

# NEXUS OBSERVATORY TRAINING WORKSHOP ON DROUGHT RISK MONITORING: CAPACITY DEVELOPMENT PRIORITIES FOR SUB-SAHARAN AFRICA

## PROCEEDINGS



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Proceedings

**Nexus Observatory Training Workshop  
on Drought Risk Monitoring:  
Capacity Development Priorities for  
Sub-Saharan Africa**

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## List of Abbreviations and Acronyms

APE	Africa Points of Excellence
DTMs	Digital Terrain Models
GIS	Geographic Information System
GPS	Global Positioning System
ICT	Information and Communications Technology
IOER	Leibniz Institute of Ecological Urban and Regional Development
LGAs	Local Government Authorities
MoU	Memorandum of Understanding
NACTE	National Council for Technical Education in Tanzania
OD	Ordinary Diploma
RTM	Radar Topography Models
SAR	Synthetic Aperture Radar
SDGs	Sustainable Development Goals
TU Dresden	Technische Universität Dresden
UNU-FLORES	United Nations University Institute for Integrated Management of Material Fluxes and of Resources
UN-Habitat	United Nations Human Settlements Programme
WDMI	Water Development and Management Institute



# 1. Executive Summary

## 1.1 Background

A regional consultation was organised in Dar es Salaam in February 2014 to introduce the Nexus Approach to the management of environmental resources. Member state representatives and researchers from seven African countries attended the consultation. One of the major outcomes of the consultation was a decision to establish an African consortium on the Nexus Approach to the management of environmental resources.

The UNU-FLORES Joint Research Project 2 that is focused on drought and flood risk monitoring served as a basis for the consultation in Dar es Salaam. Subsequently concept notes were developed on applications of water point mapping as a tool for drought risk monitoring covering water supply, irrigation and livestock sectors. The concept notes were discussed at Session 11 of Dresden Nexus Conference 2015 that was held on 25–27 March 2015. The workshop was organised to activate the African consortium on drought risk monitoring. The consortium is based on Cooperation Agreements signed between UNU-FLORES and respective ministries of Tanzania, Malawi and Ethiopia.

## 1.2 Workshop Objectives

The overall goal of the Nexus Observatory training workshop that was held in Dar es Salaam from 17–18 December 2015 was to ascertain capacity requirements for drought risk forecasting, monitoring and rapid response among African consortium member states and affiliated ministries and training institutes. The following were the specific objectives of the workshop:

- › Provide an overview of curriculum available on remote sensing, scenario analysis and data applications based on presentations from Technische Universität Dresden (TU Dresden), Leibniz Institute of Ecological Urban and Regional Development (IOER) and United Nations University Institute for Integrated Management of Material Fluxes and of Resources (UNU-FLORES).
- › Discuss partnerships for UNU-FLORES and TU Dresden joint Doctoral Programme on Integrated Management of Environmental Resources covering field work, joint supervision and accreditation of elective courses offered online through UNU-FLORES Blended Learning Platform.
- › Initiate discussions on structure, roles and responsibilities of regional partners for establishment of an Africa Points of Excellence (APE) network on Nexus Approach to the management of environmental resources.
- › Initiate discussions on the scope and reach of African consortium activities, timelines and resource contributions.

### 1.3 Participants' Profile

The workshop was attended by participants from the African consortium member states and affiliated ministries as well as training institutions.



**Figure 1: Government representatives and technical experts including those from TU Dresden and IOER came together at the Nexus Observatory Workshop to discuss drought risk monitoring in Dar es Salaam, Tanzania.**

### 1.4 Workshop Expectations

Generally, the workshop was expected to identify complementarities for research in line with the newly initiated PhD research project on drought risk monitoring – applications of geo-information technologies at UNU-FLORES and TU Dresden. The workshop was also expected to prepare grounds for the Cooperation Agreement for Africa Points of Excellence (APE) network through active collaboration with relevant ministries and research institutions in Tanzania, Malawi and Ethiopia in Africa, as well as make plans for hosting the African research consortium on drought risk monitoring within the premises of a member of the APE network in sub-Saharan Africa.

Specifically, the participants highlighted different aims they would like to have achieved at the end of the workshop. These included:

- › To understand use of scenario analysis
- › How remote sensing can be used in land cover analysis
- › How remote sensing is integrated in water resource management
- › What products are available as far as remote sensing software is concerned
- › What remote sensing and analysis tools are currently available that can be used in Ethiopia
- › Application of remote sensing in relation to drought and experience sharing from different countries

- › How to monitor and focus drought and risk assessment in Africa
- › Tools to raise capacity on drought risk monitoring
- › Experience sharing on scenario analysis
- › Upgrading knowledge on remote sensing and GIS
- › How the outcomes will help measure performance in achieving SDGs
- › Harmonisation in the understanding of remote sensing and application and the establishment of the APE
- › An opportunity to share knowledge and invite researchers to access PhD programmes offered at UNU-FLORES
- › Application of remote sensing in drought risk monitoring

## 2. Opening Session

### 2.1 Opening Remarks by Dr. Shija Kazumba, Principal, Water Development and Management Institute (WDMI)

Dr. Kazumba gave the welcome note and highlighted the importance of sharing knowledge on drought risk monitoring. He further pointed out that workshop participants should come up with solutions on how to address the growing need for risk assessment and management. All countries must join in on an action-oriented response to disaster risk management for socio-economic development. Finally, he went on to welcome all the participants to the conference.



Figure 2: (From right) Dr. Kazumba from WDMI is joined by Mr. Sitolo from the Ministry of Agriculture and Water, Malawi, and Mr. Otieno from UN-Habitat, as he delivers the welcome note at the workshop.

## **2.2 Opening Remarks by Dr. Mathew Kurian, Academic Officer, UNU-FLORES**

Dr. Kurian conveyed regards from Prof. Reza Ardakanian, Director of UNU-FLORES, who was not able to be present and offered sincere apologies for his absence. He reminded the participants on the objectives of the workshop and the outcomes anticipated from the workshop. He pointed out that the workshop offers topics, which can provide different research priorities to be taken back to the respective universities. Finally, he invited participants to show active participation during the workshop proceedings.

## **2.3 Opening Remarks by Mr. Joash Nyitambe, Head of ICT, Ministry of Water and Irrigation, Tanzania**

Mr. Nyitambe established that he is an IT professional and an expert in information management systems of which remote sensing falls as a primary data collector. He extended a vote of thanks to Dr. Kurian for UNU-FLORES's important contribution in the water sector. He finally pointed out that the workshop has the full support of the Ministry of Water and Irrigation.

## **2.4 Opening Remarks by Mr. Pireh Otieno, UN-Habitat**

Mr. Otieno, a human settlement expert from UN-Habitat based at the secretariat in Nairobi, took pleasure in congratulating Tanzania for its new political regime under the newly elected President John Pombe Magufuli and wished him all the best. He pointed out that UN-Habitat has been pushing for issues related to urban development and is continually seeking to advance its relationship with UNU-FLORES in water resources management and drought risk monitoring. UN-Habitat has developed an MoU with UNU-FLORES to track the progress in the attainment of SDG 6.3, which addresses monitoring methodologies for water and wastewater management. However, lack of data has deterred tracking of progress and this workshop would help generate input for the pursuit of data monitoring to meet the target for tracking the progress on SDG 6.3.

## **2.5 Opening Remarks by Mr. Thanasius Sitolo, Ministry of Agriculture and Water, Malawi**

Mr. Sitolo expressed his pleasure in participating in the workshop and advised that there is a need to build capacity and apply a different approach in mapping. There is also a need to make meaning of the research that is done in Africa.

### **3. Session Reports: Day One**

One presentation was given on Day One by Mr. Adam Karia from the Water Development and Management Institute (WDMI) entitled *WDMI Overview Presentation: Structure, Curriculum, Staffing, Skills*. This was followed by three parallel sessions covering various topics.

#### **3.1 WDMI Overview Presentation: Structure, Curriculum, Staffing, Skills**

Mr. Karia gave a presentation that covered the vision and mission of WDMI, its core values, the organisation structure, training programmes offered by the institute and staffing. WDMI was established in 1974 and has since undergone several transformations. The objective of the institute has remained to provide high quality training programmes on water management and technology, undertake consultancy services and research in the field of water, as well as provide an efficient management of the institute's resource.

The institute offers different study programmes that are fully accredited by the National Council for Technical Education in Tanzania (NACTE). These include a Bachelor of Engineering in Water Resources and Irrigation Engineering offered over four years and an Ordinary Diploma (OD) offered over three years in the area of Water Supply and Sanitation Engineering, Hydrogeology and Water Well Drilling, Water Laboratory Technology and Irrigation Engineering, which started in 2011/2012 in line with the Kilimo Kwanza Initiative, as well as a number of different short courses. The institute has a total number of 95 staff members, both academic and non-academic staff.

#### **3.2 Parallel Sessions**

Participants were divided into three groups that attended parallel sessions covering the topics of remote sensing, scenario analysis, and the role of indices in supporting evidence-based decision making. Presenters rotated in different groups located in different rooms to present on the topics identified. After every presentation, time was provided for participants to discuss, comment, seek clarifications and ask questions.

##### **3.2.1 Remote Sensing**

Prof. Manfred Buchroithner presented the topic covering remote sensing. He started his presentation by providing his personal reflection on past experiences when he was doing his PhD. He recounted how the first non-military satellite imagery used in Afghanistan to obtain land cover imagery showed him the important role of remote sensing. Given the importance of digital image processing in the present world, it is necessary to know how to extract information from digital imagery.



**Figure 3: Prof. Buchroithner (left) discusses the subject of Ms. Twisa's research project under the joint PhD programme at TU Dresden and UNU-FLORES.**

He further pointed out that radar images can be used at certain wavelengths, hence the importance of SAR. As such, determining the scale of coverage is the first step towards remote sensing. With respect to that, the size, position and time scale of target phenomena are subsequent concerns. Documentation should be done correctly as it is part of the process. For efficiency, it would be necessary to combine different sensors to obtain adequate thematic information from satellite imagery. Recent civilian satellites allow for monitoring of a particular location every single day for every quarter of an hour. It is either high spectral resolution with low temporal resolution or vice versa. He pointed out that most important DTMs include Shutter Radar Topography Model (SRTM) among others. Case studies covered in his presentation included:

- › Land use and land cover (LULC)
- › Snow cover dynamics
- › Land cover and soil moisture mapping
- › Documentation of droughts

He emphasised that land-use dynamics can be obtained from maps, aerial photographs, and space imagery and some references to existing datasets were made. Field validation was pointed out to be of necessity. Spot checking helps to validate results. Topographic maps are used to determine changes in infrastructure hence land cover monitoring.

As far as climate, glaciers, and river discharge are concerned, Prof. Buchroithner gave an overview of the Aksu basin as an example for glacier monitoring. Imagery for glacier monitoring has been traced all the way back to the early 1960s (e.g. Corona KH-4A in 1964). Glaciers reacting to climate change go through melting and refreezing processes. He finally pointed out that flood mapping, flood documentation and simulations are complementary.

### 3.2.2 Scenario Analysis

Dr. Georg Schiller presented on scenario approaches for strategic planning. He started by introducing the Leibniz Institute of Ecological Urban and Regional Development (IOER), which is an interdisciplinary-oriented institute in Germany. The institute focuses on four research areas, which are Landscape Change and Management, Resource Efficiency of Settlement Structures, Environmental Risks in Urban and Regional Development, as well as Monitoring of Settlement and Open Space Development. The presentation covered different topics such as the cause for scenarios, scenario approaches overview, Explorative Scenarios, and Normative Scenarios.

He pointed out that scenarios are needed to predict about the future. We have different types of futures such as the possible, plausible, probable and preferable future. Scenario analysis is used to explore what would happen (Explorative Scenario), how specific targets can be reached by seeking the implementation of a path or shape a desirable future (Normative Scenario), as well as to train on strategic thinking (Explorative Scenario).

He further said that we think about the future because of what we know we know, what we know we do not know and what we do not know we know. We must have knowledge about the future and understand all the uncertainties. Developing strategies is a key, for instance, in addressing issues of mitigations and avoidance.

Dr. Schiller led the discussion and pointed out that it is important to link infrastructure development with settlement development and how scenarios can support methodological framework to enable the creations of such link.

During the discussion session the following concerns were raised:

- › A participant from Malawi wanted to know more about the decentralisation and reduction of sealed areas strategies. Dr. Schiller responded by pointing out that decentralisation, for instance in Germany, has been used as the most effective strategy to develop human settlement in cities and rural areas. As far as sealed areas are concerned, it was pointed out that these are some places where water is accumulated and run-off is uncontrolled hence accelerating the occurrence of flooding. However, these are among examples of scenario strategies. More strategies can be developed depending on the type of risks involved.
- › A participant from Tanzania raised the issue of land use planning, which is currently not properly followed.
- › Participants from Malawi raised the issue of regularisation of informal settlement, which is currently misunderstood by decision makers. Scenario analysis is required to come up with tangible solutions to address the issues of informal settlement development in the country in the attainment of the SDGs. Squatters have the right to access urban infrastructures such as improved water and sanitation.
- › A participant from Ethiopia highlighted the role of scenario analysis in resettlement planning and master plan in infrastructure development.

- › A participant from Tanzania raised the issue of power and politics, which interfere in decision-making processes. Scenarios may be applied very well for instance in disaster risk management; however, the issues of politics also intervene.
- › Best policies remain on paper but are not implemented and some are lacking enforcement tools such as laws and regulations.
- › There appears to be a lack of political will to enforce policies.
- › There is a lack of information and updated data.
- › Technical experts should be engaged during policy formulation to fill the knowledge gap that exists between policymakers and technical experts.
- › It was also discussed how the scenario analysis can be used to predict the discharge of underground water taking into account the issues of population growth, climate change and changing landscape.
- › Research needs at different levels should be identified using scenario analysis.
- › The use of remote sensing to track past records and events was discussed.
- › Types and quality of data are key to analyse issues such as land-use pattern, run-off, population pattern, rainfall pattern, etc.
- › To minimise bureaucracy in accessing the data – in Germany, the assimilation process is used to address this situation.
- › Time horizon in project development and management is required. Some projects are implemented over a long period and impacted by changing population and the environment.
- › The scenario development is necessary to project future outcomes of events and understand the window of probability of occurrence of different phenomena (e.g. drought and climate change).
- › There is a need to build capacity on how to model scenarios and establish a simplified way to present results to decision makers.
- › A question raised was if scenario analysis is to be based on the present situation or use of past data. Scenario development requires use of past data to understand rate of changes, e.g. demographic or infrastructure and to predict future occurrences.
- › Future projections involve too many uncertainties, which make the outcomes tricky because the results cannot be validated. However, these impacts can be minimised by making assumptions that are plausible and have consistency with past events, before attempting to predict future events.
- › Governments should be ready to support research work. Resource allocation towards research is very small. It was suggested that scientists and researchers should find cross-cutting avenues to present their findings for them to gain priority and also involve sensitive LGAs.

At the end of this session, participants were asked to summarise key issues that emerged from the discussion. The following key issues were summarised by the participants:

- › There is a general lack of awareness on the importance of scenario analysis. Decision makers are not giving sufficient weight to the use of scenarios in the decision-making process. Awareness should be raised among professionals and decision makers. Professionals should provide alternative decisions to policymakers.
- › Change of mindset is required.
- › Support should be provided towards policy implementation. This will include sharing of knowledge about the policy to be implemented.
- › There needs to be more investigation on the linkage between population growth and settlement development.

### **3.2.3 Role of Indices in Supporting Evidence-Based Decision Making**

Dr. Mathew Kurian presented on the *Drought Risk in Sub-Saharan Africa – the Use of Indices in Evidence-Based Decision Making Process*. The presentation covered the governance framework, the use of indices and the cause for indices and scenario analysis as well as implications of the Nexus Approach. Dr. Kurian pointed out that environmental risks are accompanied by institutional risks. Be they environmental risks or other kinds of risks, the government has a role to play and respond to some of these global risks. Governance takes many forms such as decentralisation, privatisation and the use of ICTs, e.g. the use of water mapping technologies. He further pointed out that in order to understand whether government interventions have impacted the particular community, tools such as indices come into play.

He pointed out that just as an index is a mathematical expression that shows the relationship between two variables, indices can bring together researchers and decision makers.

Identifying the relevant set of indicators helps in developing indices for different phenomena. Data collection is also a step towards developing indices. Another option is using existing data to develop a model that will generate indices for more specific applications. The model, however, will have to be shared with the people in the field for validation. Finally, model calibration should be done to further improve the model and to update the indices. In summary, stages involved in developing indices include understanding the shortcomings of current approaches, identification of relevant indicators, weighting of variables, and discussion and negotiation among decision makers and scientists.

He also highlighted why benchmarking is required in decision-making processes. He explained that benchmarking links decisions relating to revenue and expenditure and human resources allocation to a comparative assessment of response of local authorities (governments, communities or utilities) to drought risk. These tools can be used together with scenario analysis to establish resource optimisation (water, soil and waste), which adopts remedial measures based on baseline assessment of biophysical and institutional trends undertaken by the African consortium. He concluded by discussing the implications of Nexus Approach methods, which integrate different systems such as natural resources management, ecosystem, and services coming from resource management.



**Figure 4: Participants engage in group work during the workshop.**

During the discussion session, the following concerns were raised:

- › A participant was not clear about the Nexus Approach. In response, it was explained that the Nexus Approach was developed to move beyond integrated water resources management to also include a governance dimension in the management of environmental resources. By introducing the concepts of trade-offs, synergies, and optimisation, the Nexus Approach seeks to shed light on measures that advance effective implementation in the pursuit of sustainable development.
- › A participant from Ethiopia raised the issue on whether indices can be used as an indicator for drought monitoring. Indices can be used as an indicator for drought monitoring. In addition, socio-economic indicators can be used together with indices to ascertain the impacts of drought on local communities.
- › Capacity is required for decentralisation to be effective at the local level.
- › The debate between decentralisation as a principle and the practicality of decentralisation was discussed.
- › Indices allow for the local variation and forecast about the future.

- › Decision makers should be engaged in the process of conducting research. The Nexus Approach can be used to facilitate this. The Nexus Approach could be used to help find out more about the solutions and improve the situation on the ground rather than looking at the causes of the problem alone.
- › Whether droughts are natural or artificial phenomena, the understanding will enable the coming up of mitigation and adaptation measures to address the situation.
- › Data and information are critical in forecasting. They should be classified according to scale and boundaries to meet the specific context.
- › How can capacity building in governance be applied in sub-Saharan Africa? Part of the capacity development problem is that capacity building happens without keen understanding of the environment of the people involved.
- › On the issue of access to data, although it is always difficult to obtain good data, it is more appropriate to explain to data authorities the importance of the data they are collecting and how you can help them use the data to solve other problems and advise on how to better collect it rather than to ask for data directly. It is also important to use the data we have and present it to policymakers in a simplified manner to gain support and cooperation for advancement of research.
- › Policymakers are mostly dependent on the results of research; it is the responsibility of the scientist to find a simpler way to explain the impact of research and elaborate on the usefulness of research outcomes.
- › Use of scale (specify which locations the data may apply) and boundary conditions, either administrative or biophysical, is necessary in order to strengthen feedback mechanisms.
- › It is important that the network develops or improves data collection and transfer methodologies, learn to work across disciplines, and generate innovative methods of data collection.
- › Data collectors should also receive feedback so that they can understand the impact of their efforts. Data processing skills are dwindling.

## 4. Session Reports: Day Two

On Day Two, group discussions were conducted to discuss the African Research Consortium. After the group discussion, two presentations were given by Mr. Ezekiel Salila from WDMI and Ms. Sekela Twisa from UNU-FLORES, followed by country reports from Ethiopia, Malawi and Tanzania.

### 4.1 Group Discussion

Participants were divided into three groups to discuss and had to later fill out the form prepared by Dr. Mathew Kurian on the African Research Consortium. At the end each participant filled out the form and suggested priority topics, implementing partners and the budget. The form is as provided in the table below.



Figure 5: Participants engage in group exercise in preparation for the African Research Consortium.

Table 1: Form on African Research Consortium

Expertise	Topics	Partners	Budget
Modelling and Remote Sensing			
Scenario Analysis			
Index, Benchmarking and Data Visualisation			

## **4.2 Presentation: Upgrade of Curriculum, Teaching and Didactic Skills and Informal Discussions on APE Network**

Mr. Salila began by giving a historical background of WDMI and traced the major curriculum changes that took place between 1986 and 2005. A new improved curriculum has been introduced to incorporate new technologies developing in the country. The curriculum is developed based on the inputs from a situational analysis. A group of stakeholders is involved in the situational analysis and a committee has been set up to review the curriculum and provide comments before the curriculum is provided to NACTE for approval. Stakeholders involved include both internal and external as well as representatives from the local community.

Challenges for curriculum development and review include inefficient input from stakeholders who may take too much time to give inputs and feedback to improve the occupational skills during curriculum development. The availability of time and resources to improve the curriculum is also among the many setbacks.

Mr. Salila further pointed out that educational programmes running at the institution are NACTE-approved and range from degree programmes, diploma and artisan programmes and other formal and informal short courses. From 2011 to 2015 WDMI conducted training for government officers on water point mapping. Among other challenges faced, the institution had limitations in GPS gadgets and GeoData software accessibility. There is an overall lack of professionals who can perform advanced remote sensing and GIS data processing and visualisation as part of the training in such programmes.

During the discussion participants raised the issue of how the institute received accreditation with all these shortcomings including the shortage of staff. In response, it was pointed out that the accreditation authority looks at specific basic criteria that the institute has met, such that it runs with the minimum requirement; however the additional staff with the increasing admissions would make service delivery more efficient.

## **4.3 Presentation: PhD Project on Source Sustainability of Rural Water Supply in Sub-Saharan Africa**

The presentation was given by Ms. Sekela Twisa who is a PhD researcher under the Joint Doctoral Programme at UNU-FLORES and TU Dresden. She pointed out that Africa faces a disadvantage in water accessibility because of uneven distribution of precipitation, which results in widespread drought in some parts of African countries. Prevalence of droughts further upsets the struggle for water supply. According to the Joint Monitoring Programme of 2013, 83% of the world population that do not have access to clean and safe water live in rural areas (WHO/UNICEF 2013) – sub-Saharan Africa is not exempted from this situation. In the case of Tanzania, Water Point Mapping survey shows that 49% of the water points in rural areas are not functioning. A challenge for donors is that the water points end up drying up, making the projects not sustainable.

Remote sensing is important for evaluating the quantity of water available and predicting how long it can be sustained. The focus of the research is to investigate the failure of water points from the biophysical and behavioural perspectives and also examine the reasons for success and failure of the water points. The methodologies to be used include experimentation, surveys, archival analysis, history and case studies.

During the discussion participants raised a number of questions and comments such as how to investigate sustainability before functionality, and the need to move non-functional water points to functional before they can be investigated for sustainability.

It was further observed that there is room for improvement in the scope of the study. Instead of determining the problem to be solved, it seems the study is built around finding a problem that the GIS and remote sensing tool can be used to solve.

#### **4.4 Country Presentation: Makelle University, Ethiopia**

The presentation was given by Dr. Abraha Adugne who pointed out that a regional rural development plan has been developed in Ethiopia to solve the multi-dimensional water problems specifically for the arid and semi-arid areas. The university needs partners in developing curriculum and for human resource development and research. For example, he cited that the university could potentially benefit from UNU-FLORES's online courses. The programmes will assist in developing capacity and technological advancement. The university needs to be a centre of excellence for modelling and remote sensing. A good collaboration is needed between Ethiopia, Tanzania and Malawi for better outcomes.

The Water Resource Bureau together with the University of Makelle should identify topics, contribute staff and support and facilitate data acquisition and improve approaches towards mitigating drought risks, monitoring, and data processing. The consortium meeting is to be held in 2016.

Makelle University has a system that allows for the establishment of a centre of excellence. There is support from the university management and they hope to use the APE as a platform through which they may begin work in establishing the centre for remote sensing and GIS.

During the discussion a number of questions and suggestions were advanced. The participants enquired on the issue of data accessibility. The observation was made that the data accessibility problem is more or less across the board in Africa but there exists baseline data that can be used for research even though it might limit the extent of research. For example, data for irrigation schemes are available.

Participants raised the issue on whether Tanzania and Ethiopia could collaborate and establish a centre of excellence to share data and expertise and develop research. It was noted that the collaboration issue will not be a problem and for the sake of the workshop, each country can assume a role and contribute to the success of the centre. The centre of excellence can be a sub-Saharan research centre and member countries can identify challenges and fund research towards tackling them. UNU-FLORES is prepared to assist in this endeavour. The research centre will be a win-win situation as long as the partners join forces and help each other in research and are open to share different technologies.

#### **4.5 Country Presentation: Malawi**

The presentation was given by Mr. Thanasius Sitolo who pointed out that Malawi experiences a number of challenges especially natural disasters like droughts and floods. The country signed an agreement to collaborate on jointly taught PhD programmes on drought risk monitoring.

The country is committed to work with the UNU-FLORES community. The universities involved will be the University of Malawi and Mzuzu University. Malawi is highly interested in scenario analysis, looking forward to learning remote sensing from Tanzania and partnering with Ethiopia on issues around modelling.

During the discussion a participant asked whether Malawi has a centre of excellence or a GIS and Remote Sensing Centre. In response it was said that Malawi has an adequate number of laboratories and processing power and expertise. Especially in Mzuzu, the institution has the capacity (equipment and personnel) to carry out most research despite the limitations on advanced software and data availability.

#### **4.6 Country Presentation: Tanzania**

The presentation was given by Dr. Yona Kimori and Ms. Josephine Gobry from WDMI. It was highlighted that the regional consultations began in 2014 with the participation of researchers from seven countries, which led to the unveiling of the African consortium. The concept note for Joint Research Project for Africa was then developed and eventually three countries submitted proposals, i.e. Tanzania, Ethiopia, and Malawi. The countries are equal regional partners. The need to develop mitigation measures of disaster impacts and climate change was raised. WDMI has the role of providing office space, focusing on the adoption of technology and has the opportunity for business growth. The Government of Tanzania is willing to establish a Disaster Management Centre in WDMI.

According to Ms. Gobry, the African consortium is to establish a roadmap for development of policies, infrastructure and human resources. During the discussion it was commented that the consortium has a bright future but most importantly it is necessary to realise that the researches would gain greater approval if they were of benefit to the government for instance in decision-making processes. The research initiative should contribute to the global initiatives. It will be easier to have a virtual structure rather than developing a new structure independent of research and go through extra expenses in funding it.

### **5. Conclusion and Closing Remarks**

The Nexus Observatory Workshop has been helpful in injecting optimism among the partners and streamlining discussions on the Africa Points of Excellence. In line with their strong commitment to build research capacity in Africa, partnering countries should focus on acquiring the necessary relevant capacity in order to solve the problems facing the region. The objectives have been to establish support for research to solve the prevailing drought problem in sub-Saharan Africa, and to also establish the importance of producing research that can contribute towards regional development and the need for capacity development towards the different areas of research pertaining to drought risk monitoring. The workshop has brought to light new ideas on how to tackle the problem using different tools such as GIS, remote sensing, and scenario analysis, all key in advancing data processing and visualisation skills.

The rector of WDMI organised several rounds of discussions both during the workshop and informally during a tour of WDMI campus. A final wrap-up meeting at the end of the WDMI tour was attended by Professor Buchroithner (TU Dresden), Dr. Kurian (UNU-FLORES), representatives of Malawi (Mr. Sitolo, Ministry of Agriculture and Water), Ethiopia (Dr. Abraha, Tigray Water Bureau, Makelle University), and Directors of Administration and Research at WDMI (Dr. Kimori and Dr. Karia). At the end of the discussions the following capacity development priorities were identified for which support of UNU-FLORES and TU Dresden was requested:

1. PhD research projects covering drought, groundwater management and climate change
2. Establishment of regional data repository that supports structured and systematic data collection, analysis and support to decision makers on drought risk in sub-Saharan Africa
3. Research capacity to run remote sensing and soil labs at WDMI
4. Specific nexus-relevant online courses on governance that compliment WDMI classroom courses covering water management and engineering
5. Development of post-graduate curriculum covering topics of water, soil and waste
6. Development of a sandwich PhD program with UNU-FLORES and TU Dresden through institutionalisation of regional PhD workshops/seminars that supports collaboration with African research institutes, donors and ministries
7. Training of Trainer workshops for laboratory technicians and computer programmers with expertise covering remote sensing and soil management
8. Joint development of research proposals and publications plan
9. Organisation of regional Dresden Nexus Conference (DNC) in 2019 in Dar es Salaam to showcase results of regional research and identify development priorities in presence of international partners

During the discussions undertaken at the two-day workshop and in discussions with the Permanent Secretary, rector of WDMI, TU Dresden, and UNU-FLORES, an interest was expressed in knowing more about how the discussions on regional research capacity may be structured within the framework of the UNU operating unit for sub-Saharan Africa. In principle WDMI was open to discussing in-kind contribution that would cover premises, security, and routine maintenance for a start-up phase of three years (2016 to 2019).

## References

WHO and UNICEF. 2013. *Joint Monitoring Programme (JMP) for Water Supply and Sanitation: Progress on Sanitation and Drinking-Water*. Geneva: WHO and UNICEF.

## 6. Appendix

### 6.1 Workshop Programme

# NEXUS OBSERVATORY WORKSHOP ON DROUGHT RISK MONITORING

*Capacity Development Priorities  
for Sub-Saharan Africa*

17 – 18 December 2015  
Mbezi Garden Hotel, Dar es Salaam

#### Programme Outline

DAY 1		
9:00 - 9:30	Registration	ALL
9:30 - 10:00	Introduction and Welcome Note	Dr. Kazumba, WDMI Prof. Ardakanian, UNU-FLORES Mr. Nyitambe, Ministry of Water and Irrigation, Tanzania Mr. Otieno, UN-HABITAT
10:00 - 10:30	<i>WDMI Overview Presentation: Structure, Curriculum, Staffing, Skills</i>	Mr. Karia, WDMI
10:30 - 11:00	Coffee Break	ALL
11:00 - 12:30	<i>Parallel Sessions:</i> <ul style="list-style-type: none"> <li>› Remote Sensing</li> <li>› Scenario Analysis</li> <li>› Role of indices in supporting evidence-based decision making</li> </ul> <i>Technical Presentation and Discussion involving participants from Malawi, Ethiopia and Tanzania</i>	Prof. Buchroithner, TU Dresden Dr. Schiller, IOER, Dresden Dr. Kurian, UNU-FLORES
12:30 - 14:00	Lunch Break	ALL
14:00 - 15:30	<i>Parallel Sessions:</i> <ul style="list-style-type: none"> <li>› Remote Sensing</li> <li>› Scenario Analysis</li> <li>› Role of indices in supporting evidence-based decision making</li> </ul> <i>Technical Presentation and Discussion involving participants from Malawi, Ethiopia and Tanzania</i>	Prof. Buchroithner, TU Dresden Dr. Schiller, IOER, Dresden Dr. Kurian, UNU-FLORES
15:30 - 16:00	Tea Break	ALL

## DAY 1

16:00 - 17:30	<p><i>Parallel Sessions:</i></p> <ul style="list-style-type: none"> <li>&gt; Remote Sensing</li> <li>&gt; Scenario Analysis</li> <li>&gt; Role of indices in supporting evidence-based decision making</li> </ul> <p><i>Technical Presentation and Discussion involving participants from Malawi, Ethiopia and Tanzania</i></p>	<p><b>Prof. Buchroithner</b>, TU Dresden  <b>Dr. Schiller</b>, IOER, Dresden  <b>Dr. Kurian</b>, UNU-FLORES</p>
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## DAY 2

10:00 - 11:00	<p><i>Presentation:</i>          Upgrade of curriculum, teaching and didactic skills &amp; Informal Discussions on APE network covering objectives 2-5 of workshop</p>	<p><b>Mr. Salila</b>, WDMI</p>
11:00 - 11:30	<p><b>Coffee Break</b></p>	<p><b>ALL</b></p>
11:30 - 12:30	<p><i>Presentation:</i>          Joint Doctoral Programme Covering field work, Joint supervision and accreditation of elective courses offered online through UNU-FLORES Blended Learning Platform</p>	<p><b>Ms. Twisa</b>, WDMI  <b>Dr. Kurian</b>, UNU-FLORES          Country Presentations</p>
12:30 - 14:00	<p><b>Lunch Break</b></p>	<p><b>ALL</b></p>
14:00 - 15:00	<p>WDMI led discussion on structure, roles and responsibilities of regional partners for establishment of an APE network</p>	<p><b>Dr. Kimori</b>, WDMI          Country Presentations</p>
15:00 - 15:45	<p>WDMI led discussion on scope and reach of Africa consortium activities; timelines and necessary resources</p>	<p><b>Ms. Gobry</b>, WDMI          Country Presentations</p>
15:45 - 16:00	<p><b>Closing Remarks</b></p>	<p><b>Dr. Kazumba</b>, <b>Dr. Kurian</b> &amp; <b>Mr. Nyitambe</b></p>



## 6.2 List of Workshop Participants

### UNU-FLORES, TU Dresden & IOER

10. Dr. Mathew Kurian
11. Prof. Manfred Buchroithner
12. Dr. Georg Schiller
13. Sekela Twisa

### Ethiopia & Malawi

1. Dr. Abraha Adugne
2. Dr. Bizineh Asfaw
3. Dr. Abdelwassie Hussein
4. Dr. Ahmed Mohamod
5. Dr. Hadush Goitom
6. Petro Zuzani
7. Swithern Matamula
8. Thanasius Sitolo
9. Mphatso Matola
10. Harvey Chilembwe

### UN-Habitat

1. Pireh Otieno

### Tanzania

#### WDMI

1. Dr. Shija Kazumba
2. Dr. Yona Kimori
3. Adam Karia
4. Yusuph Mbogossy
5. Livingstone Swilla
6. Magori Nyangi
7. Andrew Minu
8. Lusajo Mfwango
9. Nzoja Shauri
10. Joseph Ndanu

11. Rodrick Mero
12. Ezekiel Salila
13. Doglas Mmasi
14. Ghanima Chanzi
15. Bernard Rugayi
16. Juma Mchiro
17. Josephine Gobry
18. Lightness Eliamringi
19. Khadija Mrisho
20. Hashimu Maulid
21. Enock Busyanya
22. Ramadhani Rajabu
23. Charles Mafie
24. Philemon Barabojika
25. Jackson Mkwama
26. Anna Stephen
27. Sufian Athumani
28. Athuman Wambura
29. Mafie C
30. Frola Shayo
31. Regina Sekao
32. Mgata Mgata

#### Ministry of Water and Irrigation

1. Joash Nyitambe
2. Eng. Jackson Mutazambwa
3. Joseph Kasangara

#### Facilitator and Rapporteur team

1. Eng. Ngwisa Mpembe
2. Editha Assey
3. Nuru Mohamed
4. Emmanuel Alfred

*The views expressed in this publication are those of the authors.*

*The authors are responsible for ensuring that all figures, tables, text and supporting materials are properly cited and necessary permissions were obtained.*

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UNU-FLORES develops strategies to resolve pressing challenges in the area of sustainable use and integrated management of environmental resources such as soil, water and waste. Focusing on the needs of the UN and its Member States, particularly developing countries and emerging economies, the Institute engages in research, capacity development, advanced teaching and training as well as dissemination of knowledge. In all activities, UNU-FLORES advances a Nexus Approach to the sustainable management of environmental resources.

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