Windhoek City Learning Lab Report

Heja Lodge, Windhoek

14-15 March 2017

Compiled by

Prof. John Mfune and Ms. Kornelia Iipinge

Summary

Future Resilience for African CiTies and Lands (FRACTAL) is a four-year project that is funded by the Department for International development (DFID) and the Natural Environmental Research Council (NERC), within the multi-consortia programme: Future Climate For Africa (FCFA). FRACTALs main overarching aim is to advance scientific knowledge about regional climate responses to anthropogenic forcings, enhance the integration of this knowledge into decision making at the codependent city-region scale, and thus enable responsible development pathways.

The FRACTAL Project uses the "learning labs" process, which is transdisciplinary in nature. This process entails co-producing research questions that are relevant for all actors, including academics and practitioners, and knowledge that contributes to answering these questions. The first Windhoek City learning lab on 14th -15th March 2017 brought together stakeholders from a variety of organisations with the objective of framing relevant "burning issues" that would become the foci (pilot studies) for FRACTAL. **"**Burning issues" are defined as a topical development problems that will likely be exacerbated by the effects of a changing climate.

On 14th March 2017 (learning lab day 1), the Deputy Major of City of Windhoek opened the learning lab. This introduction was followed by presentations on the FRACTAL project, Climate-related challenges and opportunities in Windhoek, FRACTAL Project and activities in Windhoek and an overview of the learning lab approach. After setting the scene, participants were divided into groups to identify burning issues and, through a voting process, three burning issues were distilled namely: (i) Water insecurity; (ii) Lack of access to energy in informal settlements; and (iii) Lack of resources and access to services in informal settlements. The latter two issues were amalgamated into one issue, namely: Lack of services in informal settlements

On 15th March 2017 (learning lab day 2), the day was opened by a presentation on the Climate Change context in Namibia and an introduction to the Climate Risk Narrative approach. Which is being implemented in FRACTAL. Moreover, participants identified research questions related to the burning issues identified in Day 1 and mapped institutional actors involved in the burning through group discussions. The stakeholders were also asked on how they could can contribute to and gain from the city learning process.

Reflection sessions were held at the end of the second day. Feedback from participants included *inter alia* the desire to see more grassroots and high-level and representatives. Knowledge co-production processes enable important connections to be made and conversations to take place.

Acronyms and abbreviations

ACC	African Centre for Cities
CDM	Clean Development Mechanism
CoW	City of Windhoek
CSAG	Climate System Analysis Group
DFID	Department for International Development
EIF	Environmental Investment Fund
FCFA	Future Climate For Africa
FRACTAL	Future Resilience for African Cities and Lands
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GDP	Gross Domestic Product
GRN	Government of Namibia
ICLEI	International Council for Local Environmental Initiatives
IPCC	Intergovernmental Panel on Climate Change
MAWF	Ministry of Agriculture, Water and Forestry
MET	Ministry of Environment and Tourism
MoU	Memorandum of Understanding
NamWater	Namibia Water Corporation
NAYORE	Namibian Youths on Renewable Energy
NERC	Natural Environment Research Council
NHAG	Namibia Housing Action Group
SASSCAL	Southern African Science Service Centre for Climate Change and Adaptive Land Management
SDFN	Shack Dwellers Federation of Namibia
SOG	Small Opportunities Grant
START	Global Change System for Analysis, Research and Training
UCT	University of Cape Town
UNAM	University of Namibia
UNDP	United Nations Development Programme

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Introduction and background to the workshop report

Future Resilience for African Cities and Lands (FRACTAL) is a four-year project running from July 2015 to June, 2019. The FRACTAL Project is one of five consortia within the Future Climate for Africa (FCFA) Programme. 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.

The FRACTAL Project aims to:

1. Advance scientific knowledge on regional climate responses to global change.
2. Enhance knowledge on how to integrate this scientific knowledge on regional climate responses to global change into decision making at the city-regional scale.
3. Responsibly contribute to decisions for resilient development pathways through case studies.
4. Use iterative, trans-disciplinary, co-exploration / co-production processes to enhance the understanding of co-production of climate change knowledge.

The FRACTAL-related activities in Windhoek are based on the Memorandum of Understanding with the City of Windhoek (CoW), the University of Namibia (UNAM) and the Climate Systems Analysis Group (CSAG) at the University of Cape Town (UCT).

As part of the planned activities in the FRACTAL project for Windhoek, the first learning lab took place from the 14th-15th March 2017 at Heja lodge, Windhoek, to discuss the burning issues within the City of Windhoek around the water, energy and climate change. In this report "*Burning issues*" was referring to topical development problems that will be exacerbated by the effects of a changing climate. The report covers learning lab activities, an overview of the workshop process along with outcomes and lessons learned from particular sessions.

Workshop process and outcomes

In this section, learning lab activities are described based on the Programme (Annex 1).

Day One

Learning Lab Chairperson: *Mr. Olavi Makuti, Environment Division, Department of Economic Development and Environment, City of Windhoek*

1. Official Welcoming

Dr. Ndeyapo Nickanor, Dean of Science Faculty, University of Namibia

The Dean of the Faculty of Science, Dr. Ndeyapo Nickanor, welcomed members that attended this first Windhoek Learning Lab of the FRACTAL project. Dr. Nickanor's welcome remarks highlighted how Namibia is vulnerable to the impacts of climate change as shown by the increase in extreme weather events and drought. She alluded to how it is critical that strategies be developed to reduce vulnerability to impacts of climate change. Dr. Nickanor further referred to the water crisis in and around Windhoek and high rates of urbanization that pose challenges to the city as a whole. As such, research linking climate change and cities is critical to provide evidence-based relevant climate change information for urban planning and development. She welcomed all members present and

wished them a productive learning lab.

2. Official Opening

Her Worship Mrs. Fransina Kahungu, Deputy Mayor of City of Windhoek, City of Windhoek

Opening remarks for the learning lab were made by her worship the deputy Mayor, Mrs. Kahungu. In her remarks, Her Worship the deputy Mayor also introduced the Honorable Mrs. Sophia Swartz, a Member of the Namibian Parliament and representing the Parliaments Committee of Natural Resources Management. Attendance by Honorable Swartz was clear evidence of political will and engagement. In her remarks, the Deputy Mayor stressed that policies and conventions have not been successfully streamlined at the local city level. She cited the National Climate Change Policy that was enacted in 2011. Mrs. Kahungu was pleased to indicate that while Namibia is just recovering from drought, which lasted for three years, the City of Windhoek launched the Drought Response Plan in 2015: Water crisis restrictions and the "Save Water" campaign. These frameworks aim towards the Zero Tolerance Policy towards saving 40% of the water consumption. The deputy Mayor lamented the fact that in 2017, while heavy rains in Windhoek curtailed the devastating drought, it also caused devastating floods especially in the Northern central parts of the country. Such contrasting disasters constrain effective use of the limited funds to address these environmental problems.

The Deputy Mayor got the audience to read out the last paragraph of the FRACTAL leaflet as she thought these statements were so important: *"The FRACTAL consortium is part of the larger Future Climate For Africa (FCFA) programme (funded by DFID and NERC), which aims to reduce disruption and damage for climate change and to safeguard economic development and poverty eradication efforts over the long-term. In this way, FCFA aims to make new African infrastructure and urban and rural plans and investments more climate-resilient"*. She emphasized that climate change deserves serious focus as it is a key challenge. It is important to highlight that FRACTAL's help is to develop a resilient city.

3. Introduction to FRACTAL Project

Ms. Alice McClure, FRACTAL Project coordinator, Climate Systems Analysis Group, University of Cape Town

First, an icebreaker game was played for all participants to introduce themselves: "What is your name and what does it mean?" This made the room's atmosphere less formal, allowed people to make connections with each other and raised a few laughs.

Ms. McClure introduced the history, aims, and objectives (http://www.fractal.org.za/). FRACTAL Project. The aims of FRACTAL are to:

(a) Advance scientific knowledge on regional climate responses to global climate change;
(b) Enable knowledge on how to integrate this information into decision making at the city response scale;
(c) Responsibly contribute to decisions for resilient development pathways.

A 2-minute video (https://www.youtube.com/watch?v=2UQboYG9kK4) was shown on FCFA as it aims to generate fundamentally new climate science information focused on Africa and to ensure that this science contributes to human development across the continent. By using the infographic below,

Ms. McClure described the role of the city learning processes within the broader FRACTAL project (see Figure 1).

Figure 1: FRACTAL infographic

Table 1: Responses to the key questions raised from the presentation

Question	**Response**
1. How will FRACTAL bridge the communication gap between scientists and policymakers?	Ms. McClure: this is the heart of FRACTAL. She stated that climate science would be discussed in detail on Day 2 of the Learning Lab.
2. How do you address time-scale issues where city decisions on planning and infrastructure are being made now?	Ms. McClure: This is a very important and complex issue. FRACTAL has not chosen a predefined policy topic or cycle to tackle, but, through the city learning process, attempt to provide climate-related information for decisions related to burning issues, which are expected to be exacerbated by climate change in the future. Mr. Koujo: City of Windhoek has burning issues on water supply and energy demand. The embedded researcher should be able to help. CoW needs climate data. Namibia participates in the Intergovernmental Panel on Climate Change (IPCC) process but

	they are not as informed as they would like to be. They need national data for international conversations. They want the hard facts to discuss with the mayor.
3. Clarification on the process and will FRACTAL help with implementation?	Ms. McClure: We should co-produce the knowledge but there are no plans for implementation. Cities should be sharing knowledge and there are funds to do this. Mr. Makuti: Governance analysis is very important.
4. Do other cities integrate or learn from others?	Yes, FRACTAL Project aims to establish a "cross city learning platform"

4. Climate-related challenges and opportunities in Windhoek

Mr. Friedrich Koujo, Manager of the Environment Division in the Department of Economic Development and Environment, City of Windhoek

The City of Windhoek (http://www.windhoekcc.org.na/) is run by a council appointed in terms of the Local Authorities Act, 1992. The City Council of Windhoek is responsible for the provision of the following municipal services: bulk water supply, electricity, service land, develop and maintain road infrastructure, policing and emergency management, parks, and sports infrastructure. The City is run by a Chief Executive Officer. The Council has nine departments, namely:

1. Department of City Police;
2. Department of Community Services;
3. Department of Economic Development and Environment;
4. Department of Electricity;
5. Department of Infrastructure and Water Services;
6. Department of ITC;
7. Department of Human Resources;
8. Department of Finance;
9. Department of Planning and Property Management.

Windhoek includes about 400,000 inhabitants and contributed 44% of Namibia's Gross Domestic Product (GDP). In 1990, informal settlements made up 4% of Windhoek residents but has significantly increased over the years to 29.2% in 2003/4. This has led to the challenge of overexploitation of natural resources (cutting down of trees for energy). The high rates of urbanization are largely due to rural-urban migration.

The name Windhoek means 'place of steam'. Water for the City is drawn from three main dams. Von Bach Dam is about 70km from the city (capacity at between 55-60%) and Swakoppoort Dam is 90km from the city (capacity at 33%) and Omatako Dam. The City acquires 60% of its water from NamWater and 20% from groundwater and 20% from reclaimed water. The reclaimed water is treated to potable drinking quality at Goreangab Water Reclamation Plant then blended with natural water and distributed to all the consumers of Windhoek. The City is faced with limited water resources.

Mr. Koujo stated that he has personally noticed rainfall patterns changing and starting later in the year

(beginning of the rains have shifted from August in the 1970s; to October in the 1990's to January in the 2000's). In 2016, the City of Windhoek launched a water saving campaign "*Save Water*" to urge residents to save 40% of water consumption and the CoW achieved 33% reduction in water used for activities such as awareness, water conservation and retrofitting.

The CoW Environment Division is working with International Council for Local Environmental Initiatives (ICLEI) to prepare and publish greenhouse gas emissions data. However, the silo syndrome between departments is problematic and data is not readily shared. There are also lengthy decision-making processes at the City, which hinder proactive of even reactive action.

Mr. Koujo stated that there is need to think about renewables. He stated that there is no policy on renewable energy but the CoW is in the process of developing a renewable energy policy. CoW energy policy makes it clear that the city only provides electricity to registered customers/houses with title deeds. The private sector has moved to looking at renewables. He informed the participants that electricity is the main cash cow of the CoW and generates about N$2billion. The CoW requires a new power source, as the current one has reached peak demand.

Some interesting projects of the CoW include Rent-a-Drum and the material recovery plant making. The City is a centre of excellence in waste management. They collect recycling waste at the household level and this is sorted and sold in South Africa. In addition, the methane gas extraction project from Kupferberg landfill site is registered as a Clean Development Mechanism (CDM) to sell carbon credits. The Move Windhoek – transport master plan that aims to move away from a car-oriented city is funded by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the Government of Namibia. Furthermore, a spatial development framework is being developed to extend the City's Boundaries of 50km upwards. The Strategic Environment Action being formulated needs to be completed.

The City of Windhoek has the following Acts, Plans, Policies and Strategies that relate to climate change, water and energy:

(a) Namibia Climate Change Policy,
(b) Namibia Environmental Management Act 7 of 2007,
(c) Namibia Water Resources Act,
(d) Windhoek Environmental Structure Plan,
(e) Windhoek's Biodiversity Inventory and Management Plan,
(f) Windhoek's Disaster Risk Management Plan,
(g) Windhoek's Environmental Education Strategy,
(h) Windhoek's Integrated Environmental Policy,
(i) Windhoek's Integrated Transportation Master Plan,
(j) Windhoek's State of Environment Report,
(k) Windhoek's Water Demand Management Strategy (from the late 90's).

Mr. Koujo ended his presentation by indicating some ongoing projects and programs at the CoW. These include but are not limited to: FRACTAL Project, Compact of Mayors, Working group member of national climate change committee and National Greenhouse Gases inventory.

Table 2: Responses to the questions that rose from the presentation

Question	Response
1. What are the challenges to implementing a Renewable Energy policy?	Mr. Koujo: Engineers not sure they believe in climate change. They operate in silos. Engineers want to make money and there is money in traditional sources of energy such as electricity. Policy making process very lengthy and need to outsource sometimes.

5. FRACTAL Project in Windhoek

Prof John Mfune, Head of Department: Department of Biological Sciences, University of Namibia

This session started off with an interesting paper folding game. All participants were given a piece of paper and given some basic instructions on how to fold and tear it. Everyone ended up with a different pattern. Lesson learned were about the importance of not being ambiguous when giving instructions and how we become ingrained in certain ways of thinking. In addition, all participants are unique and all had something to contribute to the learning lab and that there are many ways to solve problems.

Prof. Mfune explained how Namibia will benefit from FRACTAL as the Project connects climate science to urban development in terms of integration of climate science knowledge in decision-making at city-region scale. He stated that Windhoek is undergoing continuous development, some of which is not climate proof. For example, building a block of flats in a riverbed is not climate proof development because it is prone to effects of flooding. Informal settlements are a core burning issue for the CoW as these are here to stay. However, they should be climate-resilient. He then asked how do we promote climate proof-development? Can we understand policy or decision-making processes so that we can influence decisions which are climate sensitive? In addition, capacity building from the multi-stakeholder platform on climate change workshops, training workshops, and peer-to-peer learning exchanges with other city partners will contribute to climate-sensitive urban development.

He also discussed the Small Opportunities Grant (SOG) as an example of an ongoing project of the Global Change System for Analysis, Research and Training (START) Global Environmental Change (GEC) on water security in Windhoek with the three research components:

1. Water Governance: a case study of processes, actors and timelines at the city of Windhoek industrial Effluent Water Reclamation Plant.
2. The impact of drought on water resources used for supply to the City of Windhoek.
3. Water Security and Livelihoods in Windhoek: modeling synergies and hotspots of water demand and supply in the context of climate change and urbanization.

Table 3: Responses to the questions raised from the presentation

Question	Response
1. Is the Ujams water reclamation plant already operational?	Prof. Mfune: Yes, we are looking at the historical situation e.g. what are the powers and policies – how were they used / not used.
2. Can the final water be used for irrigation?	Prof. Mfune: UNAM Masters students will investigate and document the quality and uses of the effluent from the reclamation plant

Comment from Mr. Makuti at this point about the importance of informal settlements. They are here to stay. Residents need dignified structures that are resilient to climate change.

6. Overview of learning lab approach

Prof. Gina Ziervogel, Climate Systems Analysis Group, University of Cape Town

Prof Ziervogel talked about the learning lab approach that focuses on bringing together the experience and knowledge that a diverse group of people bring to the room to identify collective burning issues. This diversity is necessary to understand complex urban problems as well as understand potential holistic responses to these problems. The learning lab process is designed to be transdisciplinary. The process entails academics and practitioners co-producing research questions and knowledge related to problems that are being faced. She noted and explained the following words on the flipchart:
(a) Co-production;
(b) Complex;
(c) Process: the process of coming together of different stakeholders;
(d) Transdisciplinarity.

Table 4: Responses to the questions raised from the presentation

Question	**Response**
Facilitator: Does this feel new (learning lab approach)?	Participant: Words are not new but FRACTAL Project is bringing an extra dimension.
How does the FRACTAL Project measure success?	Prof. Ziervogel: Milestone needs to be reached for Future Climate for Africa program. Have some criteria for evaluating the learning process but we are still learning about FRACTAL's Project learning process.
Do people with different interests from different disciplines have to compromise when they come together?	Prof. Ziervogel: Need to co-design research questions and be willing to leave out material that cannot be compromised on, or does not work in transdisciplinary teams. The transdisciplinarity process is not for everyone, and experts are still needed. But the aim is to bring diverse perspectives and types of knowledge to solve complex problems. Need to focus on agreed upon research questions and keep overarching objectives in mind. Ms. McClure: mentioned the transdisciplinary indicators written by Prof. Scott. Prof. Scott: It is a challenge but normal to feel uncomfortable when new to transdisciplinary working.

7. Identifying burning issues

Mr. Eddie Jjemba, Red Cross Red Crescent Climate Centre and Ms. Niki West, Global Change System for Analysis, Research and Training

The purpose of this session was to identify burning issues in the CoW. The session was facilitated by Mr. Jjemba. To create an interactive atmosphere, he asked participants to pair up with someone they had not yet talked with and not from the same institution. Through a game of shuffling imaginary cards participants generated a list of burning issues. This game led to pairs of participants chatting and writing down two burning issues in Windhoek on a sticky note (see Figure 2). Table 5 indicated the outcome of the brining issues written on the sticky notes by participants.

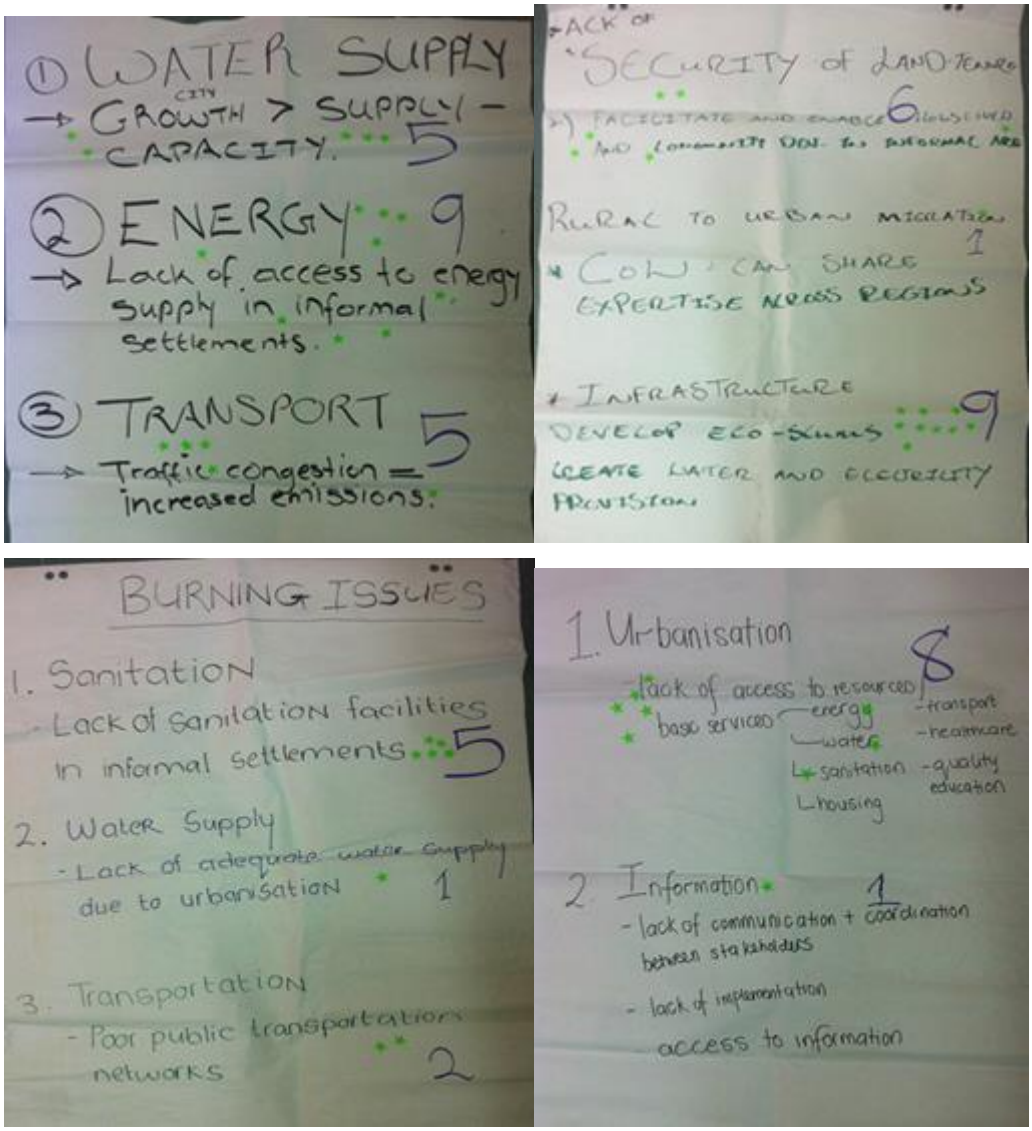
Figure 2: Participants explaining to each other what they wrote as a burning issue

Table 5: Identified burning issues by individual participant

The burning issue	Number of participants
1. Energy (moving from conventional methods to renewable)	1
2. Housing (financing)	1
3. Informal settlement expansion	3
4. Informal settlement to access to energy	3
5. Infrastructure development	1
6. Land	2
7. Land degradation	1
8. Land for settlement	1
9. Land tenure	1
10. Land tenure for urban poor	1
11. Rapid Urbanization (pressure on resources)	4
12. Sanitation	2
13. Transportation	3
14. Transportation (encouraging or creating means for public transport and encouraging environmental friendly means like cycling	1
15. Water (hydrological drought)	1
16. Water crisis	1
17. Water Scarcity	3
18. Water shortage	5
19. Water supply	3

Each pair then walked to the furthest pair in the room to discuss the issues, thereby forming a group of four discussants to further distill the burning issues. The five groups identified synergies and came up

with two or three burning issues which the group wrote on the flipchart (see Figure 3). Each group then presented the burning issues and questions were asked by the rest of the participants for clarity.



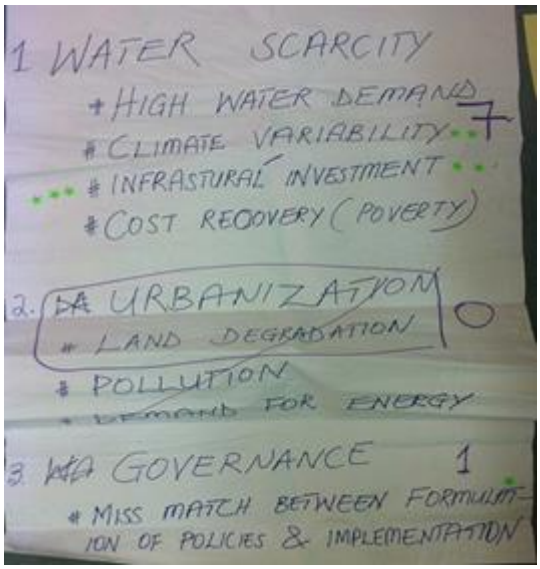


Figure 3: The distilled brining issues by the five groups

After the group presentations of the burning issues described above, participants were requested to reflect on the burning issues presented and vote for the three issues that they perceived to be most important. Ms. West highlighted that, because of the nature of FRACTAL, issues with the strongest link to climate change should be seriously considered. Each participant was given three star stickers to independently vote for what they perceived to be the most crucial issues (see Figure 4). The results from the voting exercise are presented in Table 6 below.

Table 6: Results from the burning issue voting by participants

Burning issue	**Number of votes**	**Rank (based on votes)**
Water supply: city growth exceeds supply capacity	5	5
Energy: lack of access to energy in the formal settlements	9	1
Transport: traffic congestion increases emissions	5	5
Lack of security of land tenure: facilitate and enable household and communities development in informal areas	6	4
Rural to urban migration: City of Windhoek can share expertise access regions	1	7
Infrastructure: • Develop eco-slums. • Create water and electricity provision.	9	1
Sanitation: lack of sanitation facilities in informal settlements	5	5
Water supply: lack of adequate water supply due to urbanization	1	7
Transpiration: poor public transportation network	2	6
Urbanization: lack of access to resources and basic services of energy, water, sanitation, housing, transport, healthcare and quality education	8	2
Information: • lack of communication and coordination between stakeholders	1	7

• lack of implementation access to information		
Water scarcity: • High water demand • Infrastructural investment • Cost recovery	7	3
Urbanization: • Land degradation • Pollution • Demand for energy	0	8
Governance: mismatch between formulation of policies and implementation	1	7

Figure 4: Participants voting on the burning issues

8. Distilling burning issues

Prof. Gina Ziervogel, Climate Systems Analysis Group, University of Cape Town

The top three (3) votes which were identified as the priority burning issues were:

1. Water insecurity
2. Lack of resources and access to services in informal settlements
3. Lack of access to energy in informal settlements

Participants selected burning issues of interest, or that related to their areas of expertise, and self-organised into groups to further discuss the burning issues. The discussions were guided by the following questions and considerations:

1. What are the Drivers, Impacts, Current responses and Potential responses?
2. Link to climate information and governance

3. Additional questions considered:-
   a. Have you captured multiple views
   b. Have you considered how these issues impact on environment, economy, social and political aspects?
   c. What are some of the unknowns?

The outcomes of discussions are presented below.

8.1. Water Insecurity

The Group identified Windhoek water suppliers as dams, reclamation plant and groundwater. The water users: Industry, houses, water carriers, car washers.

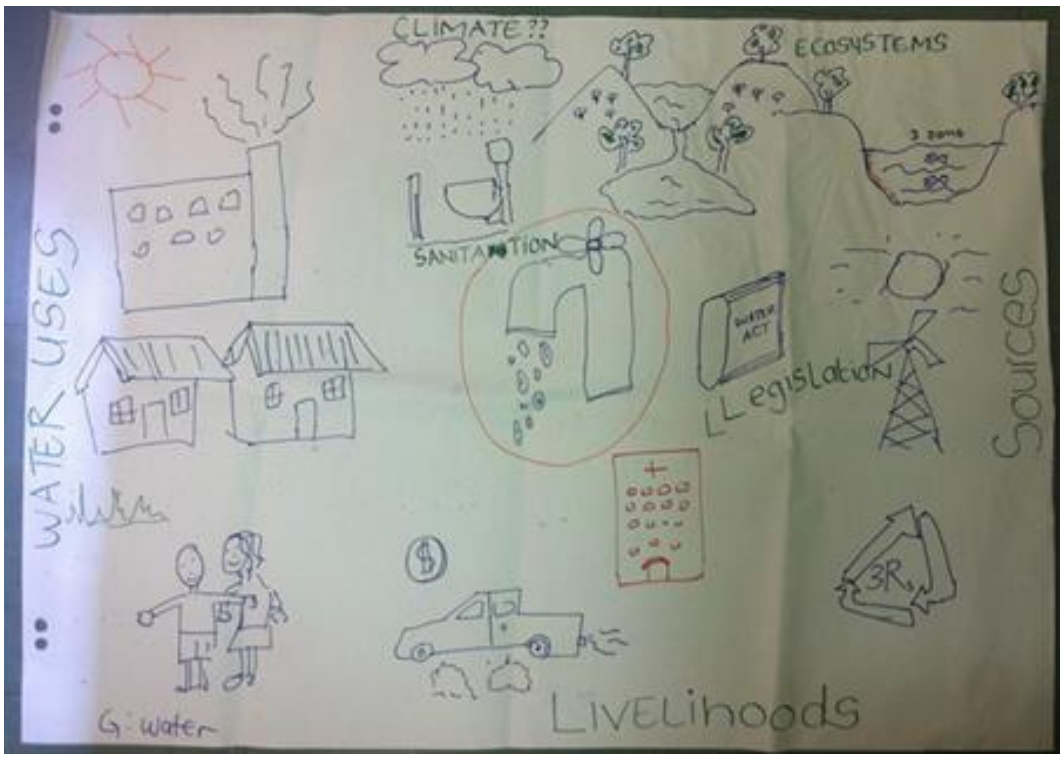


Figure 5: Drawing representing the water system in Windhoek

The group listed the following based on discussions captured in Figure 5:

i. Drivers:

- Urbanization (population growth)
- Climate change
- Industrialization
- Lack of investment for infrastructural development
- Capacity: skilled human resources
- Pollution (water quality)

ii. Impacts:

- Limited water supply (drought)
- Disruption of livelihoods
- Compromised health and hygiene
- Loss of income (unemployment and retrenchment) e.g. brewery and construction

- Unequal distribution of water

iii. Current responses:

- Awareness campaigns
- Established Cabinet Committee on water security – currently discussing inter-basin transfer.
- Extension of Water Supply infrastructure (boreholes)
- Usually rely on Von Bach Dam but drew water from two other dams as well.
- Water Demand Management (Water use restrictions – business, industry, and carwashes). Strategies for management of demand.
- NamWater consulted French company to fix pipes/leakages. They did Environmental Impact Assessment (EIAs) and had dialogues on alternative sources of water.
- Commission of Alternative water sources (desalination, inter-basin transfers).
- Water reclamation – treat portion of wastewater to potable drinking water and semi-treated water for public parks and gardening.
- Artificial recharge of aquifers (in Water Demand Strategies).

iv. Other potential responses:

- Inter-basin transfers
- Further upgrade of water reclamation plant to increase reclaimed water
- Expansion and upgrade of existing infrastructure
- Proposed policy to send water hungry industry to other areas (currently being developed).
- Upgrade old dams – to maximize water shortage. They are very old, and have accumulated silt. What about rehabilitating them so they can hold more water?
- Governance: Doing things differently
- New Water Act needs to be enacted – need regulations. They can't start implementing without regulations. The Water Resources Management Act of 2004 was reviewed to the Water Resources Management Act 11 of 2013. They are almost at their final stage. So currently the old Act is being used.
- Okavango River system is also under pressure so that is a problem. We would have to go to the Inter-Basin Transfer Committee.
- Promote water saving technologies – e.g. for car washing.
- Sooner or later drastic measures will be necessary, e.g. restrict abattoirs, mineral bottling plans, construction industry.
- Instead of using the potable water we are supplying them with grey water which is OK for construction. Workers need gloves. Goreangab Dam being used for that.

8.2. Lack of resources and access to services in informal settlements

Figure 6: Participants busy discussing the burning issue in the Informal settlement Group

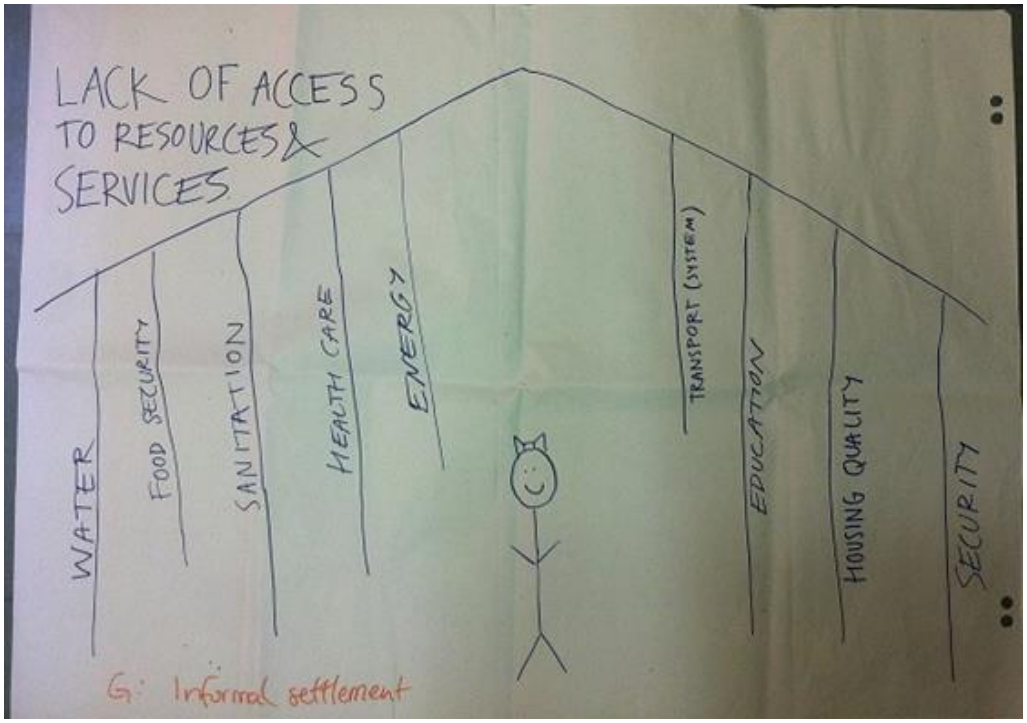


Figure 7: Drawing representing the inadequate resources and access of services in Windhoek's informal settlements

Table 7: Distilling inadequate resources and access to services in Windhoek's informal settlements

Drivers	Impacts	Current response	Potential responses
Lack of affordable service land	Unsafe housing and settlement	Upgrading informal settlement	Pro-active approach (provide serviced land)
Rapid urban growth lack of adequate financial resources	Rapid demand growth on environment and local economy	Supporting local economy	-Affordable building/housing alternative -Formalize informal settlements

Other points that were surfaced during the group discussion about access to services in informal settlements include those listed below.

- What do we mean by vulnerability? What makes someone vulnerable? If one looks at the drought in northern Namibia/Angola, people experience the same effects but are more vulnerable because of their context.
- One of the problems is that informal settlements are perceived as problems and are not often included in city planning policies.
- Resources & services that people lack in informal settlements: water, food security, sanitation, health care, education, housing quality, security, transport system & energy
- There is a need to look at innovative solutions -not regular policy plans/business as usual. Communities need to be involved in solutions related to resources.
- Some of the drivers of the limited resources (listed above) are cross-cutting, some are specific to more.
- Would be good to try identify cross-cutting issues that lead to lack of access to resources & services
- Need to be sure we don't lose sight of the current AND future effects; also focus on what is happening now.
- Access to services and resources in informal settlements is a very complex issue, which is difficult to deal with.
- Demand for services is currently outstripping supply.
- Need to look at what the government can contribute.
- What about a reception areas? How can we increase these?
- Once an area has been formally identified within urban planning frameworks, service infrastructure is implemented. Services that are offered in formal areas can't always be offered in informal areas.

8.3. Lack of access to energy in informal settlements

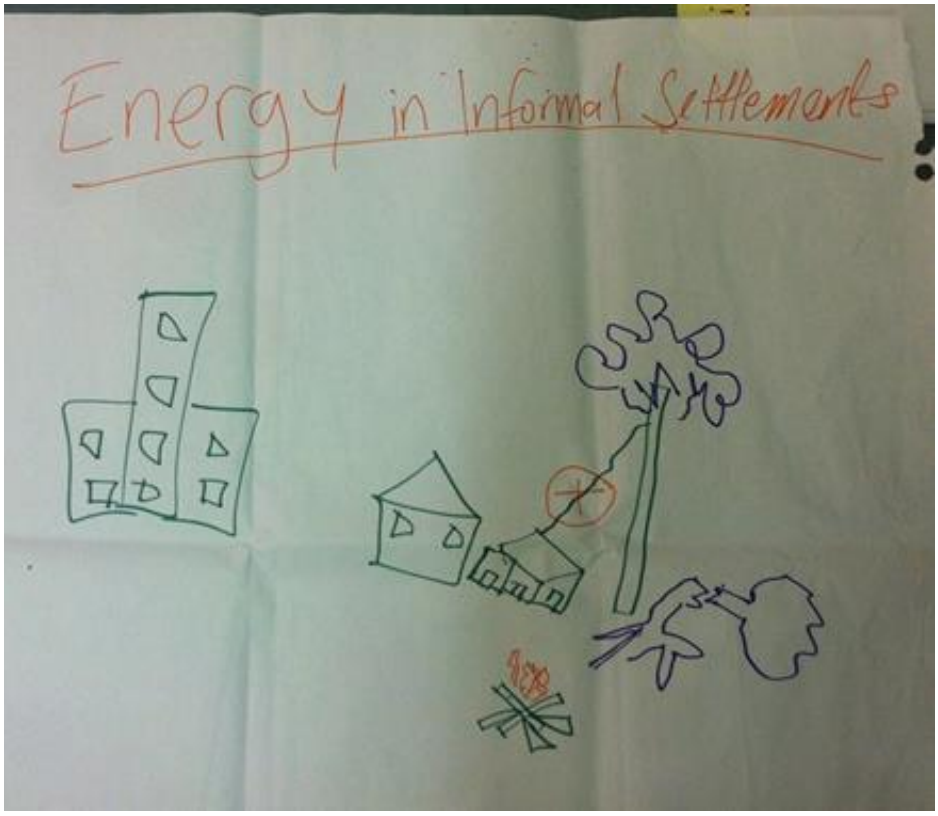


Figure 8: Drawing representing the energy insecurity in Windhoek's informal settlements

Table 8: Distilling energy insecurity in Windhoek's informal settlements

Drivers	**Impacts**	**Current responses**	**Potential responses**
-Slow land delivery of CoW to make land available so people form illegal settlements -Delay to declare township (regulations)	-Illegal informal settlements -Land degradation	-Upgrading strategy -Modernize and plan for the informal settlements	-Introduce portable clean energy -Plan to formalize informal settlements
-Lack of legal framework -CoW doesn't have renewable energy policy -Poor policy incentives for investing in generation	Inhibits investing in power (own) or energy efficient products	New investor IPP Policy formulated	-Private sector driven investment - Consolidation between stakeholders
Affordability especially to clean alternatives	Poor adoption	-Government financing scheme -Interest rates subsidies from Government	-Need portable renewable energy for informal settlements -Use biofuel or more efficient cook stoves

Limitations of awareness on alternative clean energy	People unable to make informed decisions on energy products and services	-Introduce awareness Projects by GRN/NamPower -Solar revolving fund and green soft loan scheme (gov't subsidies and low interest rates) (Ministry of Mines and Energy) -Green soft loan (Environmental Investment Fund)	-Awareness campaigns in vernacular -Need to raise awareness in settlements by talking to people -Safety campaigns -NGOs -Private sector -Public-private partnerships

9. Day 1 Reflections by all participants

Ms. Niki West, Global Change System for Analysis, Research and Training

Participants stood in a circle and each one was asked to give a reflection of what had transpired during the sessions of the day. This was led by Ms. West. Listed below are the reflections.

- Very interactive, met a lot of people, learnt a lot today especially so much about informal settlements. Happy to have met all of you.
- Enjoyed process – open environment – where everyone is equal.
- Opportunity to interact with people from different backgrounds – good to hear other people's background. Comfortable to interact. Good workshop. Expecting more tomorrow.
- Hydrology – interesting to hear how drought trickles down to people on the ground. Every day is a learning experience.
- Truly good - everyone's giving each other a chance to talk. We all think of the burning issues. People really want to take part.
- I did not know about the FRACTAL Project. The workshop is so interesting. It is process based which I have not experienced. An eye opener.
- I expected to sit and get facts. Here everyone is involved. First time I am involved in this. Everyone is approachable – the group is open.
- Experience is overwhelming and I did learn a lot. I can't attend tomorrow but this was the beginning and is the platform for engaging. The problems are here and let's see how we can work together and keep on engaging.
- I liked to meet all of you. My first time to get experience in things I have never learnt before. Most of the things discussed here affect the use of water.
- Work for city – delighted and happy to be here, especially to look at some of these issues which have not been dealt with. I'm glad issues have been identified and let's come up with some tangible recommendations.
- Honorable Mrs. Swartz (Member of Parliament): Thanks very much. Very important workshop. Good to work in groups. That issue of the Act not being enacted. Cannot I make a nice speech of parliament as to when will it come? We need this. There are nice things on paper [the Act] but if not enacted, how can it guide the city? I thank all of you. I will be here to learn again. I will feed back to my Committee.
- Thank you I appreciated it. You take a trip and you learn. Then your mind receives so much knowledge. My mind is still hungry. When will we vote?
- Thank you to organizers. Good platform for learning. When Climate Change is brought out nobody does anything and this programme will address it here.
- I felt out of place coming from the Ministry of Agriculture, Water and Forestry I felt I got the invitation by chance. With time, I have come to realize our role and I also got the opportunity to see the city unpacked. I am a resident but now have some better insights. What are the burning

issues and so forth. A good report will be taken to the Ministry of Agriculture, Water and Forestry.

- Everyone is very passionate and engaged.
- Thanks to organizers – people usually doze in workshops – I have learnt a lot.
- I have been to such a workshop before but here you have the perfect people and discussions have been good. Look forward to tomorrow.
- Three things – very good diverse team. As a young person, this is good for me. Good that the informal representatives are here. It is so good to have a politician from the start to the end; this is the first time I have seen this.
- I had fun. I am still processing two issues. How do we look at issues that are national mandates and those which are local competencies? How will we keep our eyes on climate change?
- Thanks for our invitations. We are proud of our contribution. I was given the opportunity to interact with amazing minds and this was good. Had a lot of fun. I loved the structure – a hands-on interactive process. I cannot wait for tomorrow.
- I am looking forward to the outcome of the workshop to see what practical steps will go forward.
- Glad people willing to share knowledge. In the other learning processes, we did not but people here were good at being part of designing the process as well.
- Prof. Ziervogel: Good quality of interaction in the relationships which will help going forward. So good to understand the complexities of the city and that we are all going forward together.
- Mr. Jjemba: You all had such issues. I am so glad you put your minds and energy into the process. Thanks very much for the energy.
- Prof. Mfune: we have been trying to have this workshop for several months, so now that it has happened, I am relieved. The content is very exciting and I am grateful for you coming and that this is not going to be the end. Thanks to FRACTAL colleagues. I would like us to note that your participation is not over. We will continue to dialogue.
- Prof. Mfune: I am a teacher and some of my students that I have taught are here and I see their contributions and this is my reward that they are contributing.
- Ms. West: Nice to end on positive note.
- Embedded Researcher: Thank you all for coming. I now know more about my role as an Embedded Researcher. Learned a lot from this kind of facilitation.

Day Two

A recap of Day One was delivered by Prof. Ziervogel and she introduced Day Two, highlighting that it would focus on climate change and mapping of the institutions which are connected to the burning issues.

1. Climate Change in Namibia

Dr. Jonathan Kamwi, Department of Environmental Affairs, Ministry of Environment and Tourism

Dr Kamwi gave a summary of the climate change legislation and climate change issues in Namibia. Namibia, while having the least contribution to greenhouse gas emissions, is the most vulnerable and has been hardest hit by the impacts of climate change. Namibia has experienced a rise in annual temperatures over the past decades and changes in rainfall patterns, particularly increase in the frequency of floods and droughts. National climate change committee was formed in 2001. The Namibia Climate Change Policy in 2011 with the Namibia Climate Change Strategy and Action Plan (2013-2020) approved by cabinet in 2014. Namibia has ratified the Paris Agreement. He has noted changes in rainfall patterns. The Climate Change Models give conflicting predictions so hard to trust them. Extension officers in regions do not read journals and conference proceedings.

Table 9: Key questions asked during the presentation

Question	**Response**
What info is used for the projections in the document?	They are mainly concerned with impacts and not with climate projections.
Is there a bilateral agreement about migration?	A new project launched yesterday about the impacts of climate change on migration. Should be implemented by December 2017.

2. Climate Information Narrative

Dr. Laura Burgin, United Kingdom Meteorological Office

Dr. Laura Burgin introduced the idea of climate information, explained climate change and possible impacts and then introduced the narrative approach.

As an exercise, Dr. Burgin requested the participants to read the three Climate Risk Narratives for Windhoek that were based on 2040's predictions (see Annex 3) and provide feedback based on four overarching questions:

1. In what ways would your sector be affected by the future climate given in the narrative?
2. Do you agree or disagree with any statements made in the narrative?
3. Do you think it is a useful aid for interpreting the information given by climate science? and
4. Any other thoughts about this method?

Six groups (two group per narrative type) were formed comprising people from different institutions. Groups that had the same narrative merged and shared their findings. Table 10 below shows the group feedbacks on the climate narratives.

Table 10: Climate narrative feedback from groups

Narrative	Comments
Narrative #1: Much hotter with drier rainy season	• Need to show how the action is being taken. Scenario ignores innovation and opportunities. • Should aim to incorporate positive points. • Many impacts are already being experienced. • Narratives are useful for newspapers to be read by the general public. • How can we contrast what the current situation is with the potential future in the narrative? • How to communicate potential impacts so that they're not downplayed or over-dramatized? • Caution that predictions be proved right or they will not be trusted. Do not want to create unnecessary fear in the public and then have people not trust scientists if predictions do not come true. Do not oversimplify the science. • Local context should be very well represented. • Good communication tool but need to have an in depth knowledge of local context to translate climate science into an accurate narrative. • Already conflict between Namibia and Botswana over Okavango River • It would be hard to translate narratives into indigenous languages • Other impacts that could be included: o food security, o storm water drainage, o Poor sanitation and rise in disease o Extreme pressure on health care (Lack of healthcare in informal settlements) o Local deforestation will reduce biodiversity and people will need to travel farther for firewood. o Urbanization leads to high levels of crime due to high unemployment rate. o High carbon dioxide emissions from burning coal and firewood o High cost of water treatment o Water supply disruption
Narrative #2: Hotter with more rainfall later in the wet season	Question 1: Sectors • We have the environmental sector (City of Windhoek), the energy sector (NGO) and 'people and the environment' (UNDP) - mainly the informal settlements. • UNDP – This scenario does not look good for vulnerable people. With increased population – stresses related to water supply. Late rain – shorter rainy season – not enough water. • Informal communities will be affected by heavier storms. Every rainy season there is already a problem. Buildings in river beds will be flooded. • People block drains because they use them as conduits for illegal electricity. Electricity officials refused to clear culverts fearing witchcraft. This causes flooding – more extreme flash floods. Drains are in the river beds so there are health implications as well. Question 2: Agree or disagree

	• CoW: Rain not relevant to Windhoek as we get water from catchment (upper Swakop) which is much further north and has higher rain than Windhoek. This rain is stored in two dams which are about 200 km away so it is the rain there that would be relevant. • Do not agree about still being dependent on hydropower energy in 2040 as the country would have moved to Renewable Energy by then. Question 3 and 4: • They find the narratives useful and prefer these to graphs • Should focus on the impacts of limited water supply, food security, storm water drainage, health. • Health and sanitation should be brought out and strengthened. • Need to target the narratives as specific groups. Perhaps too technical for some. Include perspectives from different groups, maybe different formats. • Khomas mainly has small livestock and game farming. Irrigation mostly in the north. • City will be stressed by urbanization • There will be high demand for solar • Hydro-electricity is not used, use of renewables in general instead. • The city will use renewables in 2040s – use present tense again. • Definitely, a useful aid – but need a target audience. Not for the person on the street. • Should be less boring looking. Pictures and more order with sub-headings. • Good for policy makers • Assumes a lot. Should be more factual. • The wet season should be rainfall season. • Weather clarified: do not understand the 75 days. • Need to discuss the increase in intensity. • Recharge should be inflow. • What about informal settlements. • No irrigation systems near Windhoek. • The vector-borne disease should mention human disease too. • Wastewater/grey-water is used for watering playing fields.
Narrative #3: Warmer with similar rainfall	• Need to define the words El Nino and La Nino in simpler words. • Agree it's getting warmer and this is noticed by the public. • Minimal investments made, but steps have been made in artificial recharge schemes. • Farmers – not sure about this area. • Should look at development plans. • The narrative is useful for planners and policy-making. It can be strengthened. A suggestion is to include some comparisons of current temperatures with future predicted temperature so people can imagine the how much hotter it will be. • It is good information. It is a possibility. Useful in any decision-making. • Vector-borne diseases are now a problem – with increased rain more vectors. Maybe the impacts could be described per sector such as health and agriculture. • It needs maybe a structure with sub headings and perhaps some visuals. • Policy makers would find it useful but it could be made simpler for other

	ordinary stakeholders.

Overall group discussion on climate risk narratives:

a. Not all will be doom and gloom as reflected in the narrative. There is need to focus on innovation which is often a product of crisis situations;

b. Avoiding distorting facts when simplifying;

c. Point out that there is a degree of uncertainty on the climate risk narratives;

d. What difference do these narratives predict in 2040 with what is happening now?

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

3. Research Questions identification

Prof. Gina Ziervogel, CSAG, UCT

A recap of the Day One activities was done by Prof. Mfune who with the participant's approval merged burning issues related to informal settlements (energy and access to services) into one. Therefore, the two burning issues identified were i) water insecurity for the broader Windhoek region; and ii) access to services (water, energy, land) in informal settlements.

In the two different groups, participants were asked to pair and note down two key burning questions, the results of which are shown in Table 11 below. The FRACTAL team participated in this voting activity.

Table 11: Key burning questions identified and the voting outcome

Key Burning Questions	**Total Votes**
Water Insecurity	
1.a. Research on smart-water use technology in the city? 1.b. What are the water saving technologies at household scale for different stakeholders?	6
2. How could water be equitably distributed among all groups in the city into the future?	5
3. How much water is used by different stakeholders per unit time (year/month etc.) and amounts of unaccounted for (leakage) water? 4. What is the relationship (pattern) between water consumption and population growth?	4
5. What are the impacts of climate change on water quality?	6
6. How should water-related policies be reformed to include climate change implications	9
7. What is the capacity of dams considering sedimentation?	1
8. Research on the potential environmental impacts of the inter-basin transfer?	1
9. What climate information would be necessary to plan for new water infrastructure?	10

Services in Informal Settlements	
1.a. We want to know the extent of knowledge of the people in informal sectors with regards to Climate Change, resilience on their settlement inter a lia, City of Windhoek upgrading of informal settlements. 1.b. How well informed are residents in an informal settlement on renewable energy?	3
2. What are the barriers apart from financial that prevent the adoption of renewable energy technologies?	10
3.a. What is the specific need on energy in informal settlements? 3.b. Energy census to quantify energy denied and use of people in an informal settlement. 3.c. Solar need and desirability assessment (Income plus expenditure data)	3
4.a.The gap between awareness plus information and implementation. 4.b. Are there any innovative grass root solutions offered?	5
5. What are the policy and institutional arrangements that have an impact on informal settlements?	4
6.a. How much does the household spend on water per month? 6.b. What is the water demand in informal settlements? 6.c. What is the lack in the current sanitation service provided by the municipality?	8
7.a. Who are the role-players from an awareness end? 7.b. What are the gaps with information and coordination between different stakeholders especially in informal settlements?	6

4. Institutional mapping of two main burning issues

Prof. Dianne Scott and Dr. Davison Muchadenyika, African Centre for Cities, University of Cape Town

This session was led by Prof. Scott and Dr. Muchadenyika. The participants were divided into two groups to map out institutions and actors related to the burning issues in the City of Windhoek.

4.1. Water insecurity for the broader Windhoek region

Water availability in the city of Windhoek was voted as a very important burning issue in the city and peri-urban areas. This group was led by Prof. Scott were the participants were then divided into groups to list or map out institutions that are actors or those involved in or with water issues in the City of Windhoek. The group listed the following institutions below:

1. Ministry of Agriculture, Water and Forestry (http://www.mawf.gov.na/) - Directorate of Water Resources Management (DWRM) and Directorate of Water Supply and Sanitation Coordination (DWSSC).

2. NamWater (https://www.namwater.com.na/)

It is a commercial entity supplying water in bulk to industries, municipalities and the Directorate of Rural Water Supply in the Ministry of Agriculture, Water and Forestry. The Directorate of Rural Water Supply supplies water to rural communities.

3. Ministry of Environment and Tourism- Department of Environmental Affairs (http://www.met.gov.na/about-met/environmental-affairs/273/); Division of Multilateral Environmental Agreements (MEA) that include Climate Change Subdivision and Biodiversity and Sustainable Land Management Subdivision.
4. Desert Research Foundation of Namibia (DRFN) (http://drfn.org.na/)
5. Ministry of Fisheries and Marine Resources
6. Ministry of Mines and Energy

7. Upper Swakop Basin Management Committee
8. Ministry of Regional and Local Government
9. Cabinet Committee on Water Security (National Assembly)
10. Cabinet Committee on Natural Resources (National Assembly)
11. Water Advisory Council (in the Water Act to advise Minister)
12. Permanent Okavango River Basin Water Commission (http://www.okacom.org/)
13. University of Namibia
14. Namibia University of Science and Technology (NUST)
15. National Commission on Research, Science and Technology (http://www.ncrst.na/)
16. City of Windhoek (Council; Department of Infrastructure, Water and Technical Services; Department of Economic Development and Environment)
17. Donors:
    a. Environmental Investment Fund (http://www.eifnamibia.com/)
    b. Global Environment Facility (GEF)
    c. BCG donor on recharge aquifer study
    d. United Nations Agencies (UNDP, UNICEF, FAO, UNESCO)
    e. World Bank
18. Windhoek Goreangab Operating Company (WINGOC)
19. Ujams Wastewater Treatment Company: industrial wastewater
20. Namibia Chamber of Commerce and Industry (NCCI)
21. Aqua Services & Engineering (PTY) LTD
22. Veolia
23. VA Tech Wabag Ltd (WABAG)

Figure 9: Presentation of the institutional mapping in the Water Group

Figure 9 shows how the group 'mapped' the most influential institutions responsible for water provision in Windhoek. The size of the circles indicates the level of influence. It is evident from Figure 9 that the Ministry of Agriculture, Water and Forestry (MAWF)'s Directorate of Water Resource Management (DWRM) and Directorate of Water Supply and Sanitation Coordination (DWSSC) together comprise the most influential institution with NamWater a close second, and the City of Windhoek (CoW) as the third most influential institution. The three observations made were that:-

a. the institutions mandated in the Water Act are not as active as they should be;

b. There are fragmented relations amongst the water and sanitation institutions and;

c. Donor funding is quite critical to ensuring local water and sanitation supply and distribution in the city.

4.2. Services in informal settlements

Inadequate services (access to energy, resources and services) in informal settlements in the city of Windhoek was voted the second important burning issue in the city and peri-urban areas. The activities within this group were led by Dr. Muchadenyika.

List of Institutions related to access to services in informal settlements in Windhoek:

1. Shack Dweller Foundation of Namibia (SDFN)
2. Community Development Committees (SDCs)
3. City of Windhoek
4. Ministry of Urban and Rural Development (MURD)
5. Ministry of Land and Resettlement
6. Ministry of Poverty Eradication
7. Office of the Prime Minister

8. Universities (UNAM and NUST)
9. Ministry of Mines and Energy
10. Policies and Laws
    a. Vision 2030 (http://www.gov.na/vision-2030)
    b. National Development Plan
    c. Harambee Prosperity Plan (http://www.gov.na/documents/10181/264466/HPP+page+70-71.pdf/bc958f46-8f06-4c48-9307-773f242c9338)
    d. Sustainable Development Goals
    e. National Housing Policy (http://www.ohchr.org/Documents/Issues/Housing/sub-nationalgovernments/201114_Response_Namibia2.pdf)
11. Other organizations:
    a. United Nations Agencies
    b. Red Cross
    c. GIZ
    d. Local Churches

Figure 10: Institutional mapping for Informal Settlements Group

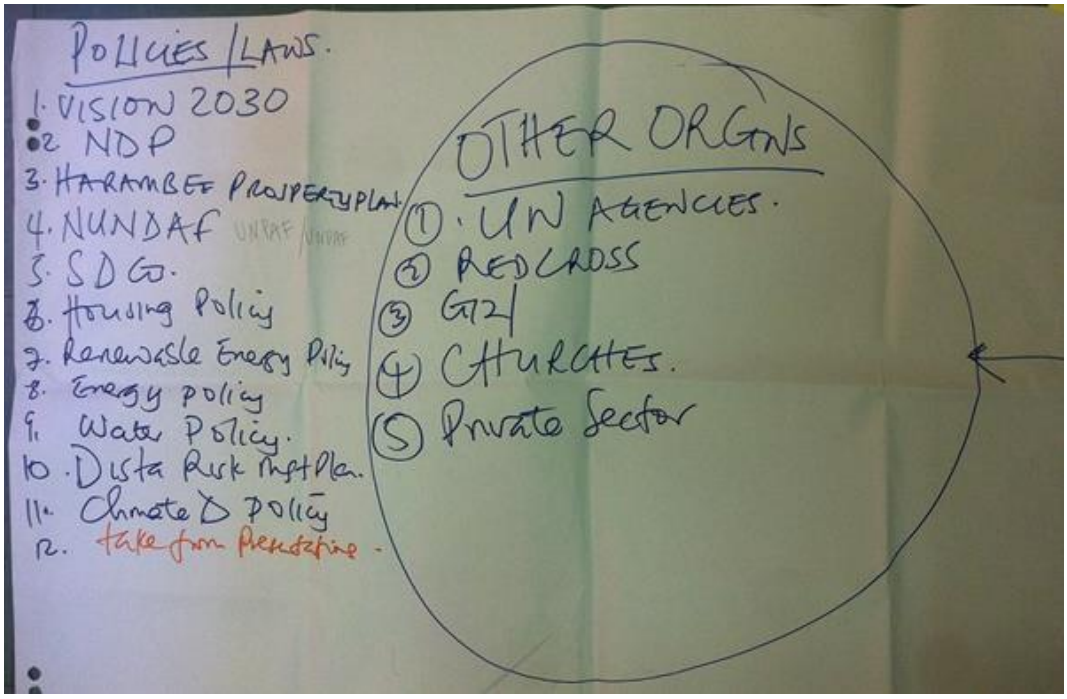


Figure 11: Institutional mapping for Informal Settlements Group

The most influential institutions responsible for providing services in informal settlements in Windhoek and presented in Figure 10 and Figure 11, as mapped by the assigned group. Three observations made, namely that:

a. There are so many institutions involved but inadequate communication between the different stakeholders;

b. It is easy to put up a shack (informal house) but requires legal considerations to be removed by CoW (court order);and

c. Donor funding is quite critical to ensuring services deliver in informal settlements.

5. What can participants offer to the process?

Ms. Alice McClure, CSAG, UCT

This session involved asking the participants what they would offer to the process and what opportunities exist that would enable further engagement in the FRACTAL process or related activities. To facilitate this process, participants were given a set of different colored sticky notes to write down answers to the following questions (see Table 12)

a) Green note: Who can contribute – what can be contributed?
b) Yellow note: So what? How will this benefit the FRACTAL project?
c) Pink note: Now what and when? What needs to be done straight away, and in a bit of time.

Table 12: What participants are offering to the FRACTAL process

Who?	What?	So what?	Now What and When?
NHAG and SDFN	Share information on clip (community land information program)	This book has information on the people living in informal settlement i.e. how many	Provide website and blog address or simply Google it from right now

	Which is a document on informal settlement profiles	people in informal settlement and their priority needs	
NAYORE	Research and awareness partner on energy in informal settlements e.g. energy census, policy standard w.r.t renewable energy	Lack of existing data on renewable issues in informal settlements NEP on data collection	Communicate and sort out logistics Writing up proposals
NamWater	Water pollution (data collection and analysis) Water insecurity (infrastructure upgrade)	To ensure a continuous water supply of good quality or potable water Evaluate our capacity to fulfill our mandate of bulk water provision	Water quality sampling and analysis (continuous) Infrastructural maintenance and upgrade By March 2018
MAWF-DWRM	Water governance Policy implementation, Policy enforcement, Water resources management data and advice	Water resources sustainability	Further awareness on the Water Resources Management Act no 11 of 2013 by March 2018
CoW Department of Infrastructure, Water, and Technical Services & Department of Economic development and Environment	Contribute to the overall coordination of the project and implement project work plan Refine research questions looking into city's water supply and insecurity Provide water-related data to assist research projects Provide relevant information regarding Windhoek informal settlements	The proposed research and other project activities will contribute to the sustainable management of the city's resources and help to build the resilient city.	As soon as possible
UNDP	We will organize a meeting with Kornelia about future collaborations.		Early April
Masters student, UNAM	Do research on water security and livelihood in informal settlements	To understand how livelihood contributes to water security or how water security contributes to livelihood of various households in the Windhoek informal settlements	Collect data and write a report on the findings. From 01/05/2017 to 30/10/2017
Mr. Iiputa, UNAM	Collect data on water governance and process Windhoek industrial water reclamation case study	To illustrate the use of climate change info in water infrastructure establishment in Windhoek leads to environmentally degrading options of sources of energy	Finalize detailed work plan and present it by 31/03/2017.
Dr. Walker, AURECON	Climate information for new infrastructure number 1 burning issue for water.	Climate change information needs to be brought into the planning proven. FRACTAL WP2	Explore how climate narratives can be developed into practical hydrological information. E.g. IDF curves, extreme rainfall events Bring climate change information into project that

			AURECON are doing for CoW
Prof. Scott, ACC	I will contribute to research on the water governance (institutional arrangement) with Davison and Kornelia Reviewing water policies to understand if they have climate change implications	Because it is important to understand water governance to understand decision making and how climate change information can be best provided to the city of Windhoek	Draw up map of city actors in Windhoek (use learning lab) plus other information Discourse analysis of water policies
Prof. Mfune, UNAM	Coordinate FRACTAL within Write Windhoek city learning lab report	Successfully contribute to the address FRACTAL objectives	Contribute to addressing climate change in CoW within 2 years' time Provide basis for future engagement of stakeholders (end of April 2017)
Ms. Iipinge, Embedded Researcher	To get all necessary city of Windhoek documents or policies relating to energy, water and climate change To review the provided documents with regards to burning issues and questions	To better research and understand the burning issues To help facilitate communication between the different communication To find out about ongoing or proposed plans/project To understand the policies that incorporate the burning issues at both local and national level	Get all contacts address for participants Research on the institutional/organizations involved in the burning issues Write the first Windhoek city learning lab report As soon as possible
Dr. Burgin, UK MET Office	Work on the next version of narratives	Gathered lots of really useful feedback and ideas Also important to integrate local or expert knowledge	Assimilate all the info Circulate with Windhoek group Discuss extra work for particular users In the next few months
Ms. West, START	Develop webinar to raise awareness of FRACTAL small opportunities grants (SOG) and help people understand how to write SOG proposals.	To increase knowledge exchange and cross-cuts learning, address a narrowly focused research question, build capacity	Will work with CSAG to develop and launch webinars in the next month.

6. What was learned from the learning Lab

Ms. Alice McClure, CSAG, UCT

All the participants were given a sticky note to write down what they have learned from the two days of the Windhoek Learning lab. Below are the answers from the participants:

1. I learned a lot about Windhoek and burning issues
2. Who should actively play a role in building bridges between the research community and decision makers?
3. More clarity on relationship between renewable energy and climate change in localized context.
4. Brought climate change and also renewable energy issues home.
5. I learned a lot about the stakeholders involved with the informal settlement. This helps with proper planning regarding my job and what I can do for informal settlements regarding renewable energy.

6. Challenges facing water supply in the city will use this to provide technical advice on water resources management and also integrate it in company's action and strategy plan
7. I learn about burning issues in an informal settlement. I learned about climate change. I learned how the FRACTAL project works.
8. What I learn out of the FRACTAL: it was informative. The plan to set a learning lab for the city. The group works to make that learn.
9. I have learned about how water is distributed and managed by the city of Windhoek. I have learned how FRACTAL is helping to improve cities living conditions.
10. An understanding of the actors involved in water supply and sanitation in Windhoek.
11. Involvement of key stakeholders is important for the success of a project.
12. Different perspectives have to be considered to formulate FRACTAL mechanisms and responses.
13. A lot but mainly about issues in Windhoek which are most useful narratives.
14. The importance of dissecting complex issues by engaging different stakeholder objectively with an aim of one goal e.g. narratives.
15. Interactive innovation approaches to defining and prioritizing issues.
16. As a city, we need to concentrate more on the livelihood of the people living in informal settlements.
17. Water quality into climate change.
18. Very thankful for the opportunity to broaden my understanding of climate change.
19. Have a better understanding of the concerned institutions.
20. A better way to refine my research question.
21. Need to invite wide range of participants from different age and sectors
22. Complexity of climate change, water issues, energy, informal settlement issues.
23. Aside from water, issues related to informal settlements and renewable energy were noted as burning issues, so will be interesting to see how they will be adopted to fit with FRACTAL Project.
24. Learned about the issues that Windhoek has related to climate change (more delimited information about the systems and issues).
25. I also learned that coordination is actually a fundamental part of the process (a lot of actors and information but no one knows who is doing what etc. at a broad level.
26. What are the city of Windhoek facing in terms of water, energy issues and what settlements are facing?
27. As an organization that deals with housing, I have learned that it is important to create awareness amongst the members and communities about climate change. That's important that we talk about climate change.
28. A better understanding of learning labs and workshop preparation skills.
29. Climate change impacts are evident within Windhoek and its surroundings.
30. The role and effectiveness of water-related policies in the efforts of building resilience to Windhoek are critical for MAWF: Department of Water Resources Management.

7. Day Two reflections by all participants

Mr. Eddie Jjemba, Red Cross Red Crescent Climate Centre

Reflections for Day Two were facilitated by Mr. Jjemba. The participants noted the positive aspects of what was learned and covered on Day Two and their reflections on what can be improved for the future activities of the FRACTAL project.

A. Positive:

- Really enjoyed the types of engagements and learned a lot
- The constant participation by all stakeholders was good
- It was a good networking opportunity
- Enjoyed the process for distilling burning issues
- Great facilitation methods
- Great to meet different people that would not normally work with
- Enjoyed the fact that all participated
- Enjoyed the narratives session
- People took it seriously and provided feedback
- Great event

B. Improvements:

- Need more key players/commitment from key players
- More grassroots people present
- More research students
- Invitations sent out well in advance
- More politicians in the room
- Think about recording the sessions for others to listen to

8. Closing remarks

The learning lab came to an end at 16:30 and closing remarks were given by Mr. Makuti, who appreciated everyone's contributions and participation, thanked the FRACTAL team (coordination and facilitation), acknowledged the organizing team and thanked Honorable Mrs. Swartz that actively participated during the two days' workshop.

Next steps for FRACTAL

An awareness workshop on climate change for Windhoek's Councillors emerged as an action to be taken forward from the Windhoek learning process. In addition to this learning lab report, particular outputs from the learning lab process have been listed below.

- Blogs related to Windhoek learning process: will be shared on the FRACTAL website.
- Connecting requests and offers cluster work plans: offers and requests that were shared near the end of the session need to be integrated into the work plans of the various clusters
- Capacity building: the requests for capacity-building activities need to be integrated into the city learning work plan.

Main lessons learned

- That diversity in the level of management being invited to the learning lab is important. Participation should also target both middle to high level representation of organizations. As well as grassroots representatives.
- FRACTAL information needs to be delivered / circulated to participants before the inception

workshop and learning lab so that the participants are familiar with the projects.

Annex 1: Learning Lab programme

Future Resilience for African Cities and Lands Project
Windhoek Learning Lab/ Workshop
Heja Lodge, Windhoek, Namibia
14-15 March 2017

Programme

Time	Session	Facilitator
DAY 1: 14 MARCH 2017		
Morning: Formal inception meeting		
08:30-09:00	Registration	Ms. Kornelia lipinge
09:00-09:30	Official Welcoming remarks Pro Vice Chancellor (RID) Official Opening Deputy Mayor City of Windhoek	Prof. Kenneth Matengu Her Worship Fransina Kahungu
09:30-10:00	Introduction to FRACTAL Project	Ms. Alice McClure
10:00-10:45	Climate-related challenges and opportunities in the city of Windhoek.	Mr. Friedrich Koujo
10:45-11:15	Tea (and group photo)	Ms. Kornelia lipinge
11:15-11:45	FRACTAL Project in Windhoek	Prof. John Mfune
11:45-12:00	Overview of learning lab approach	Prof. Gina Ziervogel
12:00-13:00	Lunch	
Afternoon: Identify and prioritize burning issues		
13:00-14:00	Volunteer-hosted groups on identifying specific burning issues - issues of concern and priority	Mr. Eddie Jjemba
14:00-14:30	Plenary Session	Ms. Niki West
14:30-15:00	Tea	
15:00-16:00	Distill burning issues	Prof. Gina Ziervogel
16:00-16:30	Voting for burning issues to tackle through next phase of FRACTAL collaborations and engagements.	Mr. Eddie Jjemba

16:30-17:00	Overview of Day 1 and closing	Ms. Niki West
Evening: Social event		
DAY 2: 15 MARCH 2017		
Morning: Climate session		
09:00-09:30	Climate change in Namibia.	Dr. Jonathan Kamwi
09:30-10:30	Climate science aims in FRACTAL and discussion on the future climate of Windhoek.	Dr. Laura Burgin
10:30-11:00	Tea	
11:00-11:30	Identify other climate and non-climate knowledge gaps and information needs linked to the #1 burning issue.	Prof. Gina Ziervogel
11:30-12:00	Plenary session (Groups report back) on climate and non-climate knowledge gaps and information needs.	Ms. Niki West
12:00-13:00	Discussion on prioritizing needs, identifying where / by whom, What knowledge / info is needed and in what format, and how to bring together and integrate disparate sources and types of knowledge into decision-making.	Mr. Eddie Jjemba
13:00-14:00	Lunch	
Afternoon: Action planning and next steps		
14:00-14:45	What would participants like to see happening next and over the coming 3 years of FRACTAL collaboration?	Ms. Niki West
14:45-15:15	What can participants offer to the process? What are the opportunities to engage further in this and related activities?	Ms. Alice McClure
15:15-15:30	Tea	
15:30-16:00	Prioritizing next steps linked to timeframes and identifying organizations and individuals responsible for driving them.	Mr. Eddie Jjemba
16:00-16:15	Reflection and evaluation.	Mr. Eddie Jjemba
16:15-16:30	Closing remarks.	City of Windhoek

Annex 2: Attendance list and participants' details

Day One: Learning Lab (14 March 2017, Heja Lodge)

No.	Name	Organization	Email Address
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Day Two: Learning Lab (15 March 2017, Heja Lodge)

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Annex 3: Climate Risk Narratives for Windhoek

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.

The rise in temperatures and reduction in rainfall have hit agricultural areas badly. Ephemeral rivers contain water for less time and water tables have fallen. Many areas can no longer support growth of crops without expensive irrigation. Farmers can no longer raise European cattle breeds due to heat stress, so many farmers now only farm small stock and the price of beef has greatly increased. These pressures on rural populations have resulted in a large influx of migrants to Windhoek.

Due to the hot weather, dams in the region experience large evaporative losses. Multi-year droughts are common and in these years Windhoek struggles to meet the water demands of its industrial, commercial and residential sectors. Further pressure on water resources is applied by the increase in the urban population and the extreme hot weather. Demand for air cooling systems is high and many parts of Windhoek's society often require treatment for heat-stress related conditions.

Hydroelectric provides a smaller amount of energy to Windhoek and the city relies more on coal-powered energy such as from the Van Eck power station. The influx of rural migrants has resulted in large informal settlements where electricity is limited and firewood is used as an alternate fuel source. The burning of coal and firewood has attributed to poor air quality in the city and many more residents seeking medical attention for respiratory problems.

Lower rainfall, lower runoff and higher evaporation rates have seen water sources become more polluted by blue-green algae and contain higher concentrations of salts. These have wide ranging impacts on the finely balanced ecosystem of Namibia. The Okavango Delta and Etosha pan see fewer species of wildlife. Coupled with the increasingly hot temperatures, tourist visits to Namibia are now fewer and the economy of Windhoek has suffered.

However some benefits from the hotter and drier climate have been felt by the city of Windhoek and region of Khomas. Flooding, and its associated damage, is less common and warmer temperatures in the dry season allow a great range of crops to be grown by those who can afford irrigation.

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.

The increased rainfall late in rain season sees ephemeral rivers contain water for longer than they did in previous decades. Recharging of dams and groundwater is high at these times. However due to the high temperatures, evaporation rates from uncovered water storage facilities are high and careful management of water is needed. The City of Windhoek continues to run a strong integrated water demand management policy with components of policy, legislation, public awareness and technology. Namibians continue to be experts in the development of sub-surface water storage and reclamation technologies. As a result, efficient use is made of the slight increase in rainfall in the wet season. Most households in Windhoek have adequate access to water.

Irrigation systems have also been invested in by those who can afford to do so. Combined with warmer temperatures in the dry season, particularly warmer minimum temperatures, larger harvests and a wider range of crops can be grown in the irrigated areas. This has led to an increase in the agricultural sector's contribution to GDP. However, disparities between the commercial and communal sectors have grown since the start of the century, with poorer farmers seeing little difference to their earnings. Complacency can also set in during wet years and when rain totals are smaller than expected can farmers can be poorly prepared requiring the city to import large amounts of grain. At times when rainfall is high, pooling surface water allows insects to breed and vector-borne disease in livestock occurs more frequently.

The demand for electricity is high in Windhoek, particularly for air cooling systems to cope with the high temperatures. This demand can mainly be met with the use of hydroelectricity and other renewable energy sources such as solar, resulting in low air pollution. Parks and recreational areas have been planted with native drought-resistance plants. Windhoek remains an attractive, clean city with high numbers of tourists. However, poorer and vulnerable parts of society often require medical attention for heat stress related conditions during the commonly occurring periods of sustained high temperatures.

Windhoek suffers from more flooding than it did a few decades ago as a result of the commonly occurring convective storms during the wet season. Informal areas of the city suffer disproportionately and costs for rebuilding damaged areas are expensive for the city.

Narrative #3: "Warmer with similar rainfall"

In Windhoek and the surrounding region of Khomas, cycles of warmer and wetter conditions followed by drier and cooler conditions persist in the middle of the 21st century. Conditions continue to be quite variable from one year to another but on the whole temperatures are about 1-1.5°C warmer than they used to be. Average annual rainfall totals are much the same as they were in previous decades. The influences of El Nino and La Nina continue to be experienced by the region resulting in some years undergoing a prolonged dry season and others being wetter than normal. When rain storms occur in the wet season they are typically more intense than they used to be as a result of the warmer atmosphere.

The increase in temperature has been gradual, and due to only a very small increase in the number of extremely hot days, the general public have not noticed a change in the climate in their day-to-day lives. Subsequently, policy makers have not made climate change a high priority in their decision making processes. As a result, minimal investment has been made in the city of Windhoek to make it robust to the impacts of the change in climate.

The city can struggle to meet water and electricity demands in the drier and hotter years as a result of high evaporation leading to low run off into dams used for hydroelectricity. The warmer weather also results in higher evaporative losses from dams and other uncovered water storage areas. The variable nature of rainfall totals in the wet season and low use of sub-surface water storage makes it hard to plan and store water for dry years.

Agricultural areas in the region have varied in their levels of adaptation to the change in the climate.

The large-scale commercial farmers have invested in water storage and irrigation technologies and provide large yields aiding Namibia's GDP. The small scale communal land farmers continue to struggle with the variable climate and suffer badly in drought years. For both sets of farmers the typically warmer temperatures have contributed to a longer growing season but crops can often be damaged during the intense rain which is now more common during the wet season.

The low level of investment in adaptation for the city has left it vulnerable to high levels of flood damage. Adequate drainage to cope with surface run-off during the heavy rain showers has not been built. Transport around the city suffers at these times. The flooding and transport disruption degrades the pleasant atmosphere and living standards for citizens and visitors to the city.