FRACTAL
FUTURE RESILIENCE FOR AFRICAN CITIES AND LANDS

Fifth Lusaka Learning Lab Report

Mika Chamba Valley Exotic Motel, Lusaka, Zambia | 12-15th November 2018

FUTURE CLIMATE FOR AFRICA

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NERC SCIENCE OF THE ENVIRONMENT

DAY 1 | 13th November, 2018

Programme

1. Registration
2. Opening and welcoming remarks (Gilbert)
3. Introductions (Brenda/Bettina)
4. Message from Windhoek (Alice)
5. Report Back (Brenda)
    a. Governance Dialogue (Brenda/Sukaina)
    b. Lusaka City Council
    c. WARMA
    d. Livingstone Conference (Rebecca)
6. The Learning Landscape (Alice,Brenda,Bettina)
7. Policy brief launch+discussion (Rebecca)
8. Lucky Draw (Alice)
9. LuWSI updates (Kasenga)
10. The fly on the wall (Chris,Richard)
11. Mapping + Clarifying Decision (Chris)
12. Information deficit (Bettina)
13. Recap of Day 1+ closure

Opening and Welcoming Remarks

by Dr Siame Gilbert

Dr. Siame welcomed everyone to the Fifth Learning Lab (LL) and apologized for starting late. Since 2016 many participants have attended more than one LL since the first one held at Chaminuka. Dr. Siame hoped for fruitful discussions and was looking forward beyond the discussions of what have we learnt. The LL was expected to be attended by 35 people but a few participants sent their apologies. He also made mention that this was the last LL in Lusaka.

Chimba Mukuka, Senior Water Engineer from the Ministry of Water, represented the Permanent Secretary. He welcomed everyone on behalf of the Permanent Secretary and emphasized that he wasn't alone in the Ministry working with FRACTAL as other key stakeholders, such as WARMA, NWASCO, LWSC, etc, were also in attendance. All these institutions have been on board since 2016 and have participated and learnt a lot from FRACTAL discussions.

Mr. Mukuka stated that he would like to see water security in relation to health, Lusaka has had outbreaks of diseases (e.g. cholera) and it is the desire of the Ministry to safeguard all water resources. Water regulators in the country have put in place laws to regulate various players in the water sector. He explained that the government wants to ensure that water is both safe and accessible, and wants to regulate the underground

water. “Before we never used to ask people to register for water/boreholes but now we are asking for payments. By doing so we are bringing order.”

Water development versus development planning. Most countries in Africa have unplanned settlements hence urban residents still drill boreholes. Indiscriminate dumping is common occurrence in these places and can help spread diseases such as cholera. Through FRACTAL we are working towards the 7th National Development Goals (NDGs). The Ministry hopes to see proper development of Lusaka’s water resources and thereby improve the lives of Lusaka’s residents.

Introduction

by Bettina Koele

Bettina Koele outlined the aim for the next two days: to see what FRACTAL has achieved and where it can go from here. During the LL participants will reflect on the FRACTAL journey since 2016 up to now. For those that have been participating from the beginning it will be quiet interactive.

The 4th Learning Lab Governance and Dialogue

by Brenda Mwalukanga

The research focuses on analysis at the city level and relays understanding of the usage of adaptation and capacity building terminology. FRACTAL carried out a small Governance Dialogue between the 3rd and the 4th LLs. Research was conducted in all the FRACTAL cities and climate change terminologies were looked at.

During the Governance Dialogue Dr. Christopher Jack gave a narrative of the Cape Town story on climate change and how it affected water supply. Community engagement was also another area of focus for the Governance Dialogue. Community engagement is currently going on through the Lusaka Water Security Initiative (LuWSI) and a Memorandum of Understanding was signed between GIZ and Lusaka City Council (LCC). Out of the 33 wards in Lusaka, 12 areas have been selected as high preference areas, which are at risk of having groundwater pollution.

Mr Museteka (Water Resource Management Authority)

As of 31st September 2018 10,000 boreholes have been registered. The implementation of sensitization requires significant funding. The permits for commercial abstraction are being issued. Application forms for commercial abstraction cost k250 and the forms will help provide data to establish how much is being abstracted. After an audit of drilling companies several culprits had not complied with WARMA’s guidelines. Lusaka groundwater monitoring systems are one of the ways in which WARMA monitors the water table. For drilling companies they need to pay to renew their permit by 31st October 2018. Drilling companies need to keep the seals and registered geologists working for them. There are about 8 regulations only 3 have been concluded (licensing,

fees and charges) the other 5 are yet to be brought out. Once all the regulations are concluded other stakeholders will be brought on board.

Policy Brief Launch and Discussion

The policy briefs are on water quality, groundwater, flooding and water supply and sanitation.

Areas to be looked at are:

- Strengthening the procedures and processes for development control. How can existing procedures be better enforced? Capacity building is required for officers in the local authorities.
- Effective engagement to reduce groundwater pollution.

Where to use the briefs:

- Create awareness in the local authorities on groundwater pollution so as to reduce the occurrence of waterborne diseases.
- Incorporate the briefs into education systems
- Pass a law to reduce pit latrines in the peri-urban areas and replace them with the communal toilets.

Flooding and Health/Water Quality

Construction and rehabilitation of drainage network. Decisions around recommendations.

Design:

- Methodology and Technology
- Bill of quantity

Mobilize funds:

- Millennium challenge
- Prioritize on the most affected Areas

Information needed:

- Temperature pattern
- Rainfall pattern
- Groundwater levels
- Hydrology

Relocating household built in dambos/wetlands/flood prone areas:

- Forming a multi-stakeholder task force
- Find alternative areas
- Stakeholder i.e. DMMU,RED CROSS to mobilize funding and relocation

Regularly enforce the planning law on development control:

- Assess the situation
- Cost the removal of structures
- Mobilize the equipment/funds

Groundwater Pollution

1. Traditional Land Tenure systems are a gap that allows for unplanned settlements thereby threatening groundwater quality.
2. Planning Authority and the public educational institutions can use the briefs
    - The media can also use the policy briefs
    - Ward development committees and other local community structures can use the policy briefs to engage the public
    - Groundwater protection network LuWSI
3. Integrate the local planning authorities and traditional authorities on acquisition of land
    - Embed traditional land tenure system in the draft land policy.

Water Supply and Sanitation

1. Strengthen procedure and processes for development
    - Find ways to better enforce these procedures
    - Capacity building: effective community engagement to reduce groundwater pollution
2. Local Authorities to create awareness of groundwater pollution in order to reduce it
    - Incorporate the briefs in education system
    - Pass a law to reduce private pit latrines in peri-urban areas
3. Addition to number 5
    - Water recycling

Lucky Draw

The lucky draw was conducted. Loveness Nikisi, from the Zambian Meteorological Department, won coffee that was sent by the Windhoek FRACTAL Team.

LuWSI Update

by Hara Kasenga

LuWSI is a collaborative initiative that tries to inspire change and deliver projects, it has four core functions: improve understanding; assess priorities; monitor water security threats; and find solutions.

LuWSI's achievements so far:

- Managed to grow partners up to 25 stakeholders.

- Water stewardship
- Over 10 schools reached for education and awareness campaigns
- $1.1m secured for the WSAIP
- $140,000 secured for the wellfield development
- Help fill gaps in water monitoring.
- Observations of rainfall and weather patterns.

A clear strategy is needed for the wellfield protection project.

Information Deficit
Group 1: In the event of increased extreme flooding, climate scientists are able to provide information relating rainfall intensity for the next 50 years.
Group 2: Warmer and extreme rainfall will be met by improvements in drainage construction, most drains will be lined with concrete in flood prone areas.
Group 3: Protection of water recharge areas in the event of warmer climate. Source for more funding for water and sanitation facilities, sources for funding to create water recycling possible.

Day 2 | 14th November, 2018

Programme

1. Circle Claps
2. Recap of Day 1
3. “The Perfect Gift"
4. Constructing Climate Change Messages
5. Mirror Circle
6. Commentary Climate Message
7. “Time Machine": Scenario exploration
8. Brainstorming: Water security action plan
9. Feedback is a gift
10. Lusaka city future visualization
11. Next steps
12. Field Trip Briefing
13. Conclusion

The day started at 0900h with a simple team exercise called the circle clap. The goal was to highlight the dynamics of communication in a small and large team. After the group exercise the team did a brief recap of what was discussed in the previous day, led by Bettina from Climate Centre.

Thereafter the participants highlighted what they expected out of the 5th LL through a simple exercise called the perfect gift. In this exercise, each participant had to imagine that a gift was placed underneath their seat. Upon opening that package they would share their expectations with the group.

Commentary Climate Message

by Dr. Christopher Jack and Richard Jones

Richard Jones from Met Office (UK) and Dr. Christopher Jack from University of Cape Town guided the participants through a series of assumptions and available data for the city based on various climate change models. According to Prof. Richard rainfall data available in Lusaka is measured on a daily basis rather than an hourly or 6 hourly basis like other parts of the world. As such, all of the models used daily rainfall measures.

Records obtained from the Zambia Meteorological Department indicate that the highest daily rainfall they have ever recorded from 1950 to 2013 was approximately 189mm. This amount of rainfall is typical for a place like Lusaka. However, most of the city is rocky which often results in flooding. According to the Meteorological Department the average rainfall per rainy season averages 800-1000mm. But climate change models indicate that these figures could increase as the city and surrounding areas are expected to receive above normal rainfall in the years to come, resulting in more flooding.

The participants later asked the two climatologists if it was possible for them to provide an estimate of exactly how much rainfall is expected in the coming years. This was to assist engineers in coming up with infrastructure standards to withstand the expected flooding. In order to come up with a single digit the climatologists explained that they would have to combine the four models and approximate the average expected rainfall for the city. Data for the last 30 years clearly indicates that rainfall and temperature patterns have been increasing significantly in the city and areas surrounding it.

Key Assumptions

by Rebecca Ilunga

After the commentary climate message, Rebecca took the participants through a series of assumptions on climate change and water security in the city.

1. Peri-urban areas in the city use less water than formal/urban areas. Majority of the participants agreed with this statement because these areas are usually not serviced by water utility companies.
2. Demand for water in peri-urban areas was approximately 90mm per person and 300mm for commercial and industrial users. The group was divided equally on this assumption as some felt that the average us was much smaller while others felt it was almost accurate. It was also assumed that approximately 300km^2 of the city is a water recharge area. Majority of the participants disagreed with this assumption as the land mass of the city is smaller than 300km^2.
3. The water recharge distribution was +6.3 between December and February and -6.3 between March and November. Majority of the participant's agreed with this assumption.
4. Non-revenue water lost through leaks stood at 45% of the total water supply in the city.

"Time Machine": Scenario Exploration

SCENARIO 1 | Hotter and Drier

Natural systems

It was expected that extreme hot days and heat waves would become more frequent. In addition, droughts will become a common occurrence in the city and surrounding areas.

Areas of Impact

Under this scenario it is expected that water shortages will occur regularly resulting in high food insecurity in the city and province. It is also expected that droughts will severely affect water levels thus resulting in hydro power shortages.

Social Consequences

It is expected that the following might be the consequences of this assumption:

- Political Instability
- Health crisis
- Conflict

Responses

To mitigate the effects of climate change under this assumption could be:

- Develop adequate building standards
- Use alternative sources of energy
- Use alternative water technologies
- Need to adapt agricultural systems to the changing climate.

SCENARIO 2 | Warmer and More erratic rainfall

Natural Systems

It is expected that rainfall might become less predictable than at another time in history. It is also assumed that the wet seasons might become wetter and dry season's drier.

Areas of Impact

it is expected that more irrigation would be required as the possibility of crop failure would increase due to erratic rainfall. Flooding is also expected to become more frequent. Heat waves are likely to cause various health risks such as heat stress.

Social Consequences

- Humanitarian crisis
- Health Impact

Responses

- Need to adapt agricultural systems to the changing climate.
- Develop adequate building standards
- Use alternative sources of energy

- Use alternative water technologies

SCENARIO 3 | Warmer and more extreme rainfall

Natural Systems

It is expected that levels in most water bodies will be stable and that evaporation is likely to increase due to high temperatures.

Areas of Impact

Agriculture is likely to be affected by high temperatures as more water will be required for irrigation. Crop failure is also expected as more and more water will be lost due to evaporation or through flooding.

Social Consequences

- Humanitarian crisis
- Health Impact

Responses

- Need to adapt agricultural systems to the changing climate.
- Develop adequate building standards
- Use alternative sources of energy
- Use alternative water technologies

Feedback is a Gift

Under this segment the team had to answer a questionnaire prepared by the FRACTAL team as a means of assessing the impact of the learning labs on the participants.

Lusaka City Future Visualization and steps to 2019

Participants were asked to visualize the future of FRATAL and how the project is to be handled from the 5th LL up to June 2019 when the project comes to an end.

Participants identified the following essential process and issues:

- Developing a continuous mechanism for stakeholder engagement
- Advocating for the operationalization of policies on climate change in the local authority.
- Actualization of policy briefs. The FRACTAL team must identify key drivers that will be useful in influencing policy for possible action.
- Making climate change information readily available, relevant, accurate and accessible to people who are most affected.
- Dissemination of the policy brief to the general public.
- Escalate policy briefs to policy makers.
- Ensure FRACTAL processes and outputs feed into WSAIP processes including climate information.

Participants also highlighted essential processes and issues that should be taken beyond 2019:

- Participants suggested a climate change conference to be held so as to discuss issues in depth and with a wide spectrum of stakeholders compared to learning labs.
- Continue with knowledge exchange programmes.
- Continue conducting learning labs.
- Advocate for the development of permanent organizational structures for implementing climate change issues and monitoring strategies.
- Institutionalize information from fractal by various partners
- Strengthen dialogue between researchers and policy makers

Participants highlighted what they thought could be avenues for the above suggestion to be actualized:

- Participants suggested that responsibilities and timelines should be assigned to various stakeholders.
- Review of existing strategies and improve on their implementation

Going forward the team felt it was necessary for a conference on climate change should be organized by the University of Zambia with Lusaka City Council being the secretariat.

FIELD TRIP: KAFUE GORGE HYDRO POWER STATION

Day 3 | 15th November 2018

The workshop participants left the hotel at 0800h for the Kafue Hydro Power Station. Upon arrival at the power station the team was met by one of the officers from Zesco. He explained that the power plant has six installed turbines which produce 165 megawatts each and 990 megawatts in total. The dam is approximately 500m above the power house and is almost 10km away from it.

The officer later introduced Mr. Mutale the safety officer of the power plant. Mr. Mutale gave a brief safety talk to the team about what to do and what not do in the power plant. He then distributed safety attire to the entire FRACTAL team and advised them to keep it on at all times during the tour of the plant.

Before proceeding to the control room one of the team members wanted to find out how much water was lost during the 2015-2016 drought that was experienced by the country and if that had any effect on power generation. In response the Zesco officer said that the dam had lost approximately 2m of water and this led to reduced production as there wasn't enough water to keep the machines operating at 100% efficiency.

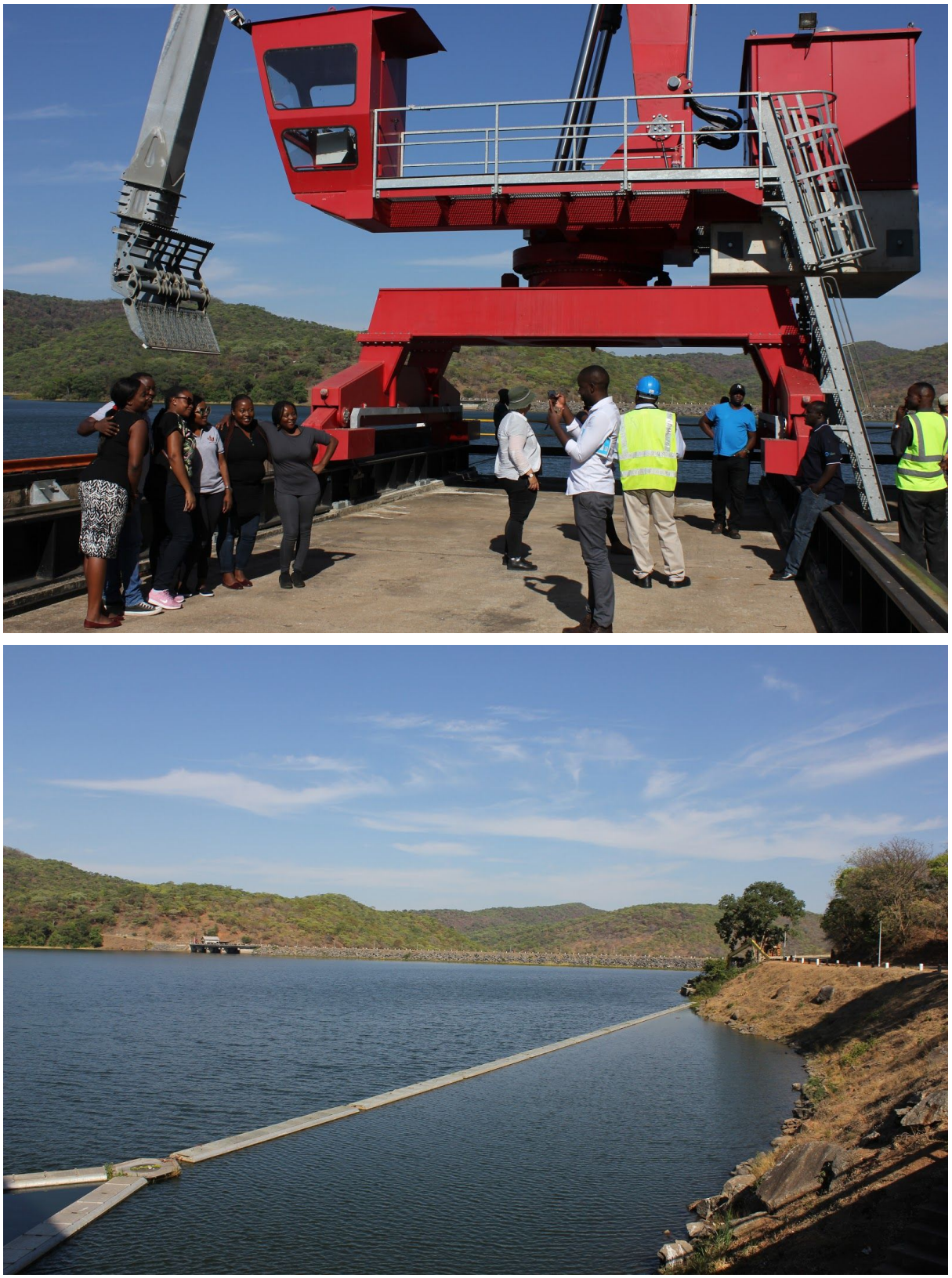

Figure 2: The FRACTAL team exploring the Kafue Hydro Power Station

The team then went to visit the control room which is also about 500m below ground. In the control room the team wanted to find out if the power plant is able to monitor long

term water levels of the dam. In response the engineer said that they do monitor the levels by collecting daily dam levels which is instrumental in estimating the level for the whole month. The team also wanted to know if the construction of the Kafue Lower Gorge would have any impact on water levels of the main dam. In response the engineer said that each power house will have its own reservoir and that water levels are carefully monitored. He further stated that the dam has been having trouble monitoring water levels digitally and that it relies on onsite cameras for readings.

In the power house the engineer explained that the first 4 turbines/units were first installed in 1971 and the other two turbines in 1977. He then went on to that the plant produces 17,000kv which is then stepped up to 30,000kv and sent to the national distribution center in Lusaka where decisions on what is required for local consumption and export are made. He then explained the principles of power generation which are motion which is provided by moving water, an armature which is an induced magnet and a conductor which are used for transmission.

From the main section of the power house the team was taken to the cooling room. In the cooling the engineer explained that the water from the turbines is at room temperature. As such, the fish can survive the whole process of power generation. From the cooling room the engineer directed the tour to the switch room were the team saw the isolators and the earth switch of the power plant. The team was later directed to the transformer room were the transformers are housed. Other areas that the team visited were the graft tube, ventilation room and transformer protection room.

In the afternoon the team toured the dam, where they saw the intake gate for the water that powers the turbines. At the dam site the team was led to the dam wall where officers from Zesco explained how the dam is maintained and how water levels influence the opening and closing of the spillway gates in various seasons. As the tour came to an end, the officials from Zesco escorted the team to the gate of the facility. The FRACTAL team arrived back in Lusaka around 1800h.

ATTENDANCE LIST

Name	Institutional	Cell No.	Email
Chimba Mukuka	MWRD	0977452632	uchmukuka@yahoo.com
Jonathan Mwanza	Shibuyunji Council	0977641683	mwanzajonathan@yahoo.co.uk
Brenda Mwalukanga	LCC/UNZA	0977926743	Lunela2004@gmail.com
Jonathan Chanda	LCC	0979641057	Jonathanchanda14@gmail.com
Richard Jones	Met Office	+447753880358	RichardJones@metoffice.co.uk
Christopher Jack	UCT	+21837164448	Cjack@csag.uct.ac.za
Alice McClure	UCT	+27719998982	Alice@csag.uct.ac.za
Rebecca Illunga	Aurecon	+27833815361	Rebecca.illunga@aurecongroup.com
Gilbert Siame	UNZA	0979457414	SiameGilbert@yahoo.co.uk
Levy Museteka	WARMA	0978847218	levymuseteka@hotmail.com
Dorothy Ndhlovu	UNZA	0976691705	Ndlovu.dorothy@yahoo.com
Loveness Nikisi	ZMD	0977369029	Love.nikisi@gmail.com
Mununga Mungalu	Lwsc	0979475644	Mununga01@gmail.com
Ngoza Namuchimba	LCC	0977212690	Ngozanamuchimba31@gmail.com
Audrey Daka	LCC	0973430909	audreydaka@gmail.com
Bwalya Funga	LCC	0977834723	bwalyafunga@gmail.com
Sukarina Bharwani	SEI	+4479880358	Sukainai. Brearwani@sei.org
Lozidaba Tembo	LCC	0965109964	lozidabatembo@gmail.com
Mboyonga Kaputula	LCC	0977225022	Mboyongakaputula@gmail.com
Mupelwe M Matete	LCC	0979160853	Mupemac@gmail.com
Nachombe N Kandila	LCC	0968311638	nachombe@gmail.com
Cecilia Mwengwe	MLG	0977312022	Ceciliamwengwe@yahoo.co.uk
Peter Petulo	WARMA	0955923501	pppitaagnt@gmail.com

Bettina Koelle	Climate Centre	'795743914	
Hara Kasenga	NWASCO	'108246	a@nwasco.org.zm