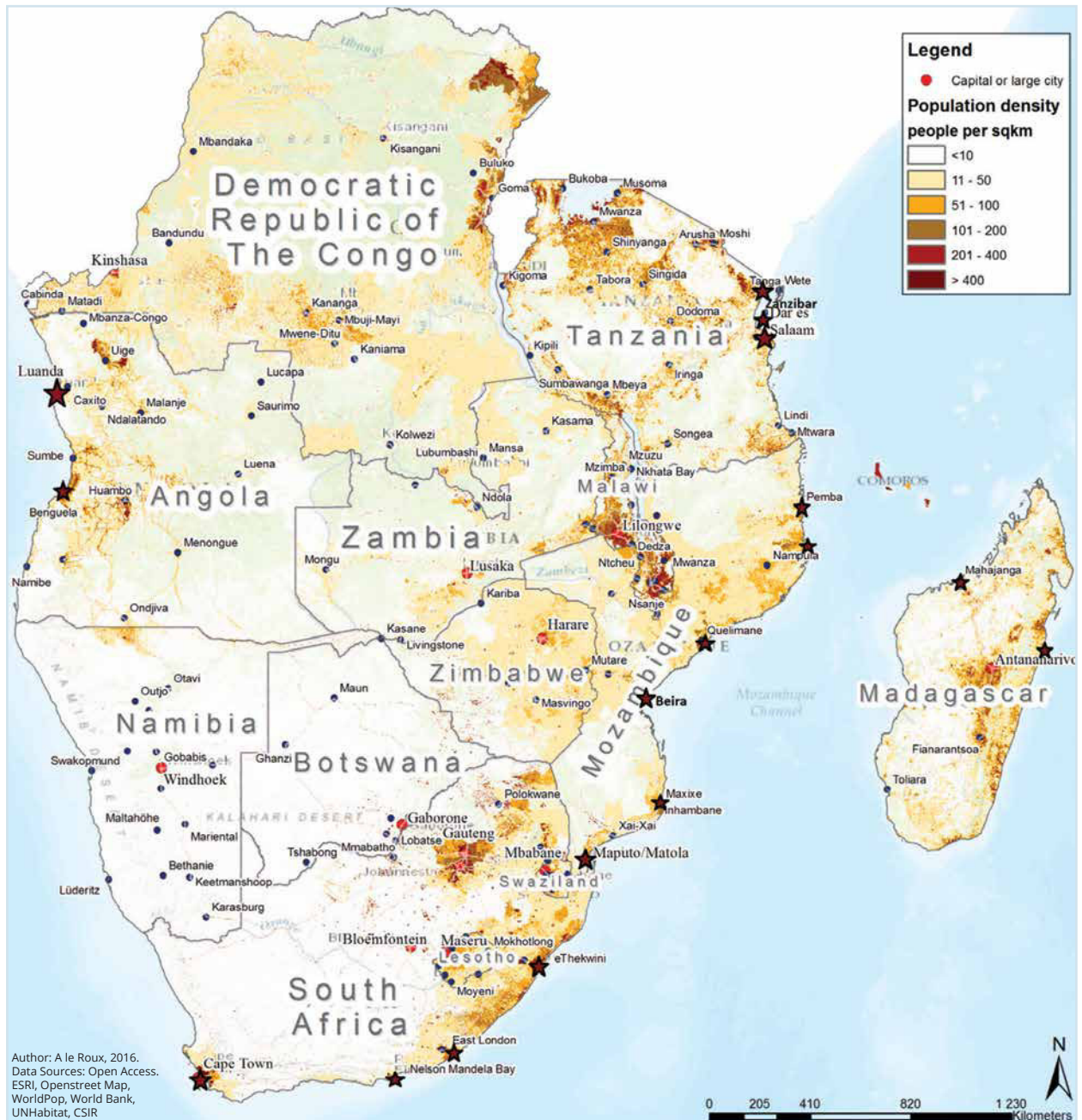


Figure 10.2: Population density and distribution; and coastal settlements with populations above 200 000 people

The impact of climate change on cities will be complex and, based on their spatial locations, diverse (UN-Habitat, 2013). Projected climate change (see Chapter 2) will result in a growing number of vulnerable people (both socially and physically) exposed to a growing number of natural hazards, resulting in a higher number of people at risk. A rapidly growing vulnerable urban population (unmanaged growth resulting in sprawl, people settling in low-lying or environmentally sensitive areas) coupled with the expected increases in hazards (sea-level rise, greater number of cyclones, extreme temperatures, increase in intensity of rainfall, drier inlands, etc.) and inadequate infrastructure (lack of stormwater runoff, failure to adhere to building codes, inadequate infrastructure networks) will prove devastating for many cities in the SADC region. Many governments in the SADC countries are already struggling to meet the basic needs of city dwellers and a rapidly growing urban population will place enormous pressure on governments to create sustainable human settlements. The risk of injury, loss of life, damage to infrastructure and costly recovery processes, among other things, will increase as climate change will exacerbate pre-existing vulnerabilities.



Case study: The vulnerability of Luanda (Angola) to climate change impacts

The capital of Angola, Luanda, was originally designed for half a million people by colonial Portuguese planners. Luanda is now home to a population of more than five million people, and is currently one of the five fastest growing cities in Africa (UN-Habitat, 2011; UN-Habitat, 2014). Twenty-seven years of civil war saw many people flee to Luanda, which was largely spared from the conflict. With peace came economic opportunity, and even more people came to the capital from the impoverished countryside. This urbanisation has not been managed well, and the housing problem has been left unattended for half a century (UN-Habitat, 2014). The population of Luanda is projected to grow at 3.7% between 2010 and 2025 – from 4.8 million to 8.7 million people (Freire et al., 2014). To keep up with the average annual growth rate, Luanda will have to provide for almost 300 000 new inhabitants per year (UN-Habitat, 2014), posing great challenges for the provision of infrastructure and services (Eriksen et al., 2008).

Angola's post-war economic growth was quite robust for more than a decade, though its economy, based mainly on oil exports, is one of the least diverse economies in Africa. It attracted significant foreign capital investment that created wealth for Luanda, but the impact on employment has been limited. This is not only because oil revenue is

fuelling corruption and political cronyism, but also because education was severely affected during the war years, to the extent that the oil industry had to import skills from other countries due to a lack of qualified personnel (UN-Habitat, 2014). At present, Luanda is one of the most unequal cities in the region, with one of the highest slum populations (66% of urban dwellers in Angola live in slums). In Luanda, 54.3% of the population live below \$1.25 per day and the Human Development Index is 0.486 (UN-Habitat, 2014). The accommodation needs of the highly paid oil workers have increased residential costs, thus pushing out the urban poor to the periphery of the least desirable urban areas such as river basins, low-lying areas, coastal swamps and environmentally sensitive areas, causing huge disparities, segregation, fragmentation, inequalities and vulnerabilities. The city faces urban challenges typical of many southern African cities: urban sprawl, segregation, unemployment, slum and informal settlement proliferation, inequality and poverty, hunger, social exclusion, housing backlogs, inadequate infrastructure and a severe lack of service provision. Even when clean water is available, it may not be affordable to the poor. This lack of services renders cities more vulnerable to the impacts of climate change and disasters, as their adaptive capacity is depleted (UN-Habitat, 2014).





Case study: The vulnerability of Luanda (Angola) to climate change impacts (continued)

Projections indicate that Angola would most likely experience increases in temperature and seasonal shifts in annual rainfall in the future. A World Bank aquifer index indicates that Angola is very likely to become a water-scarce country in the future, with a projected decrease in annual runoff of between 30-50 percent (Schellnhuber et al., 2013), as well as a 30% variation in the duration of the rainy season (UN-Habitat, 2014). As a low-lying coastal city, Luanda is vulnerable to sea-level rise, salt-water intrusion and storm surges. It is already exposed to unsustainable large-scale degradation of its coastal area and is expected to increasingly experience coastal erosion, regular localised flooding, and soil degradation. Other impacts comprise heatwaves, droughts, air pollution and high night temperatures. Vulnerable sectors include biodiversity, tourism, health, infrastructure, fisheries, agriculture and food security (Eriksen et al., 2008; UN-Habitat, 2014). Fisheries and market gardening in particular are very vulnerable due to the importance of these industries to the poor and their sensitivity to climate variability (Niang et al., 2014). Furthermore, with Angola's economy being heavily dependent on fossil

fuels, the global pressure for mitigation measures may affect the national economy, and specifically the economy of its cities, such as Luanda (UN-Habitat, 2011).

The aftermath of the civil war in Angola, rapid urbanisation, the lack of urban management and continuous environmental destruction have undermined the capacity of Luanda to adapt to climate change. Slum dwellers are the worst off as they often live in the most dangerous and most exposed areas, have the worst quality housing, and are constantly exposed to various hazards (UN-Habitat, 2014). Luanda needs to urgently address its many urbanisation issues, while simultaneously planning and designing the city to adapt to the impacts of climate change. This could include revising floodlines, upgrading and protecting infrastructure, establishing coastal set-back lines, relocation of vulnerable settlements, implementing early warning systems, and intervening in high-risk areas. Adaptation options should especially be pro-poor.



10.4. Response measures and conclusion

Settlements in southern Africa are highly vulnerable to climate change but have low levels of adaptive capacity. Despite numerous efforts, there is an adaptation deficit in Africa. The lack of adaptation can foremost be explained by a lack of understanding and political acceptance of urbanisation and informality in many countries. Urbanisation is complex and challenging, but should be embraced as a powerful and unavoidable process that represents an invaluable opportunity for development. “Urbanization is not a sub-plot, but rather the main policy narrative for Africa” (Freire et al., 2014), for the urban population will almost double in the next two decades (UN Economic Commission for Africa, 2014). Policy-makers should prioritise and manage urbanisation challenges by planning settlements systematically, enabling concurrent, diversified economic development, investing in infrastructure and basic services, developing institutions, increasing productivity, improving liveability, monitoring long-term risk and vulnerability factors, mobilising local and foreign investors, and by carrying every resident along with their plans (African Development Bank Group, 2012; Freire et al., 2014; Niang et al., 2014; UN Economic Commission for Africa, 2014). In this regard, the urban management and planning function in cities needs to be strengthened to help cities plan ahead for inclusive growth and avoid certain situations, such as the emergence of more urban slums (Freire et al., 2014). However, governments should accept existing informality as a response to the housing backlog, and resist a universal approach of eradication and relocation of slums. Rather, governments should provide the environment and services for informal settlements to become full-fledged, self-sustaining and dignified components integrated into the city (Rajab, 2015).

There are various barriers to local adaptation, which include institutional, cultural, political, social and gender-related aspects. However, adapting to climate change offers an opportunity not only to address the threats presented by the impacts of climate change, but also to address many of the development challenges of existing

and future urbanisation. Successful urbanisation and adaptation are “primarily about coordinating various types of long-run investment” (Freire et al., 2014). A targeted, flexible, differentiated and contextual approach to climate change adaptation is required that reduces settlements’ exposure to events while simultaneously addressing a broader process of poverty reduction, ecosystem stability, social justice and equality, and political and institutional change. Such an approach assumes a constantly changing, complex urban system, place-based vulnerability, and adaptation options specific to the local context, culture and tradition (Mercer, 2010; Faling et al., 2012; Niang et al., 2014).

Often significant financial resources, investment in institutional capacity and technological support are required to build adaptive capacity and implement adaptation strategies at both a national and local government level (Niang et al., 2014). Adaptation options could also be low-cost and simple low-regrets adaptation measures that reduce the current and future vulnerabilities of households and have multiple development benefits. Physical adaptation options could include to design for the efficient use of water; protect high-yield agricultural land, environmentally sensitive areas and natural landscapes from urban sprawl; plan greater interconnectivity between different land uses and transport; intensify land uses where appropriate; revise flood lines; design to cool cities through natural ventilation; retreat, accommodate or protect from sea-level rise; relocate, adapt or safeguard critical infrastructure; create rainwater storage and flood retention areas; plan to harvest water and conserve energy; comply with building codes and zoning restrictions; and structurally adapt buildings (UN-Habitat, 2011; UN-Habitat, 2014; United Nations ESA, 2014; Department of Environmental Affairs, 2014a; Department of Environmental Affairs, 2014b). Soft, pro-poor adaptation options that build resilient livelihoods include social services, safety nets and protection; better water, land tenure and governance security over land and vital assets; and strengthened civil society (Niang et al., 2014).