Supporting climate-resilient urban planning: 10 lessons from cities in southern Africa

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This brief presents key insights on integrating climate information into climate change-related adaptation planning in African cities. The projects – FRACTAL (Future Resilience for African CiTies And Lands) and its successor, FRACTAL-Plus – took place over a seven-year period (2015-2022) in nine cities in sub-Saharan Africa.[1] Here we present 10 lessons learned through the projects, providing examples of key elements that can support long-term, transformational action to build climate resilience (McClure et al., in review).

Context

Vulnerability and exposure to risks created by the impacts of urbanization and climate change pose severe threats to rapidly growing, unplanned and informal settlements in urban areas of low- and middle-income countries (IPCC, 2022). Places that face the greatest risks also have the most limited adaptive capacity and resources to plan for them.

Learning Lab participants gather during the FRACTAL project, Lusaka, Zambia.
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Political, social, cultural and economic structures can hinder or support climate-resilient actions. Climate services have entered into this mix by trying to boost adaptive capacity, typically in the form of user-relevant products such as tools, datasets, reports, and policy briefs. There has, however, been limited evidence that the provision of climate services (when focused on developing information products) help to reduce vulnerability, support adaptation, or work within established policy timeframes (Klein and Juhola, 2014).

We argue that the emphasis of climate services must shift away from a product-driven focus towards services that are driven by decision-making needs and contexts. To this end, we contend that provision or development of a climate information product should be viewed as just one component of a climate service process, rather than its ultimate goal (Daniels et al., 2020). We also contend that the learning, relationships and networks built through climate service engagement processes are more effective than products in leading to long-term climate resilience and sustainability (Norström, 2020). Indeed, our experiences within diverse cities in the FRACTAL projects (see Figure 1) suggest that more durable and sustainable climate-resilient development is likely to emerge from focusing on key aspects of the process of co-production (IPCC, 2022).

1 The cities are Lusaka (Zambia), Windhoek (Namibia), Maputo (Mozambique), Durban, Johannesburg and Cape Town (South Africa), Harare (Zimbabwe) Gaborone (Botswana) and Blantyre (Malawi).

Figure 1: Map of FRACTAL partner cities with focal cities highlighted in yellow and their respective Embedded Researchers.

Lessons

We offer these 10 lessons to guide researchers, practitioners and urban stakeholders designing adaptation projects in both the Global South and North on how to address climate resilience and to prioritize key elements to help transform urban planning with the human and financial resources that are available. These elements inevitably depend on context and different capacity constraints; nevertheless, some key ingredients will enable project managers to think through what is feasible to enable those features that can provide the most impact – regardless of the setting.

1. Facilitate inclusive and empowered collaboration

An empowering foundation for locally led, sustainable urban planning can be provided by using skilled and inclusive facilitation to help diverse stakeholders co-create priorities, goals and knowledge.

Throughout the FRACTAL project, each city held multi-day Learning Labs: transdisciplinary sessions that involved many different interest groups, including city planners, councillors, community representatives, the private sector, civil society, researchers and others. The Learning Labs were designed to identify the most important and urgent common issues that participants faced so as to create a shared understanding of challenges, priorities, agendas and potential solutions. The project team deliberately avoided guiding these discussions of issues from the standpoint of climate science and climate change risks. The team emphasized a context-led rather than context-informed approach. We referred to the key issues selected by stakeholders as "burning issues", and these issues guided all subsequent work.

All engagements were framed as inclusive and open, using a transdisciplinary, participatory, process-driven, iterative design (Koelle et al., *forthcoming*; McClure, 2020; Arrighi et al., 2016). A key aim was to create a "safe space" for dialogue and to ensure all voices were heard to gain a deep understanding of the burning issues. Attention to these details was intended to avoid negative power dynamics that might otherwise have emerged. The process led to high levels of respect and trust amongst participants, promoted co-ownership of and investment in the process and its outcomes, and created long-term relationships and networks that were sustained beyond the lifetime and scope of the project.

"The Learning Labs, think tank sessions, city dialogues and regular in-country interactions helped consolidate partnerships amongst a diverse group of actors who included academia, central and local government agencies, international development organizations and community representatives."

– David Mwamba, Lusaka, GIZ Technical Advisor to the Lusaka Water Security Initiative (LuWSI).

A FRACTAL Fellowship Programme funded by the project provided a series of learning sessions to develop the capacity of local city facilitators to themselves conduct such interactive dialogues and Learning Labs beyond the lifetime of FRACTAL. Before the end of the project in 2021, fellows co-facilitated at external events to allow them to put this learning into practice with partners from different cities.

Playing a game to explore water supply and sanitation issues in Lusaka.
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2. Create formal collaboration mechanisms

Formal institutional mechanisms to link city councils, local universities and the project can ensure that participants have the time and resources to work together.

Formalized institutional processes fostered collaboration between the project, and each local university and council within each city. A Memorandum of Understanding (MoU) between the three institutions enabled seamless sharing of city development priorities (from city officials and practitioners) and climate and social science (from researchers). The MoU made it possible for the project team and researchers embedded within each city to access governance spaces, and for municipal officials to participate in work with scientists (for example, in Lusaka, co-producing much used policy briefs on water scarcity, groundwater exploitation, water quality, sanitation services and flooding or co-producing city climate response proposals).

This formal collaboration provided city officials with a mandate to question research assumptions, contribute resources to the research agenda, and to creatively articulate the FRACTAL value added from their own perspectives, agendas and experiences. This approach created a fertile middle ground where policy and climate science met. It was in this middle ground with the city officials and scientists having clear *locus standi* in the research that FRACTAL delivered innovations, actions and learning, all necessary for locally grounded and inclusive climate resilient development. Setting up such collaborations at the city level centered on building trust and nurturing relationships with patient, assertive and motivated city champions.

"The word is 'transformation'. It is important we transform and not do 'business as usual'. We need to go forward to incorporate climate change. To do so, we need to be a team and not work in silos."

– Windhoek City department representative, 2019.

3. Place researchers in city government

Embedded researchers and local champions can identify and create entry points to set the stage for longer-term impact.

The MOUs (described above) enabled the innovative mechanism of six early-career researchers to become embedded within city councils in addition to their own research institutions. As they became familiar with decision-making and policy processes, these individuals became key to identifying and creating entry points for related climate and other relevant information. They received support from principal investigators, municipal representatives and a dedicated coordinator, who created a space for connecting and reflecting on a weekly basis (Pretorius et al., 2019; Taylor et al., 2021). The project also made use of local champions: highly engaged and proactive individuals in city council departments, local NGOs, or civil society organizations. People in these roles provided information that enabled the project to

be continually reflexive, adaptive and responsive. Indeed, they were central in making decisions about the diverse people to invite to serve as stakeholders, the policy processes that were brought to the fore, and the momentum maintained between events. By virtue of their placement in local governments, the embedded researchers and local champions developed capacity to undertake collaborative and impactful research on climate-related issues, and to understand how such issues are guided by and feed into urban policy and practice. This approach developed the capacity of these early career researchers - for example, a FRACTAL researcher embedded in Lusaka city government went on to coordinate the Lusaka Water Security Initiative (LuWSI) until 2019 (Pretorius et al., 2019; Taylor et al., 2021).

The FRACTAL Embedded Researcher cohort.
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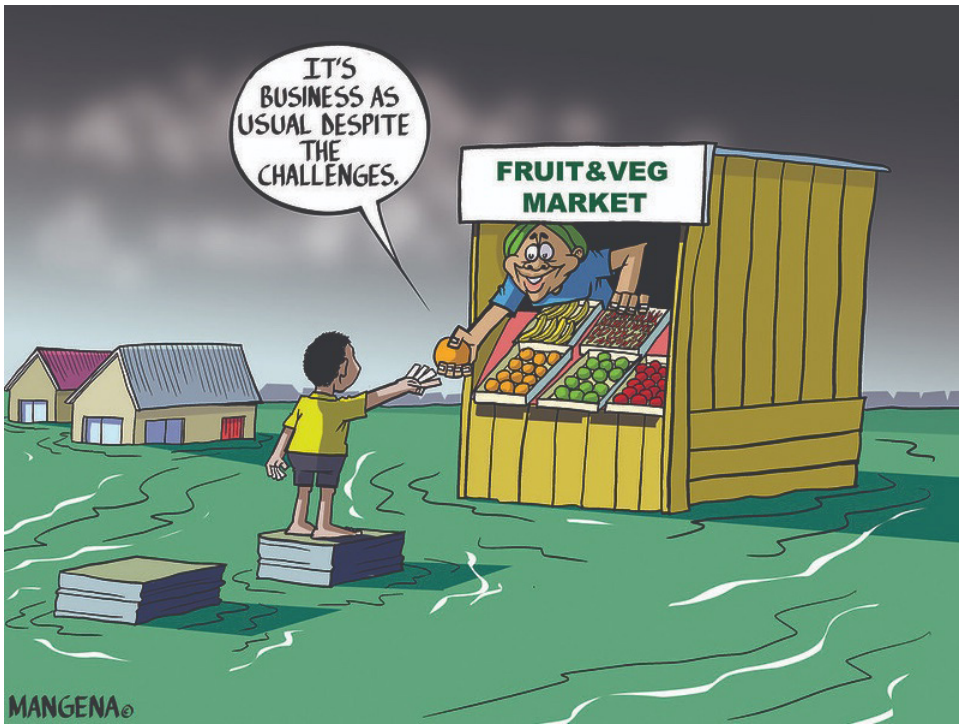
4. Use creative means to exchange different types of knowledge

A holistic understanding of context can be achieved by stepping out of one's comfort zone to consider the lived experience of local people alongside scientific inputs.

Tension can arise within highly interdisciplinary teams that engage in meaningful stakeholder participation. This tension was used as a catalyst for core learning opportunities in FRACTAL. These different lenses proved to be valuable to all participants; indeed, it required some participants to step out of their comfort zones, expand their receptivity and broach alternative ways of knowing (Scott and Taylor, 2019). Making use of a variety of creative activities and multimedia techniques (such as interactive games, role plays, participatory decision exercises, cartoons, and visual models) helped to build trust and create a safe space to contribute and share perspectives (see image, right). To achieve a holistic understanding of context and burning issues, the FRACTAL project went beyond modelling and climate science, to explore stories, surveys, videos, media analysis, other documentation of lived experiences and the psychology driving decisions.



Cartoon depicting the challenges of life in flood-prone inhabited areas of Lusaka
© B.Mangena

FRACTAL engagements showed both the challenges and the value of gathering and integrating such diverse inputs. As an example of a challenge, mass media accounts of flooding events often contrasted heavily with memories of the event among participants who had experienced the disaster. As an example of the value of diverse inputs, the use of flood-risk models and community surveys yielded valuable insights about the experiences and perspectives of inhabitants of flood-prone areas in informal settlements, showing that respondents were living in informal areas that had been prone to flooding for more than 18 years, on average – largely because, despite the flood risks, the area offered inexpensive accommodation, and proximity to workplaces, social networks, and families. As such, field visits were also essential for all participants of Learning Labs to understand lived experiences of the communities impacted by flooding; these trips were always co-organized with and accompanied by community members.

Field visits helped participants appreciate the multiple challenges facing flood-prone informal settlements.
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The climate scientists had to learn new ways to share information, and they had to listen to different perspectives from community representatives, social scientists, and city workers. Thus, creative-communication methods were important. For example, the project used hot seat dialogues, an approach that required climate scientists to have an open dialogue about their thought processes and opinions regarding data and models and the assumptions and uncertainity associated with them. Skits where other actors shared their knowledge in a new format were also used. e.g., through a Climate Evidence Box (Janes et al., 2020), early warning SMS messages, or a piece of theatre, as performed by the Youth Federation Group in George, an informal settlement of Lusaka. The group is affiliated with the Zambia Homeless and Poor People's Federation, a member of the Slum Dwellers International Zambia Alliance. This made science more accessible to people in different fields and to those with non-academic backgrounds and increased understanding about how communication can be better tailored to its audience.

Sharing and interpreting differing types of climate information.
© Tamara Janes

5. Promote trust

A culture of respect and trust promotes collaboration and can lead to more integrated work across disciplines, government departments and governance levels.

A culture that promoted openness, respect, trust, collaboration, and learning (both horizontally and vertically) was a key enabling factor to reach a shared understanding of the causes and potential solutions relevant to burning issues. Relationship and network building supported better coherence, coordination and collaboration at the level of technical planning and implementation, but also created a mutual understanding of the challenges faced by technical staff and senior decision-makers. The approaches used sought to avoid uncoordinated and maladaptive responses, and to seek out opportunities for synergies. For example, in Windhoek, participatory, process-driven, iterative co-exploration processes at different institutional decision-making levels resulted in a strongly matched set of needs between senior decision-makers and technical staff within the Department of Water. In Lusaka, survey results identified the need to strengthen local, district-level governance linkages with flood-management infrastructure, integrated development planning and disaster risk management to avoid incongruencies between high- and local-level plans.

Creating a shared understanding in complex decision contexts benefits from applying a range of participatory decision-support methods and activities for co-exploring burning issues, decision processes, and climate information needs. We found that this approach built trusted relationships, broke down silos, strengthened capacities, and informed city agendas, such as city climate change action plans. For example, applying innovative, participatory decision-process methods (Taylor et al., 2017) is an ideal approach in situations in which relevant data are limited. The processes we used made clear the varying stakeholder preferences, values and priorities; this led to a shared understanding of issues across city divisions and departments and across decision-making levels. In certain city engagements, participants acknowledged that decisions are largely made based on cost, and sometimes on social acceptability; political players are driven by short-term motives, including what will lead to more votes in the next election term. Participatory exercises, such as creating a common language for discussion (Daniels and Bharwani, 2020), and using tailored decision methods allowed for the exploration of issues. For example, stakeholders could discuss what a water-secure city would look like in 2030, and what important factors should be considered in an ideal decision-making process. This helped to lead to deeper consideration of the types of climate information that are relevant, accessible, and useful for each decision domain.

"[FRACTAL engagements]…provided opportunities to stakeholders to think and propose solutions to some of Lusaka's most pressing water security challenges. This helped me gain a deeper insight into climate terminology [and] climate science, and [helped me understand] how important these are for decision making".

– David Mwamba, Lusaka, GIZ Technical Advisor to the Lusaka Water Security Initiative (LuWSI).

6. Examine wider contexts

FRACTAL engagements tackled priority issues from a systems perspective.

The engagement sought to avoid looking at city issues in isolation from the wider regional context, or solely from the perspective of a single driver or actor (Ilunga and Cullis, 2020). The systems perspective allowed participants to consider various scenarios and give them an opportunity to distil assumptions and interrogate models (Jack et al., 2021) that would otherwise appear as a "black box".

Finding innovative ways to co-explore climate risk information, uncertainty, and assumptions in data was key to increasing awareness, understanding and capacity about the potential role of climate information in decision-making. A prime example of this was the role played by climate risk narratives – narrative descriptions of a context under different plausible climate futures which qualitatively integrate climate science evidence with local socio-economic, environmental,

and built environment contextual knowledge and information (Jack et al., 2020). Deriving the narratives and the end product were both valuable; the process of deriving plausible climate futures and discussing with the full group of stakeholders (including but extending beyond climate scientists) was essential in enhancing understanding, and the resulting set of bespoke narratives have been integrated into related planning documents and teaching materials.

Follow-up work demonstrated the limits of climate information when used in isolation. For example, existing information on changes in extreme rainfall in Lusaka did not provide the full story on changing flood risk in the city. To effectively and holistically communicate risks, the project integrated flood-inundation modelling with careful and open deliberation. Discussions addressed how to share, tailor and package information for different groups. For example, mobile phone providers were urged to share actionable information, such as flood warnings, via text messages in multiple local languages.

Stakeholders in Lusaka, Zambia, played games that helped them to think creatively about institutional strengths and weaknesses in accessing, applying and integrating climate information in city-level decision-making.

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7. Help cities learn from one another

Cross-city visits and small grants can help institutions act through increased knowledge exchange, learning, collaboration and innovation.

FRACTAL was designed to support city and academic partners to participate in cross-city exchanges that gave them opportunities to share knowledge and experiences about similar challenges they were facing, and potential solutions they were considering. For example, Lusaka and Windhoek delegates visited Maputo. Durban and Gaborone delegates visited Windhoek. An exchange took place between Harare and Lusaka. In addition the FRACTAL Project also funded the exchanges, using its small opportunity grants, a feature that was part of the project's strategy to allow cities to pursue emerging city-specific topics requiring new research. The exchange visits and small opportunity grants allowed for cross- and inter-city learning and testing of ideas on climate-responsive, urban interventions.

For example, in a visit between Lusaka and Durban, participants shared lessons on the co-benefits of climate-response strategies related to efforts to clean up the Umengi River in Durban. Participants also saw first hand how an engineered dumpsite works. The Lusaka exchange with Windhoek enabled participants to share learning on rainwater capturing and aquifer recharging, effective water conservation and waste management, water re-use on a large scale and the use of public-private partnerships in the semi-arid environment of Windhoek city. The Deputy Mayor of Lusaka exchanged ideas with the Mayor of Maputo on how to set up a climate desk in a city. The exchange visits facilitated learning by doing. The involvement of multiple groups such as community residents, local councillors, municipal staff and scientists allowed for exchange dialogues to go beyond research, and involve examples of concrete actions that cities were taking and discussion on climate actions being implemented in the urban water sector. Further lessons learned included decisive leadership in addressing informal settlements from Harare and community engagements in Durban and Lusaka (Ndebele-Murisa et al., 2020).

City	Key issues	Host city	Purpose
Harare	• Water supply challenges • Low quality water • Poor solid waste management • Wetlands degradation • Integration of climate change into planning at city level	Lusaka and Windhoek	• Understand adaptation strategies • Compare risks and vulnerabilities in the water and energy sectors
Lusaka	• Flooding • Low quality water • Water insecurity • Poor solid waste management • Integration of climate change into planning at city level • Informal settlements	Windhoek and Durban	• Understand adaptive measures • Suggest recommendations for increasing awareness and adaptation capacity • Promote sustainable use and protection of surface and ground water sources in Lusaka
Durban	• Flooding • Informal settlements	(Hosted Lusaka delegation)	• Examine LuWSI and the water security initiatives being implemented for coordination • Develop quick win projects that can be delivered in a short time frame
Windhoek	• Water supply challenges • Low quantity water • Rural-urban migration • Informal settlements	Lusaka	• Bring key city actors together • Share knowledge and experiences related to the ongoing water and climate change work in both cities

Table 1: Summary of key issues, city exchange visits and visit purpose.
Source: Ndebele-Murisa et al., 2020

8. Boost participants' confidence

Developing the confidence of participants (both providers and users of climate information) can be as important as responding to their capacity needs.

Activities described above fed into the co-creation of solutions that were owned by local stakeholders in FRACTAL cities. Local agency was strongly supported by responding directly to capacity development and training needs identified during Learning Labs and other engagements, and through city-specific research, and city-to-city visits.

FRACTAL engagements built capacities and confidence in multiple ways and at many levels. Engagements sought to respond to local needs of stakeholders and institutions as they arose. For example, FRACTAL delivered councillor training in Lusaka and Maputo and transformational climate leadership training in Windhoek (Janes et al., 2020). Workshops were held with city departments (at different operational and decision-making levels) to understand and help address challenges to implementation and barriers to supporting staff in their work (Bharwani et al., 2019). These efforts led cities to collaborate across departments. For example, the City of Windhoek renamed its Climate Change Strategy and Action Plan, making it the city's *Integrated* Climate Change Strategy and Action Plan (ICCSAP); it also committed to including capacity development as a new pillar of the strategy.

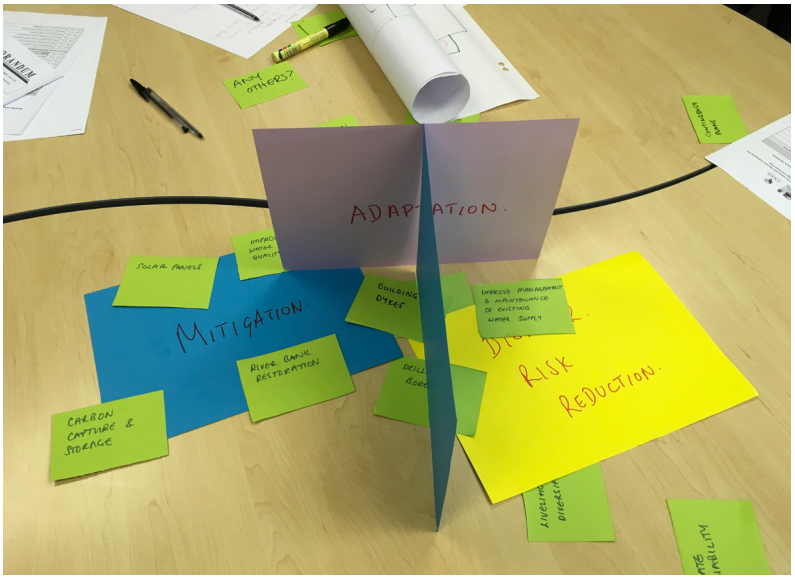
> *"That consensus is there now... one of the major lessons is climate change mainstreaming...[...]... into city operations and also that bridge between academia and local authorities...I think it's the first of its kind. That cooperation between academia and the simplification of scientific information, information of narratives, infographics, that the layman in the city corridors can understand. Those two are very important."*
>
> **– Olavi Makuti, City of Windhoek, Environment Division.**

Further capacity development took place through a final project conference, the FRACTAL Urban Caucus, for cross-city learning and knowledge exchange. This included actors from across the science-society interface from all nine cities and included a visit to an informal settlement in Lusaka and interventions from a youth theatre delegation to share their lived experiences through poetry and role play.

9. Support participants to teach one another

Project participants can learn from one another and can work together in new ways.

The project was deliberately set up to facilitate cross-learning among disciplinary specialties. There were core teams for each city, including internal project-learning clusters on certain issues, such as climate, decision-making and governance. The learning in each team and cluster was iterative, interactive and inter-disciplinary with cluster members bringing together different disciplinary expertise, experiences and skills. The project sought to share information across the disciplines. For example, city-focused core teams shared insights about urban flooding with clusters working on climate science, hydrological modelling, ground water systems, urban governance, and decision-making science.



Creating a common language
© Sukaina Bharwani

This clustering of research groups and work packages within FRACTAL allowed members to learn from one another. Participants had to adopt new ways of communicating with a different disciplinary audience. This sometimes required using a different language or terminology. From a climate-science perspective, engaging within and across clusters provided an opportunity to work in a way that was entirely different to a more traditional science-led approach which may have prioritized climate issues first and foremost. This resulted in immense learning opportunities for scientists involved in the FRACTAL process. This learning emphasized a decision-first approach (FCFA, 2015) for climate scientists within FRACTAL; this approach has since been carried through to many other activities across Africa, Asia and Europe (e.g., beginning with development objectives and embedding and aligning the use of climate information and impact assessments with a broader context).

10. Balance political time horizons

Addressing both short- and long-term benefits can help set the stage for decisions that have the potential to withstand political change.

Improving climate resilience requires joint efforts and a lot of resources of multiple agencies and participants over time. Unavoidably, stakeholders involved must balance the trade-offs between maximizing social goods in the present and in the future (Jacobs, 2016). FRACTAL's work highlighted the importance of implementing solutions that can show both immediate and long-term benefits, sometimes framed as "no-regret" options or those that do not lock planning into a particular pathway, potentially increasing vulnerability in the future. For example, building up effective drainage infrastructure and systems can be seen as offering an immediate benefit by addressing flooding issues that are a current concern; at the same time, it also can be seen as providing long-term benefits by aiding human health and improving the local environment over time. While this may take several generations to benefit from, if infrastructure is correctly planned, it is likely to provide tangible benefits regardless of the intensity and magnitude of future flooding events. Sometimes, activities and policies are prioritized according to their feasibility and political currency rather than their importance. Thus, ideally, issues should be addressed through undertakings that are designed to be robust to changes in political leadership to build trust and engagement of citizens in decision-making. There should be long-term continuity of policy, collaboration and climate action and associated accountability.

"Innovative and strategic solutions should be co-developed to enhance the government's ability, commitment, and accountability to implement flood-resilient policies and interventions in the long term."

– Mayor of Lusaka, Ms. Chilando Chitangala.

Outcomes addressing climate-resilient development

The City of Maputo – The city established a Climate Change Department and created a conceptual early warning tool for climate-induced vector- and water-borne diseases. As of this writing, the concept has been upscaled to the national level by the National Institute of Health (INS) and a FRACTAL partner, with the support of the WHO Mozambique country office. INS is now testing an Early Warning, Alert and Response System for climate sensitive diseases.

The City of Windhoek – The city has developed an Integrated Climate Change Strategy and Action Plan (ICCSAP). The plan is being tabled for final approval with the Council though changes in the governance structures have delayed this process.

First City Dialogue of Maputo, group discussing different city scenarios related to water supply, quality and sanitation in 2040.

© FRACTAL project

The City of Lusaka – FRACTAL has informed several climate and water related interventions in the city including groundwater protection at two major boreholes, sanitation improvement projects in informal settlements, and waste management strategies and actions. Lusaka City Council used policy briefs co-produced in FRACTAL workshops to inform six Local Area Plans (LAPs) for water security investment, the creation of the Lusaka Water Supply Action and Investment Plan (WSAIP), climate action strategies in the draft Integrated Development Plan (IDP) and implementation of the Lusaka Sanitation Project. The IDP will be the first plan to include a specific strategy for climate change action in Lusaka.

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