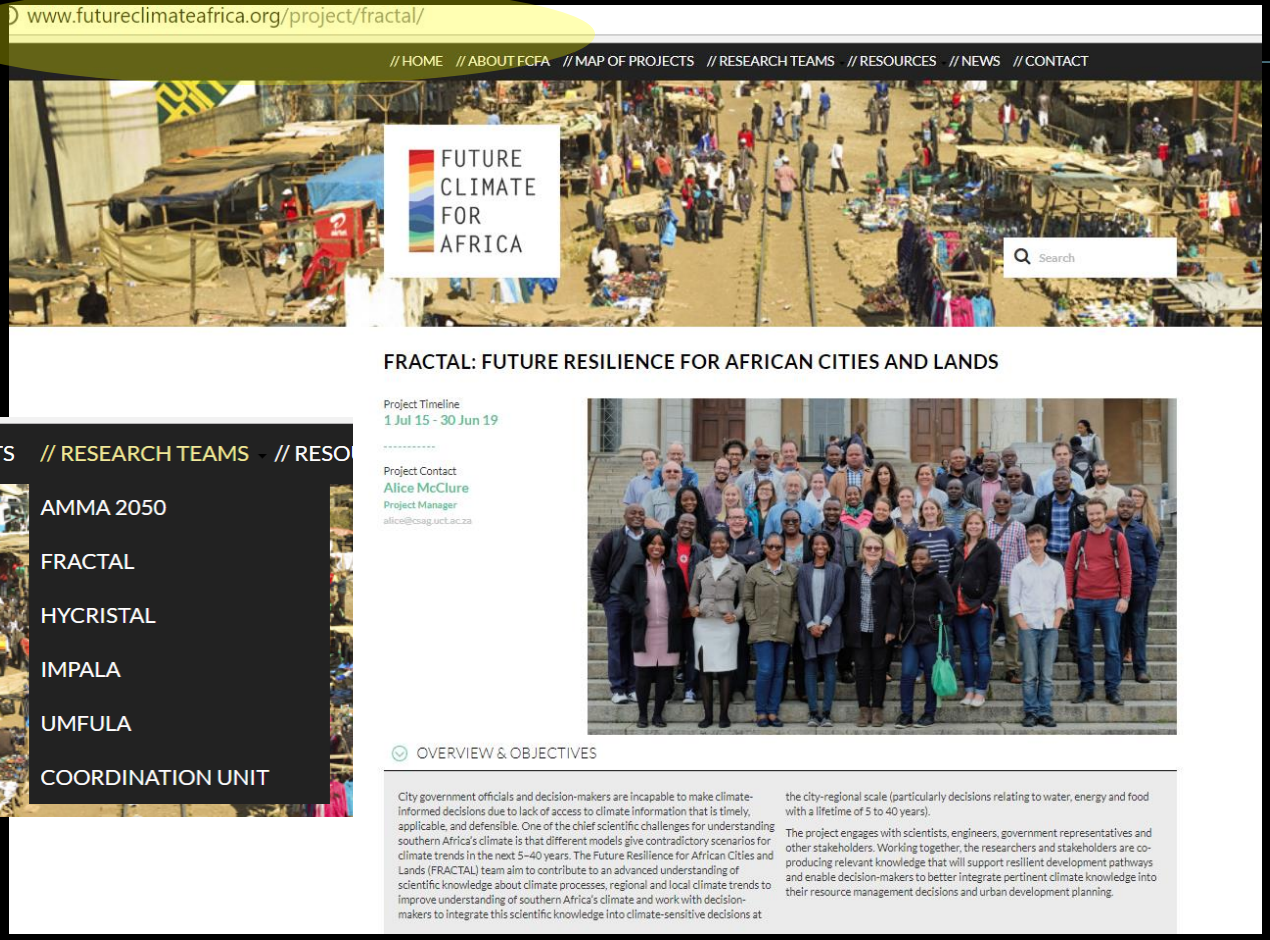

FRACTAL
FUTURE RESILIENCE FOR AFRICAN CITIES AND LANDS



Future Climate for Africa (FCFA) aims to generate fundamentally new climate science focused on Africa, and to ensure that this science has an impact on human development across the continent.

NERC SCIENCE OF THE ENVIRONMENT

FRACTAL

UKaid from the British people

The aim of the FRACTAL project is to ***advance scientific knowledge*** *about* ***regional climate responses to human activities*** *and* ***work with decision makers to integrate this scientific knowledge into climate-sensitive decisions at the city-regional scale****.*

FRACTAL is designed to work ***across disciplines*** *within the scientific community and* ***foster strong collaboration*** *between researchers, city government officials and other key decision makers in southern Africa.*

9 Southern African Cities

LUSAKA | Zambia

Brenda Mwalukanga *Institutional partners have been engaged at the first Learning Lab resulting in joint planning and implementation for water security and resilience. We expect to see more learning and collaboration amongst stakeholders in the water and energy sectors.*

WINDHOEK | Namibia

Kornelia Iipinge *FRACTAL has enabled learning exchanges between Windhoek, Harare and Lusaka. Through city learning processes in Windhoek we have also explored what climate information is needed for resilient infrastructure design.*

GABARONE | Botswana

Lapologang Magole *Researchers from the University of Botswana, together with key individuals from the water sector and city management, have developed climate narratives for Gabarone.*

BLANTYRE | Malawi

Burnet O'Brien Mkandawire *FRACTAL has held an engagement workshop with multiple stakeholders and been part of an innovative discussion paper on a proposal to turn solid waste into energy. Climate narratives have also been developed.*

HARARE | Zimbabwe

Mzime Ndebele-Murisa *GEC funding has enabled research into climate risks, the nexus between climate, water and energy, and decision-making. A successful ER model was implemented. Exchange visits to Lusaka and Windhoek highlighted common water scarcity.*

MAPUTO | Mozambique

Genito Maure *The Maputo Water Dialogue was the first event to bring multiple stakeholders at the city level to the same platform to discuss water issues. It shed light on where the gaps are likely located between producers and users of climate information.*

CAPE TOWN | South Africa

Amy Davison *Through FRACTAL, there has been interest shown in developing learning workshops that bring together City of Cape Town officials and academics in open discussion around climate and climate change.*

JOHANNESBURG | South Africa

Given Mbara, Lebo Molefe and Mzukisi Gwata *The Climate Change Adaptation Framework reports have been presented to section 79 and mayoral committees and a green light has been given to engage further stakeholders.*

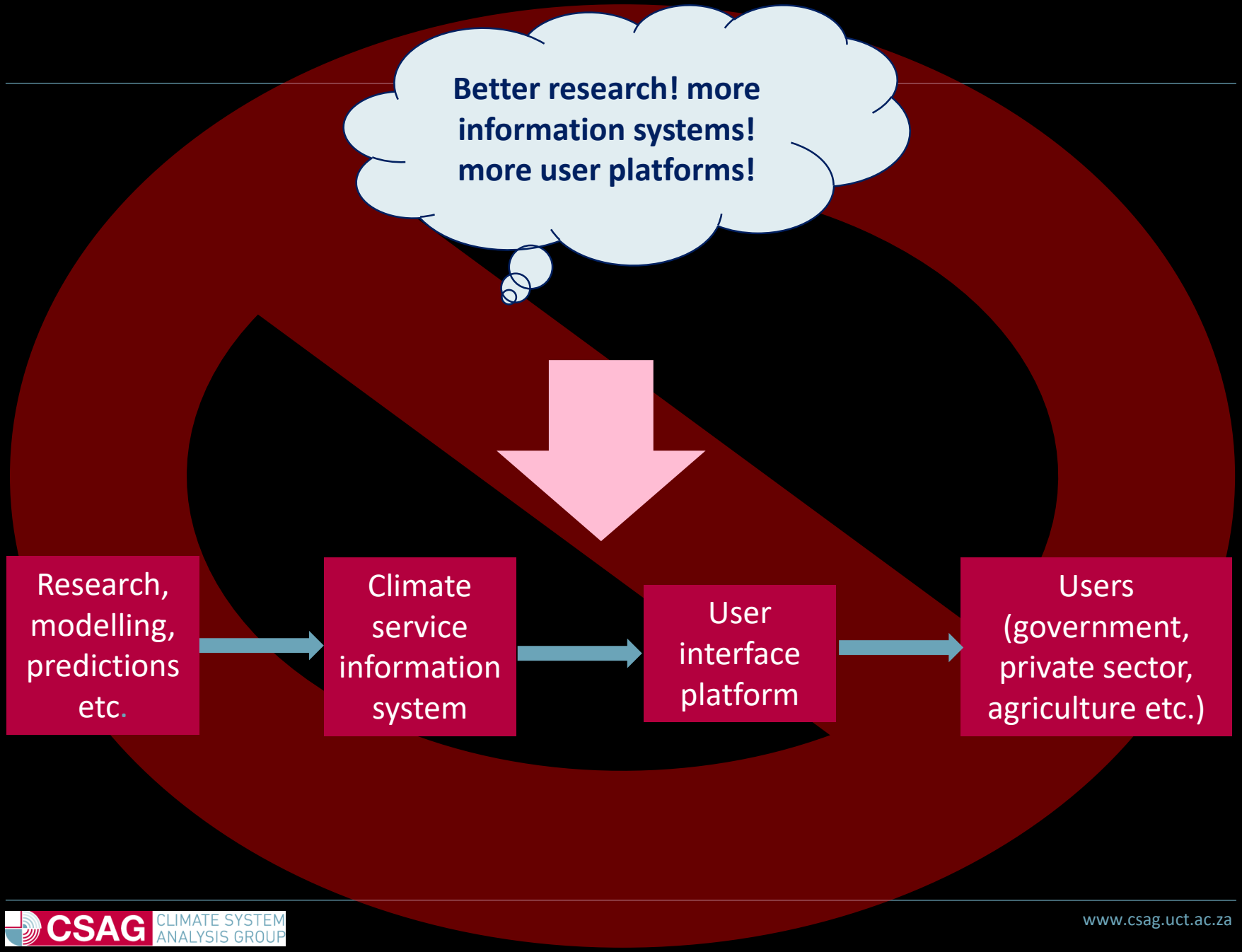
DURBAN | South Africa

Lulu Van Rooyen *FRACTAL has investigated ways to integrate climate change information into biodiversity planning. This has sparked interest in a series of workshops to mobilize climate change knowledge within various departments in the city.*

WORK PACKAGE 1: Unpacks the **city-specific contexts**, asking what are the urban climate change risks and impacts, how resilient are the cities and what decisions are being taken for adaptation and development?

WORK PACKAGE 2: Aims to understand the **decision-making space in the FRACTAL cities** and looks for opportunities to better incorporate climate information into local decision-making contexts.

WORK PACKAGE 3: **Advances understanding of physical climate processes** that govern the regional system (observed and simulated). From this, it develops robust and scale-relevant climate information.


Better research! more information systems! more user platforms!
Research, modelling, predictions etc.
Climate service information system
User interface platform
Users (government, private sector, agriculture etc.)

"Current modalities of climate services are largely supply driven and rarely begin with the multiplicity of climate sensitive development challenges"

Let's try understand the context better before thinking about climate services/information… Why?

- Not all information is **relevant (context dependant)**
- If information is relevant, it doesn't mean it's **significant (time/value/priority dependant)**.

What are the pressing issues in African cities?

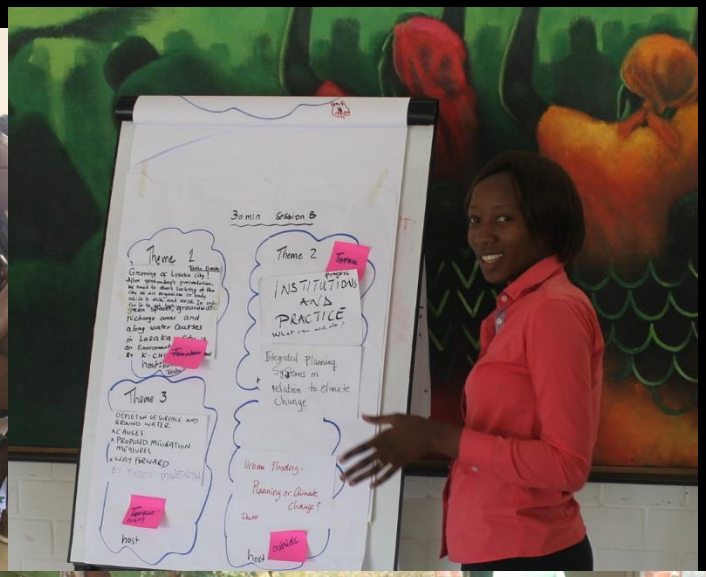
What are the socio-economic and physical elements of these issues?

How will these issues get worse under conditions of climate change?

What climate knowledge can we produce that will help make better decisions under these conditions?

How can we produce this in a way that integrates multiple perspectives?

What are the pressing issues in African cities?

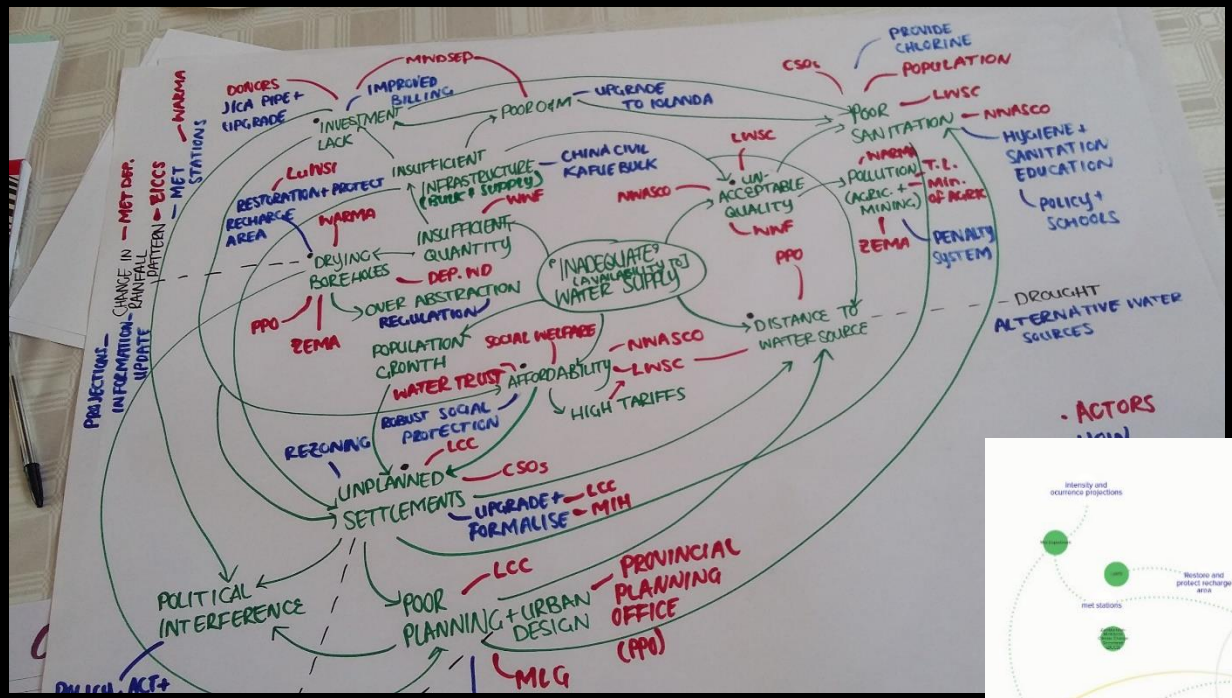


Shut up and listen, listen, listen…

City learning events (video)

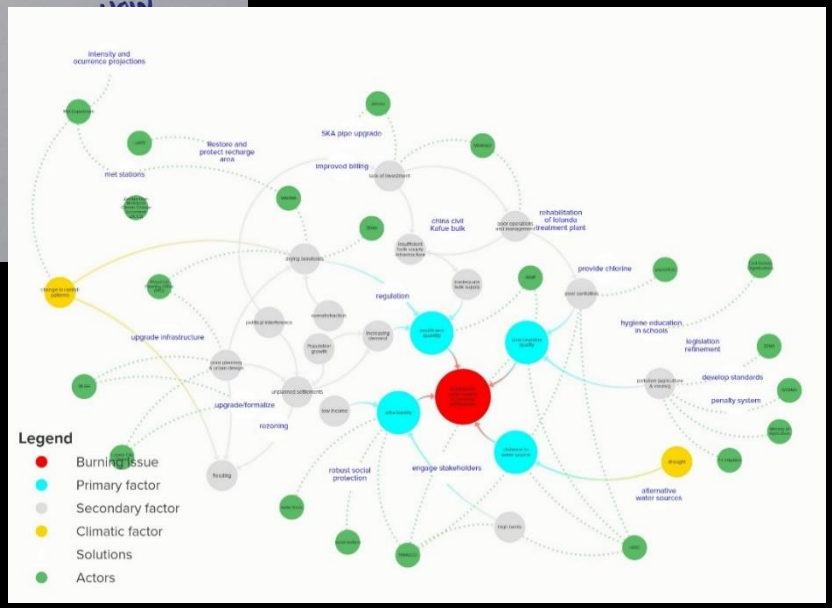
Embedded research (video)

What are the socio-economic and physical elements of these issues?



'Mess mapping' (decision makers, NGOs, researchers etc.)

100+ interviews with government across three cities



More listening and a little bit of talking…

How will these issues get worse under conditions of climate change?

(how does climate fit in?)

An analytical framework

Sources: What data or information is incorporated? This does not include expert prior knowledge
What are the implications or potential consequences of this?

Actors: Who is actively involved in the process?
What are the implications or potential consequences of this?

Intention: What is the intent of the distillation activity?
How does this inform the process and choices made

Audience/context:
Who is either explicitly intended to be the audience, or potentially might constitute an audience or context for use of the information? What is the context for use of the distilled messages?

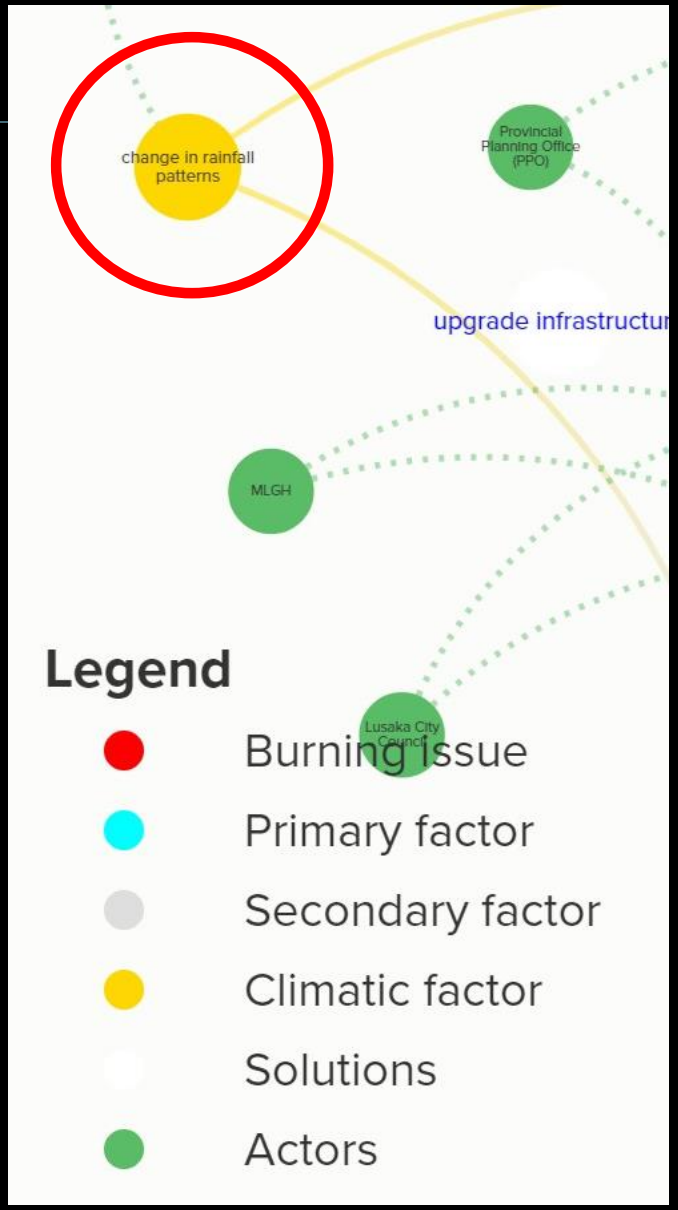
Methodologies: What are the qualitative and quantitative methods used?
What are the implications or potential consequences of this?

Uncertainty and contradictions: How is uncertainty and/or contradictory evidence dealt with?
What are the implications or potential consequences of this?

Decisions: What decisions are made in the process and how are those decisions made?
What are the implications or potential consequences of these?

Transparency: How are the limitations and potential consequences of each decision evaluated and communicated

Communication: How is the process, resultant messages, and limitations communicated outside of the process?



How will these issues get worse under conditions of climate change?

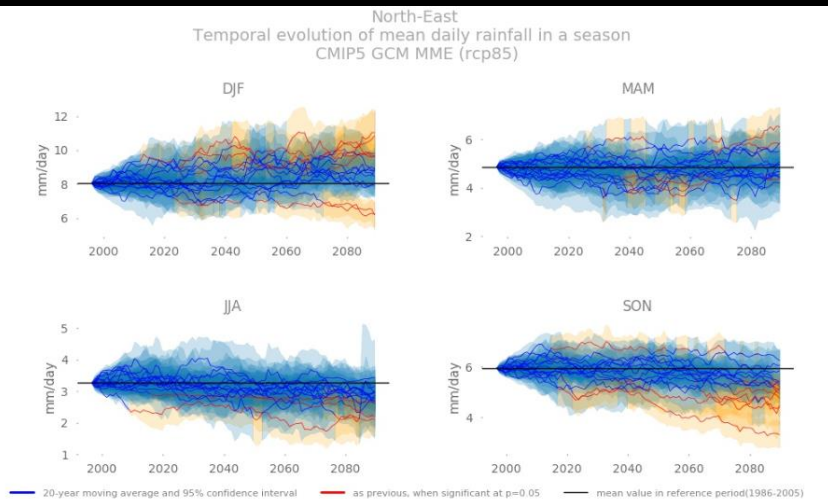
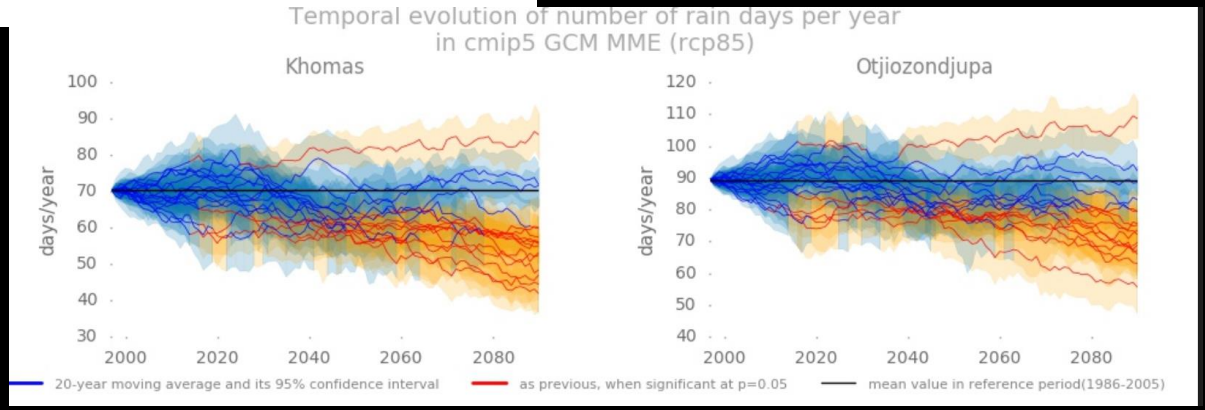


Figure 5: Some model projections show increasing average intensity of rainfall in the core rainy season (Dec-Feb), and some show decreasing, particularly in winter (Jun-Aug) and early rainy season (Sep-Nov).



How will these issues get worse under conditions of climate change?

Narrative #1: "Much hotter with a drier rainy season"

In the middle of the 21st century, Windhoek and the region of Khomas experience temperatures which are much hotter than they used to be. The hottest years which were experienced by the region at the start of the century are now normal. The number of extremely hot days (above 35°C) has doubled on average, although some years are cooler and some are even hotter. The hot weather lasts much longer that it used to with many more extremely hot days being felt at the start and end of the rainy season. In central and northern Namibia, rainfall totals have also reduced since the start of the century. On average, Khomas receives about a third less rainfall than it did previously in the rainy season but this varies greatly year-to-year due to the influence of El Nino and its interactions with local scale processes such as the availability of soil moisture to drive convective rain systems.

Narrative #2: "Hotter with more rainfall later in the wet season"

The climate of Windhoek in the middle of the 21st century is hotter than it was previously. Temperatures are about 1.5 to 2° warmer on average in all months than they were at the start of the century. Extremely hot days are more frequent, particularly in the wet season. Temperatures rise above 35°C on around 75 days of the year; this is an increase of about 50% from the start of the century. Intense convective downpours, triggered by the hot weather and the high moisture content of the atmosphere, occur frequently towards the end of the wet season. However the rains are not reliable and some years are still as dry as the dry years at the start of the century.

How will these issues get worse under conditions of climate change?

20. Use of comparative analysis (now and the future) and figures to make the narrative more befitting.

21. Needs to be work-shopped with more time to comment.

22. Other impacts that could be included:

a. Should focus on the impacts of food security, storm water drainage, health.

b. Local deforestation will reduce biodiversity and people will need to travel farther for firewood

c. high unemployment

d. Urbanization leads to high levels of crime

e. Extreme pressure on health care (Lack of healthcare in informal settlements)

f. Poor sanitation and rise in disease

g. High carbon dioxide emissions from burning coal and firewood

h. High cost of water treatment

i. Water supply disruption

j. For youth, farming is difficult, lack of loans

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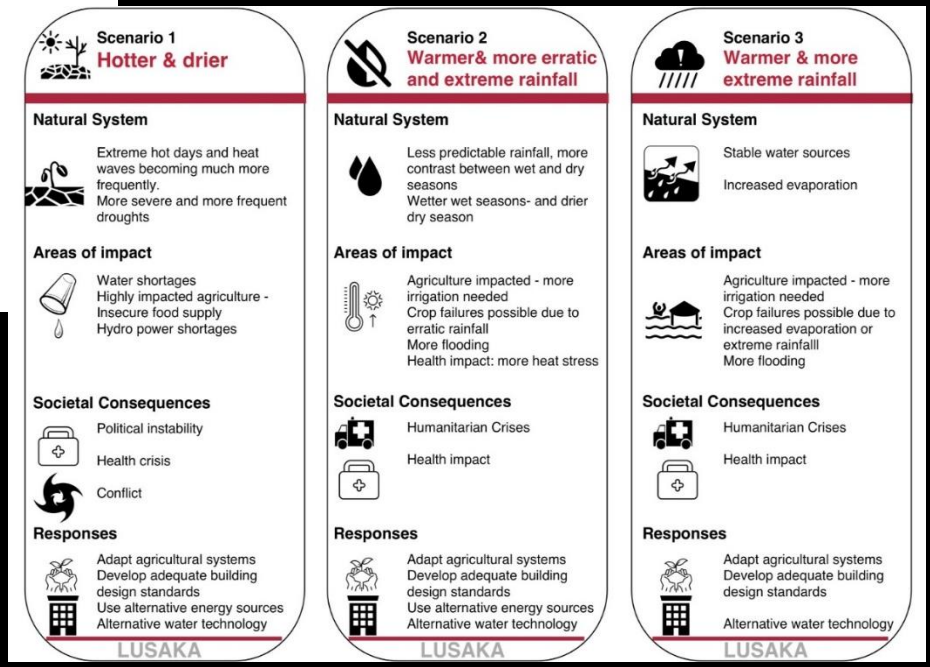

What climate knowledge can we produce that will help make better decisions under these conditions?

Climate science experiments

Lusaka
Here again, flooding is a critical issue and potential changes are important. While the CMIP5 projections evidence rainfall changes from no change to drying, resolving local scale convection responsible for flooding would provide stronger evidence for changes in heavy rainfall in the future

Maputo
In this city, the land/ocean boundary and the role of the ocean in local heavy rainfall may be the most interesting focus. A convective resolving experiment that includes changes in local SSTs, or even a more structured senstivity study looking at the response of local convection to both higher atmospheric moisture, high atmospheric temperatures, and higher SSTs would potentially be informative

Show all 3 replies

Bruce Hewitson
16 Aug 2017

Sorry: "anonymous" above is BH. But going further, this is a relevant question for the FRACTAL Climate cluster general definition of research questions beyond modeling experiments.

Francois Engel...

Political leadership needed to mitigate climate change

WINDHOEK mayor Muesee Kazapua said climate change adaptation and mitigation actions can only be successful with the involvement of political leadership.

He said this at a two-day transformational leadership workshop on climate change for City of Windhoek officials in the capital yesterday.

He emphasised that Windhoek has heeded the global call and national responsibility to tackle climate change at a city level.

The city is indeed busy establishing the relevant policy frameworks to coordinate their response to climate change.

"One such framework is our climate change strategy and action plan, which we intend to finalise by June this year," he said.

Kazapua further explained that the strategy and action plan is the instrument that will guide the actions of the city in the fight against climate change for the next five to seven years.

Speaking at the same occasion, Khomas regional governor Laura McLeod-Katjirua echoed Kazapua's sentiments, saying for climate change adaptation and mitigation efforts to yield any fruits, commitment from political leadership at multiple levels of government is required.

She, however, said the lack of information regarding climate change is seen by some as a critical barrier in dealing with its effects at a political level.

"It is, therefore, crucial that we scale up the efforts to build the capacity of political leaders to effectively deal with climate change issues," she noted.

The training is being facilitated by the Future Resilience for African Cities and Lands (Fractal) entity.

Fractal is funded by the United Kingdom government, and is part of the multi-consortia Future Climate for Africa programme, which aims to generate fundamentally new climate science focused on Africa, and to ensure that this science has an impact on human development across the continent.

The training will end today.

– Nampa

Windhoek Climate Change Strategy & Action Plan

water through the Millennium Challenge Account as a flood control measure.

Lusaka: policy briefs with decision makers

pollute groundwater.
5. Connect households to the sewer network: shift from septic tanks to sewer network, which does not pollute groundwater. In partnership with MCA a project is currently underway, e.g. in Mtendere, Chalala, Mandevu.
Promote water harvesting at household and commercial level - process involves collection of rainwater to be used for various activities.
6. Water trusts: provision of portable water in peri-urban areas using community structures to access clean water.

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Veronica Kalulushi ..., Zambia Homeless and Poor People's Federation
Dr Richard Jones, Science Fellow, UK Met Office Hadley Centre, UK

Dianne Scott
17:29 22 Mar
Delete: *"(Mongu-Lusaka)*

Dianne Scott
17:30 22 Mar

include:

- Discussing the integration of climate and biodiversity information for the Biodiversity Planning Branch, also part of the work for the Durban Climate Change Strategy: Biodiversity Theme implementation.
- Attended SANBI's Biodiversity Information Management Forum

Climate & biodiversity information for Durban

How can we produce this information a way that integrates multiple perspectives?

DURBAN AND LUSAKA SIGN CLIMATE CHANGE ACTION PLAN

IT WAS a historic day for climate change action when a visiting delegation from Zambia signed the Durban Adaptation Charter with eThekwini Municipality to establish its own Climate Change Compact partnership in Lusaka, the capital city of Zambia on 8 February.

Six officials from Zambia attended a two-day Lusaka-Durban Learning Exchange Workshop on 7 and 8 February to learn about eThekwini's various internationally recognised climate change adaptation and mitigation strategies. The aim of the visit was for Zambia officials to also get a better understanding of how eThekwini has established strong partnerships with universities to tackle climate change.

Apart from the robust knowledge sharing sessions, the Zambia delegation was also taken on site visits to see working projects that the City has in place to reduce its carbon footprint and mitigate climate change. The first stop was the Buffelsdraai Landfill and Research Hub, which is the City's environmentally sensitive landfill site and community reforestation project.

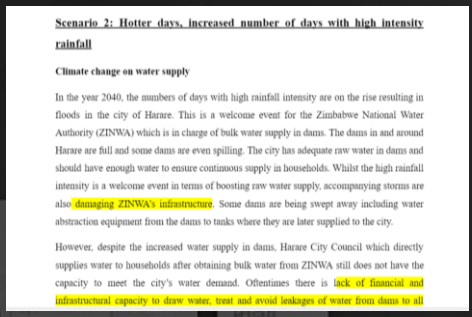
Lusaka city Councillor Lubea Kapapula said he was left in awe at the energy regeneration and clean drinking water projects led by eThekwini.

After visiting the Sihlanzimvelo Community Stream Management Programme in KwaMashu, Councillor Kapapula said: "It is amazing to see how eThekwini has partnered with communities to take ownership of their surrounding natural water supply and keep streams and rivers clean. There are so many excellent systems in place in eThekwini from grand scale projects like generating electricity from methane gas to creating jobs by promoting tree planting. Our team will definitely work with eThekwini to improve service delivery in Lusaka."

Lecturer and Researcher from the University of Zambia, Dr Gilbert Siame said he was thoroughly impressed and inspired by the unique relationship eThekwini has formed with universities.

Workshop facilitator, Dr Sean O' Donoghue from the City's Environmental Planning and Climate Protection Department said: "It's about dealing with adaptation, best practices and climate change challenges."

The visit was funded through FRACSAL (Future Resilience of African CITies and Lands), a four-year research project by the Climate Systems Analysis Group (CSAG) at the University of Cape Town on advancing scientific knowledge on climate change in southern African cities.

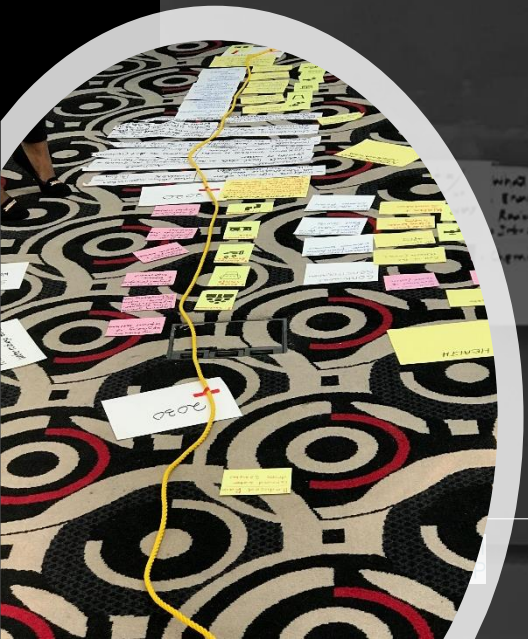


Scenario 2: Hotter days, increased number of days with high intensity rainfall

Climate change on water supply

In the year 2040, the numbers of days with high rainfall intensity are on the rise resulting in floods in the city of Harare. This is a welcome event for the Zimbabwe National Water Authority (ZINWA) which is in charge of bulk water supply in dams. The dams in and around Harare are full and some dams are even spilling. The city has adequate raw water in dams and should have enough water to ensure continuous supply in households. Whilst the high rainfall intensity is a welcome event in terms of boosting raw water supply, accompanying storms are also damaging ZINWA's infrastructure. Some dams are being swept away including water abstraction equipment from the dams to tanks where they are later supplied to the city.

However, despite the increased water supply in dams, Harare City Council which directly supplies water to households after obtaining bulk water from ZINWA still does not have the capacity to meet the city's water demand. Oftentimes there is lack of financial and infrastructural capacity to draw water, treat and avoid leakages of water from dams to all



- City learning processes designed on the principles of co-production/ transdisciplinarity
- Lots of processes (sometimes games) to bring together different types of equally important knowledge
- Scientists/decision makers/NGOs
- Collaboration and learning across cities AND with national government

FRACTAL legacy discussion

- Brought together decision makers and other people who have information in the city.
- Iterative Learning Lab (LL) process and there's evidence of this idea popping up in other places.
- The narrative idea has been developed and expanded and is now making its way into the big, bad world.
- We've begun the conversation about the role of climate information in decision making… this information is sometimes not the most important.
- We've started the conversation related to climate change in the cities in which we're working.
- Built networks and relationships that were previously not in these cities.
- The capacity building work (e.g. Transformational Climate Change Leadership workshop in Windhoek) is going to play a huge role in the FRACTAL legacy.
- A different articulation of 'capacity building' is being developed within FRACTAL, linked to horizontal learning, which challenges the notion of producer-user of climate information.
- The emergent, reflexive approach to research has paid off, which is something we need to document and articulate clearly.

FUTURE RESILIENCE FOR AFRICAN CITIES AND LANDS (FRACTAL)

Growing Climate Knowledge for Action in Urban Africa

climate
better understand southern Africa's climate, its drivers and systemic impacts on city-regions

multiple scales
Explore connections between climate sensitivities and decision-making at urban, national and regional scales

governance
better understand decision-making in southern African city-regions on water, energy, food and climate issues

learning labs
multi-stakeholder learning processes to co-explore and co-produce knowledge on climate-sensitive *'burning issues'*

city dialogues
various city-based trans-disciplinary engagements beyond and between the Learning Labs

city regions
fostering context-relevant yet transferable learning within and between 9 city-regions, to varying degrees

City learning
ongoing and iterative learning processes (including learning labs and dialogues) that drive the co-production of relevant climate knowledge

www.fractal.org.za