



Understanding and supporting climate-sensitive decision processes in southern African cities

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For cities to develop in ways that are sustainable, climate-resilient and equitable, considerations of climate variability and change must factor into planning, investment and management decisions. Doing so requires robust, actionable climate information and the capabilities and mechanisms to integrate climate information into complex technical and political urban decision-making processes, with key roles for local governments and universities. Southern African cities are marked by rapid urbanization, weak economies, severe infrastructure deficits, high levels of inequality and informality, and undercapacitated governments and scientific institutions. A growing number of co-production processes supported by decision-support tools, underway in the region, create spaces for engagement and learning about how climate risk features in urban decision-making processes. This paper reviews recent research on how climate information is brought to bear on key city development and urban management decisions in southern African cities, with a focus on the key actors and partnerships involved, illustrated through the cases of Lusaka and Durban. It challenges the emphasis on co-producing decision-support tools, arguing in favor of using such tools in the pursuit of engagement and collaboration across formal and informal actors that shifts the power dynamics of decision-making shaping southern African cities.

Addresses

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Introduction

Rapidly growing southern African cities face significant climate risks posed by existing climate variability and extremes within a context of severe infrastructure and public services deficits, weak local economies, high unemployment, meagre public budgets and widespread informality. Already, many cities experience the negative impacts of climate related extremes, including flooding, water-borne disease outbreaks, drought, power outages and food insecurity. Many of these climate impacts are projected to intensify over the coming decades unless considerable investment is made, and action is taken. As such, the need to factor climate risks into the decisions that shape the development and management of cities is clear.

First the review discusses how the climate and urban agendas intersect in southern Africa, highlighting widespread climate risks, especially in informal areas, and weak devolution of policy making, resourcing and implementation to the local level. We point to the need to take seriously the scale and significance of informality and auto-construction in southern African cities, that is, large numbers of people building dwellings and livelihoods in conditions not (or minimally) regulated and provisioned by the state, when comparing with or transferring lessons from climate policies and plans in cities of the global North.

The third section reviews what multi-scalar climate information is relevant to decisions shaping cities and how co-production processes can integrate such information into decision-making. It supports an increasing recognition that a linear, supply driven flow of climate information has limited impact on decision outcomes. Instead, stakeholder engagement and knowledge co-production is being shown to increase the integration of climate information in decision-making. But navigating complex power dynamics is challenging. In sections four and five the cities of Lusaka in Zambia and Durban in South Africa are used to demonstrate what climate-sensitive decision-making at the city scale entails. Both cities provide documented evidence of co-productive efforts to enhance climate resilience yet are different in the extent and ways in which the climate agenda has developed locally. Lusaka provides a clear illustration of how co-producing climate risk information can shift the policy narrative, from water supply insecurity to hydro-power

shortages affecting water distribution. Durban reveals the importance of sustained efforts to build the capacities and partnerships needed to integrate climate information into measures that address informality and inequality in the city.

The review concludes by proposing to invert the dominant view within the climate domain of co-production processes being the means to create better climate information products and decision-support tools. We suggest that, in complex southern African urban contexts, products and tools can be used as a means to enhance the engagement processes needed to stimulate learning and action. Instead of focussing on climate information products and decision-support tools as being the key to driving decisions that enhance climate resilience, we argue that sustaining co-production processes through which diverse and fragmented actors build mutual understanding and collaborative capacities is key to promoting coordinated decisions and actions to build urban climate resilience.

Governing the climate resilience of southern African cities

Most climate-related research and implementation initiatives in southern Africa have targeted agricultural issues, with a predominantly rural focus. Yet in South Africa and Botswana, urban settlements host 65–70% of the national population and in many other southern African countries the rate of urbanization is high and increasing [1]. Growing urban populations coupled with inadequate investment capacity in many southern African cities has resulted in large numbers of urban citizens living in informal settlements [2]. These areas are characterized by multiple, dynamic communities, realities and economies of auto-construction that develop outside of the formal urban planning and servicing processes [3–6].

Most cities across the region are not well adapted to the current climate, let alone future climate. Addressing climate risks in southern Africa needs to include a focus on growing urban populations and peri-urban areas that characterize cities in this region [7]. Collaborations amongst researchers, government representatives and city stakeholders, undertaken within the Future Resilience of African CiTies And Lands (FRACTAL) project, identified water insecurity and the lack of access to clean potable water, especially in peri-urban and informal settlements, as a critical climate-related concern facing cities in southern Africa [8**]. Flooding was also identified as a priority concern in many of the cities, especially in informal settlements with inadequate drainage infrastructure and a lack of sanitation resulting in disease outbreaks, notably cholera, during floods.

The need to address growing urban climate risks sits in a highly fractured governance landscape in most southern African cities. Decentralizing political, administrative and fiscal power to the local scale has been on the regional policy agenda for decades, but implementation remains weak resulting in fragmentation between urban governance actors [9**,10]. Failures to deliver basic services to a large and growing proportion of the urban population generates high risk conditions. The poor performance of decentralization efforts in many southern African cities accentuates but complicates calls for vertical integration – strategic linkages between national and subnational levels – to meet climate goals [11].

In the southern African context, international donors, financiers and foreign investors have a strong influence over national and local agendas, often with little coherence and coordination amongst them [12]. This partly stems from insufficient generation of local public revenues from taxes and user fees to fund public service and infrastructure operations and maintenance, let alone the expansion and upgrading required to meet climate adaptation or mitigation goals [13,14]. There are serious capacity constraints on implementing policies, strategies and plans, at all levels of government but especially at local government level [15,16*]. In addition, local governments often rely heavily on local academic institutions and consultancies for the generation of data and knowledge. Much of what happens in southern African cities occurs in the informal sphere, mainly through processes of auto-construction, outside of safety regulations and risk management policies [3,6]. Climate information needs to guide formal decision processes, but collaboration and learning across formal and informal actors are essential to address the lived realities of urban climate risk. Recent work on issues of food security, urban food systems, nutrition and health highlights the complex formal-informal linkages and cross-scalar dynamics of decision-making within which climate considerations play out [17].

An underreported constraint on sustaining the city-scale climate agenda is the high turn-over and movement or reassignment of government staff, both political and technical staff. This severely undermines traction and continuity in policy, planning and implementation processes. It partly reflects complex politics at play, locally within and between political parties and between the national and local levels of government, including issues of corruption and mismanagement that obscure and distort decisions [18,19]. The political dynamics are particularly problematic where city governments are led by a national opposition party, that is, vertically divided authority [20,9**]. Without adequately understanding these political dynamics and the levels of influence that various actors hold in the urban space, the capacity to support climate-sensitive decisions from

conceptualization through implementation and review will remain weak and ineffective [21–23].

Supporting climate-sensitive decision-making

Urban vulnerability to climate hazards is not limited to the spatial bounds of the city. Most cities are dependent on water catchments located some distance from the city, some extending across national borders, and hence potentially vulnerable to changing rainfall and evaporation over those catchments, as well as competing water demands from agriculture and neighboring countries [24,25]. Many cities in southern Africa are vulnerable to the reliance of national and regional energy systems on hydropower exposed to changing climate extremes [26]. Food is sourced from elsewhere in the country, from neighboring countries and even from other continents, exposing cities to fluctuations in food availability and prices resulting from climate shocks across the globe [27]. Utilities providing basic services in African cities generally service formally planned and developed areas, while those living in informal settlements rely on alternative strategies to access water, energy and sanitation [28–31]. It is clear that climate hazard information of relevance to cities is complex and ranges from local to global scales.

National governments across southern Africa have committed to developing climate response strategies and plans. Where these already exist, they incorporate a variety of climate information ranging from single global climate model projections through to comprehensive ensemble projections and impacts modelling. However, the climate information is at a national or provincial scale, focused on sectoral impacts, that is difficult to relate to the urban scale [32*,33]. Local scale climate information for urban decision making is often raised as a key gap in the climate information landscape [34*,35,36]. Climate model downscaling enables climate projections to be developed at urban or even intra-urban scales. This is of value in evaluating changing risks associated with extreme rainfall events for engineering design applications [37]. However, while the skillful spatial scale of Global Climate Models (GCMs) should be respected and GCM outputs at scales of less than 300–400 km treated with caution, the extended spatial scale of the urban risk context, through regional water catchments, energy and food systems, means that in many cases, regional scale climate hazard projections can provide useful evidence to inform urban adaptation and resilience strategies. The critical challenge in most southern African cities is making sense of relevant regional or local scale climate information within the complexity of urban decision making. The challenge is not primarily one of information provision, but one of fostering effective multi-stakeholder deliberation over the implications of climate change.

Evidence from recent efforts to better understand and support climate-sensitive decisions affecting southern African cities suggests a need to move away from a narrow, supply driven, product-oriented approach to producing climate information where the underlying premise is that a lack of information is the primary obstacle. Instead, process-based approaches are needed that build capacity, ownership and agency, strengthen relationships and networks, and increase understanding between actors, both at the same scale and across scales [38,39]. Studies on co-production from cities in the global South emphasize contextual characteristics mentioned earlier, such as high inequity and power imbalances between different groups of stakeholders [40–42]. These characteristics need to be considered to enhance the use and value of climate information in decision-making. Co-production processes aimed at strengthening urban climate resilience need to involve multiple actors within and outside government to integrate different forms of evidence relevant to the multiple realities of southern African cities, including climate information. Bringing together a diversity of perspectives and resources is critical in the context of southern African cities characterized by dynamism and informality, capacity constraints, and complex urban climate risks. The influences of power and politics on the outcomes of such processes are being increasingly acknowledged, with growing calls to more explicitly consider these factors in the design and implementation of co-production processes to support decision making [43*,44,45]. More research is needed on how to evaluate co-production processes supporting climate-sensitive decisions, accounting for the intangible nature of various normative and relational outcomes, many of which emerge beyond the lifetime of a project cycle and are difficult to attribute.

Co-producing climate risk information in Lusaka

Lusaka is one of Africa's fastest growing cities with water insecurity a key concern [46]. Lusaka's water sector consists of both formal and a largely unmonitored informal water sector; both of which are exposed to reduced rainfall, declining groundwater levels and quality, and ongoing urban development and growth [47,48]. The Kafue River basin is a valuable natural resource both as a primary water source, supplying roughly 50% of Lusaka's formal, reticulated water, as well as a key component of the country's hydro-power system.

Lusaka was a pilot city for the co-production process developed in the FRACTAL project, centered on a more open and inclusive approach to producing climate change knowledge for urban planning. Multiple types of evidence were included in the co-production process and deliberation of diverse perspectives, urban experiences and agendas was encouraged [49**]. This required

societal stakeholders (e.g. local governments and civil society groups) and scientists alike to be open to various worldviews, the potential to make mistakes and, as shared understandings of contextual climate risks were developed, reconsider appropriate responses. Human relationships were valued with trust between and capacities of local and national government staff, civic representatives and scientists being built to enable a more open, inclusive and flexible approach to co-producing knowledge [50]. This co-productive process highlighted important factors such as the lack of monitoring of informal groundwater extraction, thought to account for as much as 80% of Lusaka's total (formal and informal) water supply.

Through FRACTAL engagements in Lusaka, reliance on the Kafue River for water was identified by stakeholders as a critical climate vulnerability. A regional water resource sensitivity study was undertaken to explore hypothetical shifts in rainfall across the Kafue River catchment, integrated through a water resource model. The results indicated that Lusaka's offtake of water was so small compared to the average flow in the Kafue that even a 50% reduction in rainfall across the catchment would not cause water levels to drop enough to threaten Lusaka's water supply. However, the Kafue Gorge hydropower scheme is vulnerable to drought under current conditions. Low flows already result in energy crises, which in turn create severe water shortages because of a lack of electricity to pump water [51]. The study helped shift the narrative about the Kafue being a potentially limited water resource, to be an almost certainly limited hydropower resource. It demonstrates that a lack of climate information that is robust at urban or intra-urban scales is not always a barrier to constructing information of relevance to urban climate risk. A co-production process to collaboratively construct narrative descriptions of plausible futures under different climate scenarios (i.e. climate risk narratives) was used to share and integrate understandings of climate risk across multiple state and non-state decision-makers and stakeholders [49^{••}]. Despite limited decentralization in Zambia, this space for engagement and learning, has helped Lusaka City Council take initial steps to integrate climate risks into their latest five-year Strategic Plan and the new Water Security Action and Investment Plan [52,53[•],54,55].

Co-producing to strengthen capacities in Durban

While Lusaka is just starting to address climate adaptation at the city scale, Durban has had a longer, more extensive and high-profile engagement on climate adaptation. The climate change agenda has been gaining traction in Durban since the early 2000s [56]. In South Africa, metropolitan governments – such as eThekweni which governs the city of Durban – have been

constitutionally mandated to take on sustainable development and environmental management agendas [57,58]. Officials in the eThekweni municipal government have been instrumental in shaping a city-wide, cross-sectoral climate change agenda and embedding it in political and administrative structures, with a committee and a task team convened by the Mayor's Office and the City Manager's Office respectively. One of the early actions undertaken by eThekweni municipality was to commission a review of global and regional climate change science and data sets and translate these into an understanding of local impacts and potential responses [59,60]. This was used to develop a strategy and set of sectoral plans to mainstream climate measures across municipal operations, including a programme of Community-based Ecosystem Adaptation [56,61]. With support from the C40 network, eThekweni undertook a review of the Durban Climate Change Strategy to formulate an updated climate action plan to align with the 1.5°C ambition of the Paris Agreement. Climate and socio-economic projections for the Durban city region in 2050, visualized using a series of interactive maps, were developed to reassess key climate risks and vulnerabilities and prioritize actions. This work highlighted that it is not only the construction of suitable climate information (at relevant spatial and temporal scales), but also the means through which climate information is brought to bear within complex decision-making processes, spanning the political and administrative domains, that need to be addressed at the city scale [62]. High levels of vulnerability to climate hazards are concentrated in informal settlements across the city [63]. Emphasis is therefore placed on linking the climate agenda to job creation, especially through programmes that create local, low-skilled work opportunities removing solid waste and invasive plants from waterways and revegetating areas with indigenous species to reduce flood risk [61,64,65].

In Durban, various knowledge partnerships have built up between the city government, the University of KwaZulu Natal, local community groups, consultancies, neighboring municipalities and other cities through the Durban Adaptation Charter and then Central KwaZulu-Natal Climate Change Compact [65–67]. 'Learn-by-doing' has been a guiding principle through much of the city's climate-related work. While strongly driven from within the city government, the role of international networks and funding agencies, such as ICLEI-Local Governments for Sustainability, Rockefeller 100 Resilient Cities and the C40 network, have been influential in shaping and enabling the development of the climate agenda in Durban [68[•],69]. These partnerships have not been without tensions and conflicts over priorities, approaches and legitimacy. But they have been instrumental in fostering and sustaining a dynamic and wide-reaching climate agenda at the city scale that is progressively being

mainstreamed and institutionalized into the functioning and development of the city [68*]. The partnerships have been critical in convening spaces that bring together a range of stakeholders and in strengthening the capacity of local climate actors.

Conclusion

Lusaka and Durban illustrate where diverse, emergent and grounded knowledge co-production processes have been central to building a city-scale southern African climate agenda. However, being necessarily iterative and non-linear, co-production approaches are resource intensive [70] and can also surface or compound inequalities [44], just as easily as they can empower and support. Finding ways to engage both the formal and informal parts of the city in understanding climate risks and co-producing workable adaptation options is proving challenging yet essential. This demands new thinking and skills within the climate services community to support climate-sensitive decisions at the city scale in southern Africa. Many operating in the climate services space promote engagement and cooperation as a means to developing a tailored decision-support product or tool [71]. Developing or adapting a climate information product, tool or resource is still widely assumed to get to a better decision and thereby decision outcome. Our review highlights the impact of major informality, weak urban governance structures, and severe capacity constraints in understanding and supporting climate-sensitive decision processes in southern African cities. We argue for the need to invert the emphasis on co-production processes being the means to produce better climate information products to support decision making. Instead we suggest that decision-support products (like climate projections, climate risk narratives and water resource models) need to serve cooperation and engagement processes that stimulate learning and action between diverse state and non-state actors, while addressing the complex power dynamics at play. This should not risk co-production becoming an end in and of itself without societal impact. Processes of co-production, engagement and learning build the relationships, trust, capacities and reciprocity that are critical to arriving at more robust and climate resilient decisions and associated actions. At the same time, these processes must grapple with and reflect the differing priorities and interests inherent in rapidly growing, highly unequal cities developing within a changing climate.

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Conflict of interest statement

Nothing declared.

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- of special interest
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