

PROCEEDINGS

1ST INTERNATIONAL SCOPING WORKSHOP on the Establishment of the
United Nations University Institute for Integrated Management of Material Fluxes
and of Resources (UNU-FLORES) and Its Twin in Mozambique

11 – 12 November 2010, Dresden, Germany



Maputo River, Mozambique

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of the 1st International Scoping Workshop on the Establishment of the **United Nations University Institute for Integrated Management of Material Fluxes and of Resources (UNU-FLORES)** and Its Twin in Mozambique

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by
Dr Reza Ardakanian
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Coordinated by



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*Konrad Osterwalder*

Foreword

When preparations for the 1st International Scoping Workshop on the United Nations University Institute for Integrated Management of Material Fluxes and of Resources (UNU-FLORES) started during the summer of 2010, I was pleased to note that the initiative to establish this Institute in Dresden, Germany, is gaining momentum. The topic of UNU-FLORES is at the heart of UNU's overall aim to foster sustainable development. The Institute is thus determined to strengthen and complement the capacities and expertise related to the management of resources – water and soil in the first place – and the development of sustainable handling of waste which are already available within several existing UNU Institutes and programmes. Dresden is indeed an appropriate place for such an Institute since it was in the region of Saxony where the term „sustainability“ was coined in the 18th century in the field of forestry and where sustainable management of forests was first explored, practised and taught to students. Today, the main partner university of UNU-FLORES, the Dresden University of Technology (TUD), offers several unique structures, combining engineering, natural sciences and socio-economic disciplines to develop integrated approaches for sustainable management of resources. UNU-FLORES will make use of this expertise and carry it further and upscale existing approaches, adding an international dimension.

One of the main new strategies which UNU has pursued in recent years in accordance with its vision of being truly international and of overcoming a geographical skew in the location of its Institutes, is the 'Twin Institute concept'. By establishing a second or third campus of existing UNU Institutes in developing countries, UNU's global presence will be enhanced. It further aims to maintain high level research and educational capacity worldwide. UNU-FLORES is a unique case in this respect since the establishment of a Twin Institute, most likely in Mozambique, goes side-by-side with the establishment of the Institute in Dresden.

The 1st International Scoping Workshop held in Dresden in November 2010 was a significant step forward towards the establishment of UNU-FLORES, as it demonstrated a significant commitment on the part of all involved parties, both scientific and political. Scientists from TUD, Mozambique, other African countries, the international community and from UNU discussed and shaped the scope and mission of UNU-FLORES and identified areas for cooperation and the potentials for synergy. The political stakeholders were present too, namely the Saxon State Minister for Higher Education, Research and the Fine Arts, and the Ministry of Science and Technology of Mozambique, represented by Deputy National Director and the Ambassador of Mozambique to Germany, and conveyed their commitment and support. It was this professional and political momentum which paved the way for further progress: shortly after the workshop in Dresden, the Memorandum of Understanding on the establishment of UNU-FLORES in Dresden was signed by the German Federal Minister of Higher Education and Research, the Saxon State Minister for Higher Education, Research, and the Fine Arts, the Rectors of TUD and UNU, and the Council of UNU adopted the statute of UNU-FLORES during its 57th Session in December 2010.

This report on the state of the art and the current status of UNU-FLORES may serve as a comprehensive reference for all partners who are already involved in the initiative. More importantly, it may inform future partners, especially those working with regard to the envisioned Twin Institute and the conceptual development and background of the Institute. Hopefully, by so doing this report will contribute to maintaining (for present partners) or accelerating (for future partners) the momentum which is still needed to establish UNU-FLORES as a Twin Institute and help to fulfil the important mission it has.

Prof. Dr Konrad Osterwalder

Rector, United Nations University
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1. Introduction

The 1st International Scoping Workshop on the United Nations University Institute for Integrated Management of Material Fluxes and of Resources (UNU-FLORES) took place in Dresden, Germany, on 11 and 12 November 2010. It was attended by more than 30 high-level stakeholders from UNU, Dresden University of Technology (TUD) and associated institutions, from Mozambique, other African countries and international experts. During this workshop, participants were informed about the general strategies concerning research, education and capacity development within UNU, TUD and the government of Mozambique. They were briefed about the status of the conceptual development of UNU-FLORES, the situation in Mozambique and Southern Africa concerning resource management (problems, developments) and about current activities concerning capacity development of all involved partners. Based on various background documents and an earlier distributed questionnaire, these issues were elaborated on within working groups.

The goal of this document is to provide workshop participants and further stakeholders interested in the initiative or those who are becoming involved at this point, with a comprehensive documentation of the state of the art concerning the establishment of UNU-FLORES in Dresden and its envisaged Twin in Mozambique. Thus, besides documenting the results of the scoping workshop, preparatory steps and background documents which had been prepared before the workshop are also included. In addition, the Memorandum of Understanding (MoU) on the establishment of UNU-FLORES in Dresden, which meanwhile has been signed by the involved parties i.e. UNU, TUD, the German Federal Ministry of Education and Research (BMBF) and the Saxon Ministry of Higher Education and Fine Arts (SMWK), is provided, documenting the important first formal steps in establishing UNU-FLORES.

In the last section key activities since the organization of the 1st International Scoping Workshop as well as brief remarks on the next steps are outlined. Clearly, for the process to continue smoothly, cooperation and continued inputs by all involved partners are crucial. This working document intends to keep up and manifest the momentum gained during the first workshop through the next workshop and further, eventually resulting in a clear cut implementation plan, fully supported by all partners.



Participants in the 1st International Scoping Workshop in Dresden. Photo: UNU-ViE

2. Background documents

While preparing for the 1st International Scoping Workshop and as general background information for the implementation of UNU-FLORES in Dresden and its Twin in Mozambique, it was considered crucial to have a clear picture of the core area of focus of the proposed Institute. The ideas on this issue were elaborated in the concept note and proposal, approved by the Council of UNU and finally accepted for funding by BMBF and the Saxon government. This concept note was based on the existing expertise at TUD, mainly provided by the Faculty of Forest, Geo and Hydro Sciences (FGH), the will of UNU to establish an Institute within the field of management of matter fluxes and of resources and on feedback by the funding agencies. With small amendments, the below outlined draft of the core area of focus of UNU-FLORES was extracted from this concept note and thus represents the conceptual status of UNU-FLORES as of November 2010.

With respect to the proposed Twin in Mozambique, it was considered essential to first gather an overview regarding the status of water-related research in Mozambique and its neighbouring countries. The below report is based on enquiries carried out between September and October 2010.

A steering committee, composed of stakeholders from UNU and TUD, decided in the summer of 2010 that in order to create momentum for the process of establishing UNU-FLORES, a scoping workshop should be organized in due course. A list of stakeholders to be invited was composed, mainly covering potential future partners among UNU, TUD and associated institutions as well as partners from Mozambique and neighbouring countries. Since these stakeholders were antici-

pated to represent the future scientific network of UNU-FLORES, their support and commitment had to be ensured. Therefore, a scientific questionnaire was drafted and distributed alongside with invitations to the 1st International Scoping Workshop. This questionnaire aimed at clarifying the cooperation potentials with these stakeholders as well as their expectations. Responses were evaluated and summarized, distinguishing between the main stakeholder groups: UNU, TUD and African stakeholders.

2.1 UNU-FLORES: Draft outline of main areas of focus and interfaces with partners

2.1.1 Mission statement

UNU-FLORES will contribute to improve the efficiency of the use and management of resources, such as water, soil and waste in developing and emerging countries in scientific, educational, managerial, technological and institutional terms.

Innovative concepts for target- and region-specific knowledge transfer of results as well as appropriate methodologies and approaches for undergraduate, postgraduate and professional education will be developed for sustainable capacity development.

As a result of research and development projects, decision support for various target groups, such as ministries and governmental organizations, municipalities, enterprises, NGOs and other stakeholders will be provided.

2.1.2 Research directions

The proposed UNU-FLORES Institute will be dedicated to research, postgraduate education and training of professionals in order to contribute to integrated management and capacity development for material flow and resources management. It will deal first and foremost with environmental resources (e.g., soil, water and waste) with the perspective to address other geo- and energy resource flows as the Institute develops. UNU-FLORES shall contribute as a fulcrum point to the development of global sustainable management strategies. The Institute will be closely affiliated with TUD and other Dresden and Saxony-based relevant research institutions, thus exploring the potential and contributing to the international up-scaling of what may be called "Competence Centre Dresden".

Instead of the hitherto attempted static spatial referencing of the resource management (e.g., water resources management of a river basin: in simplified terms an input-output model) it will be explored whether the consistent tracing (follow-up) and management of the resource throughout its migration (passage, flow, transport, transfer) during subsequent compartments and phases would lead to a more comprehensive insight and ultimately more efficient and sustainable management results. In case of the resource water, this approach would imply to enclose both the so-called small and large water cycles. The small cycle includes the following sequences: "nature" withdrawal, channel transport of water, treatment plant, distribution system, consumption/use, collection and transport of sewage and waste water, treatment, recycling and/or return to "nature", is linked to the large water cycle (passage of water in the "natural" hydrosphere: atmosphere,

biosphere, lithosphere, oceans and so forth). In simplified terms this means the replacement of the traditional input-output model by the concept of linked cycle monitoring and management. The development of this, what may be called "linked cycle management" approach is the core scientific task of the Institute.

The above sketched challenge is envisaged to be addressed within five scientific sections:

1. Systems and Flux Analysis
2. Global Change Assessment (climate, land use, demographic, socio-economic)
3. Water Management
4. Soil and Land Use Management
5. Management and Treatment of Waste

The two "core" sections "Systems and Flux Analysis" and "Global Change Assessment" and their respective research scopes define the challenge, the approach and expected results of UNU-FLORES. The multi- and interdisciplinary approach pursued in these efforts will be supported by three further subunits where expertise related to the three resources/materials will be grouped.

The "Water Management" section will particularly focus on the two hydro-cycles: the "natural" and the "artificial" hydro-cycle. The natural hydro-cycle describes the flux of water and vapour in the geosphere, biosphere, hydrosphere and atmosphere at different scales, of which the basin/aquifer scale is the smallest one. The "artificial" hydro cycles such as the municipal (urban, rural), industrial and agricultural ones focus on the intensive interactions and pollutions of water along its passage in pipelines, canals, ditches, when used as a production factor, cooling, generating power, consumed or deployed as conveyance agent. Among these "small" hydro cycles the urban one will be given ample consideration, although the agricultural cycle offers the best opportunities to explore soil-water interaction and hence subsurface fluxes at various scales. This section has an excellent cooperation potential with the United Nations University Institute for Water, Environment and Health (UNU-INWEH) and the UN-Water Decade Programme on Capacity Development (UNW-DPC).

"Soil and Land Use Management" considers both the impacts and the interactions: potential improvements but also deteriorations of soil texture, fertility and availability through changing land use and its management. Both socio-economic, but also climate change, altering vegetation cover, increasing rainfall intensities, compaction/erosion tillage and accelerated decomposition of organic materials will be considered. Urbanization and development of transport infrastructure are considered as clear-cut threat because they not only lead to prime agricultural land loss but also contribute to the sealing of the surface of land. Deforestation, especially by using fire is not only one of the most widespread land use changes but also contributes both directly and indirectly to climate change.

The section “Management and Treatment of Waste” covers the issue of collection, storage, processing and recycling of waste thus considering it both as “refuse” to be disposed but also as a source of energy or nutrients. Particular emphasis will be given to the identification, assessment and rehabilitation of contaminated sites (wild deposits, old military areas, etc.), providing an excellent impetus for collaboration with the “Soil and Land Use Management” section. It is to note that collaboration potentials with the United Nations University Institute for Natural Resources in Africa (UNU-INRA) and the United Nations University Institute for Environment and Human Security (UNU-EHS) are excellent.

2.1.3 Education and capacity development

UNU-FLORES, as all UNU Institutes, will engage both policy relevant research in the above described challenging areas and in postgraduate capacity-building activities at Master and PhD level. At Master level a very close synergy will be sought and explored with similar programmes offered by TUD FGH. During the first phase, UNU-FLORES scientific staff will contribute as resource persons and thesis supervisors to the programmes. Once the Institute reaches its intended strength, depth and width, the formulation and launch of joint Master degree programmes in integrated resource management could be envisaged.

As far as the PhD programme is concerned, this high level segment will be considered from the very beginning of the conceptual and institutional development of UNU-FLORES. Being directly linked with the research programme, the PhD component, while admittedly an organizational burden for an emerging Institute, would strengthen the research component by providing swiftly the critical mass of research capacity. Joint PhD activities enable the rapid and effective linking of UNU-FLORES to:

- TUD
- UNU Institutes (UNU-INWEH, UNU-INRA, UNU Tokyo-based programme on sustainability science, UNU-EHS, the United Nations University International Institute for Software Technology (UNU-IIST), UNW-DPC)
- German and Dresden-based scientific institutions, such as the Helmholtz Centre for Environmental Research (UFZ), key partner of the Helmholtz Interdisciplinary Graduate School of Environmental Research (HIGRADE).

Next to the cycle-oriented integrated resource/material flux management concept as the main scientific challenge, a multinodal water resources management-oriented PhD programme can be envisaged as the other key characteristic of the proposed Institute.

2.1.3.1 The multinodal UNU PhD programme on “water”

UNU-FLORES will join the family of geographically distributed UNU Institutes. Several of these entities have viable water-related research and education activities, frequently engaging with local academic partners and universities in PhD or Master level programmes. Within the new strategic initiatives, UNU aims to be-

come itself a graduate degree awarding university in order to fulfil its paramount capacity-building mandate for developing countries. Within this context, a crucial chance and challenge is to explore the hidden synergies in the distributed research and teaching capacities of existing and new UNU Institutes. In this context, a particular role can be foreseen for UNU-FLORES.

The envisaged multinodal PhD programme focusing on “water” could start with three continental “nodes” in Northern America (UNU-INWEH in Hamilton, Canada), Asia (UNU Tokyo-Yokohama) and Europe (UNU-FLORES, Dresden, and UNU-EHS, Bonn). This PhD programme is conceived to admit students at any of these nodes. Once registered as a student of the respective “entry institute”, the successful PhD candidates enter a joint programme where all nodes (and their respective local partners) contribute to the curriculum and research opportunities with their main field(s) of competence. Coursework is offered in block-lecture modes, envisaging also rotating lecturers. Students mainly spend the substantial part of their research phase elsewhere than their entry points among the participating nodes.

The following development trajectories can be pursued:

- to extend the scheme for Africa (presumably UNU-INRA in Accra)
- to involve the UNESCO-IHE Institute for Water Education (located in Delft, the Netherlands) in the programme
- to explore whether the degree awarded should be issued by UNU alone, or at the participating nodes joint and/or double degree models should be established.

Capacity development for and in developing and emerging countries is considered to be a crucial aim of UNU-FLORES, within but also along the above outlined multinodal programme. Education of future research on sustainable resources management is provided through a PhD graduate school programme and a Master of Science programme hosted by TUD. It will be carefully evaluated how the educative courses can become joint projects together with other UNU Institutes related mainly to water.

2.1.3.2 Dresden-based graduate school

A PhD graduate school will be implemented with the goal of ensuring a profound and unique education scholarship programme for PhD students. The graduate school can be linked to the graduate academy of TUD and to the graduate school HIGRADE of UFZ in collaboration with – among several universities – TUD. The linkage to these large graduate schools guarantees for networking of the UNU PhD students and opens up opportunities for an enormous variety of courses.

2.1.3.3 Master of Science programme

A Master programme on resources management and material flux analysis could be hosted at TUD FGH. The present Master course Hydro Science and Engineering

held in English could serve as a basis which would be extended with various modules allowing the students to diversify their study contents.

The UNU Master programme could be linked with the United Nations Environment Programme (UNEP) programmes held at the Centre for international postgraduate studies of environmental management (CIPSEM) in Dresden. For 30 years, each year six-month courses on environmental management and three one-month courses on changing topics are organized for about 20 students from developing and emerging countries. The implementation of such a Master programme should include the option to implement a kind of twin degree of UNU and TUD.

2.1.4 Relation to Dresden University of Technology

There will be strong cooperation of UNU-FLORES and TUD in teaching, research and with regard to shared infrastructure.

2.1.4.1 Research cooperation

Both parties will profit from joint projects and UNU will provide an international network as well as international staff with access to international research funds. TUD has a good record in research on environmental problems, implementation of solutions, international education as well as a long experience in cooperation with industry and application for research funding.

2.1.4.2 Cooperation in teaching

The strong cooperation in teaching is outlined above in chapter 2.1.3. On the one hand, administration of the Master programme open for UNU scholarship Master students is run by TUD. On the other hand, UNU personnel offers a variety of lectures and modules which are open for regular TUD Master students. Topics for Master theses are also offered and supervised by UNU.

The director of the UNU Institute will be a professor at TUD, similarly to the twin professorships between Helmholtz or Leibnitz institutes and TUD.

2.1.4.3 Infrastructure: classrooms, laboratories, dormitories

TUD provides its infrastructure for UNU activities, where it seems inefficient to build up an independent infrastructure for UNU. This refers to the administrative capacity for teaching which refers to the organization for the Master course as outlined above. Here, seminar rooms are also provided.

Experimental research on environmental problems often requires laboratory capacity. Instead of building up this capacity at UNU, the equipment and laboratory space will be shared with that of TUD, especially at FGH. However, personnel to carry out laboratory experiments or analysis may be recruited at UNU, either among scientists financed on a project basis or among technical assistants, respectively.

2.1.5 Interfaces to other UNU Institutes

UNU-EHS (Institute for Environment and Human Security) in Bonn:
Flood research, risk perception, land use and climate change, adaptation, vulnerability assessment and impact analysis of mass migration on water cycles.

UNU-ISP (Institute for Sustainability and Peace) in Tokyo:
Urban risks, sustainable development, urban planning and infrastructures.

UNU-LEH (Institute for Landscape and Ecosystem Health) in Slovakia:
Ecosystems management, rehabilitation of deteriorated ecosystems eventually through engineering approach and adaptation to dynamic changes (climate, politics, economics).

UNU-INWEH (Institute for Water, Environment and Health) in Canada:
Since UNU-INWEH is thematically closest to UNU-FLORES, it is important to define this interface. On the basis of the four thematic areas Water-Health-Nexus, Freshwater Ecosystems, Dryland-Ecosystems and Coastal-Zone-Ecosystems, overarching goals include the improvement of drinking water accessibility, sanitation and the advancement in Integrated Water Resources Management (IWRM). However, the Dresden-based Institute's approach is different since it is more model and laboratory research and development-oriented than the UNU-INWEH approach. For this reason, synergy effects can be developed.

UNU-INRA (Institute for Natural Resources in Africa) in Ghana:
Improvement of food security via enhancing the efficiency of irrigation and water resources management in the Volta River Basin.

UNU-IIST (International Institute for Software Technology):
this Macao-based UNU Institute is actively involved in software development for water resources management.

2.1.6 Twinning strategy for UNU-FLORES

The internal impact assessment within UNU revealed a geographical skew in the distribution of the location of UNU Institutes. While expertise in core challenge areas such as natural resource management, adaptation to the adverse effects of climate change and unsustainable economic practices are available in the more than a dozen Institutes of UNU, most of them are located in the so-called developed countries.

In order to rectify this mismatch between the locations of available knowledge and the prevailing needs for it, UNU has embarked on a process called "twinning" which would imply the establishment of additional campuses of its existing and future institutions. Twin Institutes (indeed 2nd or 3rd campuses of existing ones) should be located in developing and transitional countries. They should be demand-driven and receive in-kind, financial and moral support from the new host countries.

Water is a crucial factor of development and several UNU Institutes – among them the Germany-based ones like UNU-EHS, UNW-DPC as well as the envisaged future UNU-FLORES Institute in Dresden have substantial knowledge on several aspects of water and its management. The involvement of research organizations and researchers from developing countries, first and foremost in Africa, is crucial as it has been proven and widely expected that the most negative impacts of climate change and unsustainable activities, though frequently practiced, would be felt in the South, notably in sub-Saharan Africa. The African Ministerial Council on Science and Technology (AMCOST), in cooperation with the New Partnership for Africa's Development (NEPAD) has also identified the need for a concentrated, concerted and solution-oriented science for African development and the adaptation to cope with the vagaries of climate change, desertification and disasters of natural origin. The Consolidated Plan of Action for Science and Technology for Africa (CPA) calls among others for the establishment of regional (African) centres of excellence with different thematic scopes. A Twin Institute of UNU-FLORES in Africa could thus be conceived as a part of an African regional centre of excellence foreseen by CPA.

Located along the south-eastern rim of the African continent, Mozambique is intersected by several major rivers (Zambezi, Limpopo, Buzi, etc.) draining the central highlands towards the Indian Ocean. The flow regimes of these rivers are particularly subject of climatic variability and climate change.

In addition, large-scale development activities, water withdrawals and reservoirs upstream contribute to further aggravation of drought, while they do not provide enough storage space to alleviate the worse consequences of floods. Therefore, Mozambique is very vulnerable to the consequences of natural hazards due to its geographical location. A series of devastating floods during the last decade destroyed some of the results of the development Mozambique had experienced in the last two decades.

Mozambique has emerged from a long lasting civil war with considerable political stability, reforms and a developing economy. In many aspects, while still in need for human capacity development to carry further its economic and institutional progress, Mozambique can be characterized as one of the most promising African countries. It could be identified as a "role model" for countries developing under similar conditions and opportunities. The capacity needed (both at individual and institutional levels) could to a great extent be provided and strengthened through collaboration and sustained presence of UNU in Mozambique. Establishing a water-related Twin Institute of UNU-FLORES in Mozambique would not only be of great help for Mozambique but could also have a strong regional impact.

This positive account on stability, local interest and potential ownership as well as clearly identifiable needs and challenges make Mozambique the primary potential partner for UNU to consider this country as the location of its first Twin Institute in Africa. Preparatory work for the establishment of this Institute should start concomitantly with establishing UNU-FLORES in Dresden.

2.2 Overview of the current state of water-related research in Mozambique and Southern Africa

2.2.1 Rationale

This section aims at providing a brief overview about the current state of water-related research (only freshwater) in Mozambique and neighbouring countries. The emphasis will be mainly on water, since it is supposed to be the core issue of the proposed Twin Institute besides soil and waste, which will be considered in a later phase of preparation of the Mozambique Twin of UNU-FLORES. The importance of water research and water management is clearly recognized by both the scientific community and the Mozambican Government, as indicated by several recent initiatives. For instance, a Mozambican symposium on water resources took place in Maputo in September 2010 and another large international conference (Water-Net Symposium) will be held in October 2011 (please see below). Moreover, the launch of a new Master course at Eduardo Mondlane University (UEM) is envisaged and the Ministry of Science and Technology (Ministério da Ciência e Tecnologia, MCT) recently established a water research institute.

This brief overview is based on experience gained while being involved in the initiative for establishing UNU-FLORES and its Mozambique Twin. A first query in the ISI Web of Science (search term "water AND Mozambique") as well as general internet queries using the same search terms were additionally performed. To some extent the scope of this overview includes neighbouring countries, however South Africa was deliberately neglected in this respect, since the information available on that region is rather extensive for the purpose of this document which serves mainly as providing a brief overview on the topic. Within the region, WATERnet (www.waternetonline.org), a regional network of university departments and research and training institutes specialized in water, located in Harare, stands out in being very active on water issues. WATERnet is the regional network within Cap-Net (<http://www.cap-net.org/>), an international network for capacity-building in water resources management by the United Nations Development Programme (UNDP). In October 2011, Maputo will host the 12th WATERnet/WARFSA/GWP-SA Symposium, the largest scientific event on water, gathering more than 300 international delegates.

As a first general impression it emerges that international visibility of water-related science in Mozambique is increasing in regard to papers available in the Web of Science. However, rather few papers were found with the first author's affiliation being in Mozambique. Many more project reports, Master's thesis and dissertations containing relevant information on water-related issues are principally available even though they are more difficult to find. It should also be noted that documents in Portuguese, which certainly may have a large impact in Mozambique, were not considered here.

In Mozambique, research activities related to water are clearly concentrated in Maputo, at UEM and more specifically, in the Faculties of Engineering and Agriculture. A Master's course in Hydraulics and Water Resources (first edition) has been launched in the department of Civil Engineering of UEM in 2010.

Until recently, UEM was the only public university in Mozambique. The second and the only recently established public university in Mozambique, University of Zambeze (UniZambeze) in Beira, with satellite stations distributed among several cities, is planning to emphasize on water research in the future. A joint project by TUD and UniZambeze started in the summer of 2010 dealing with issues of water quality assessment, including aquatic ecotoxicology. It is anticipated that this project will become a starting point in this direction.

2.2.2 Issues in water research

Below, current and recent research and development activities, mainly in Mozambique, are grouped into major research directions. Examples given for each of the research directions are indeed meant to represent examples, without claiming to be comprehensive.

2.2.2.1 Drinking water supply

In a country where according to current official figures nearly half of the country's population and about 45 per cent of urban residents do not have access to safe drinking (Matsinhe 2008), this is certainly an issue of vital importance. Accordingly, many projects work on improving the situation, funded both by national and international (e.g., WaterAid) donors. Local water suppliers are certainly involved in several research and development (R&D) projects both in the Maputo area (Águas de Moçambique, projects G-MOSAIC, MyWATER and TRUST) and in rural regions (e.g., FIPAG, Devex project). Research activities are also concentrated on this issue, ranging from rather technical aspects of desalination (Arnal et al. 2010) and methods of improving drinking water treatment (Matsinhe 2008) to management and regulation aspects of service providers (Matsinhe et al. 2008). With few exceptions (Godfrey et al. 2005; Muiuane 2007) groundwater supply seems to be largely neglected in current research activities, but since 2008 a groundwater network was established within WATERnet. In the context of water supply, social implication within communities (Baptista 2010) and gender issues (Afonso 2004) are also taken into consideration.

To conclude, although many projects work on improving drinking water supply, much more needs to be done. Some research is carried out, however groundwater is still understudied.

2.2.2.2 Waste water treatment

Sanitation and waste water treatment is increasingly becoming an issue especially in the larger cities. Similar to water supply, many donors are active in projects aimed at improving the situation (e.g., IRC, WASHCost Project, NUFFIC, Water and Sanitation). In the case of Maputo, insufficient infrastructure gives rise to heavy surface and groundwater pollution posing significant health and environmental risks. However, it was concluded from a modelling study that a full-scale collection and treatment of sewage will not be sustainable and that small-scale systems might be a better option (Chan 2004). Such challenges are faced by many regions of southern Africa (Nyenje et al. 2010).

2.2.2.3 Flood protection

Mozambique is naturally prone to being affected by floods and has developed an ample experience in coping with them (Hanlon and Frances 2002; Kampffer 2009; Vaz 2000). This positive account holds both for municipal authorities especially concerning warning systems (Kampffer 2009) as well as local people adapting their life styles (Artur 2008). New techniques for improving early warning and monitoring systems are also being developed (Asante et al. 2007).

2.2.2.4 Water quality assessment

The need for water quality assessment and management programmes is widely recognized in Mozambique (Hugman 1984) and some attempts for its implementation were made (Chilundo et al. 2008). For Zambezi River, the assessments from various periods and countries covering aspects of biodiversity, morphology and so forth are available (Hall et al. 1977; Ronco et al. 2010; Scott 2010; Timberlake 1998). Nevertheless, systematic investigations and longer-term monitoring programmes still seem to be scarce. In this respect, involving local stakeholders and indigenous knowledge and practices in water quality monitoring also seems to be a promising approach (Nare et al. 2006).

The proposed project of TUD/UniZambeze could be an important building block in establishing a comprehensive monitoring scheme as basis for integrated water management. This project has started in 2011 as a pilot study for two years. However, it is intended to be extended and upgraded afterwards both in a spatial scale and scope.

2.2.2.5 Integrated Water Resource Management

Putting water quality assessment into a wider perspective, it is typically incorporated in IWRM schemes. Being a great challenge in itself within UNU-FLORES, IWRM is anticipated to be upgraded to an even higher level of understanding capable of leading to more efficient and sustainable management results. IWRM is a central issue in e.g. WATERnet and seems to be generally accepted as state of the art concept within the scientific community. In principle, IWRM is considered within the legal framework concerning the water sector in many countries, including Mozambique. However, detailed management plans for specific regions or watersheds and their implementation still seem to lag behind. Identifying a priority ranking of the fundamental factors affecting the implementation of IWRM schemes may be helpful to bring about (and review) progress in this respect (Gallego-Ayala and Juizo 2010). An important prerequisite is certainly the comprehensive compilation of geographic, climatic and hydrologic conditions, as well as the description of land use provided e.g., for the Limpopo watershed (Brito et al. 2009). In addition to this, there is a need for good data on water demand (Gumbo et al. 2003), which is strongly increasing in many regions, especially due to irrigation projects (Van Der Zaag et al. 2010).

Finally, in order to be implemented, any management scheme requires the involvement of local people and communities (Scodanibbio and Manez 2005). Within this context, broader approaches such as assessing risks from climate change (Hahn et al. 2009) and the gender aspect (Ribeiro and Chauque 2010) have to be considered. Likewise, other resources than water (Twomlow et al. 2008) have to be taken into account.

2.2.2.6 Supra-national water management issues and examples

Virtually all major rivers in Mozambique are shared with other countries. Trans-boundary management plans and decision-making are therefore a mere necessity. This issue has been addressed with respect to many aspects, from water quantity estimation (Juizo and Lidén 2008; Matondo and Mortensen 1998) considered as an important basis for management plans to their political implementation (Juizo and Hjorth 2009; Slinger et al. 2010).

2.2.3 List of relevant African stakeholders and current projects

2.2.3.1 Research institutes

- Universidade Eduardo Mondlane (UEM), Maputo
- Universidade Zambeze, Beira
- Instituto de Investigação em Águas (IIA, Ministry of Science and Technology), Maputo
- Contacts to the following institutions in Mozambique need to be established: International Centre for Water Economics and Governance in Africa (IWEGA), Maputo; International Water Management Institute, Maputo; Centro de Desenvolvimento Sustentável em Recursos Naturais, Chimoio; Laboratório de Engenharia de Moçambique, Maputo; Parque Nacional da Gorongosa, Beira-Gorongosa
- Further: see partners in WATERnet.

2.2.3.2 Water supply/sanitation

- Águas de Moçambique (AdeM), water supply Maputo: Projects G-MOSAIC, MyWATER and TRUST
- FIPAG (Fundo do Investimento e Património do Abastecimento de Água), water supply Beira

2.2.3.3 Administration

- Ministry of Science and Technology in Mozambique, Ministry of Agriculture, Ministry of Public Works, Ministry of Energy, Ministry of Environment
- Instituto Nacional de Gestão de Calamidades (INGC)
- Conselho Regulador da Agua (CRA)
- Direcção Nacional de Aguas(DNA)
- Regional Water Administration of Southern Mozambique (ARA-Sul): see projects AdeM
- and other regions: ARA-Centro, ARA-Zambezi, ARA-Centro-Norte.

2.2.4 List of foreign/international project partners involved

- Official Development Assistance to Mozambique Database ODAmoz (<http://www.odamoz.org.mz/>)
- Water and Sanitation Programme (WSP)
- DEVEX international development business, careers, news
- IRC International Water and Sanitation Centre, NL
- Department of Chemical and Nuclear Engineering. Polytechnic University of Valencia, Spain (Arnal et al. 2010)
- Lund University, Department of Water Resources Engineering, Sweden (Juizo 2008; Matsinhe 2008)
- Nuffic (Nederlandse Organisatie voor internationale samenwerking in het hoger onderwijs): Water and Sanitation
- UNESCO-IHE, Delft (NL)
- UNICEF (Godfrey et al. 2005)
- University of Cambridge, department of engineering, centre for sustainable development, UK (Chan 2004)
- University of Halle, Germany (Baptista 2010)
- University of Wisconsin, USA (Hahn et al. 2009)
- Wageningen University and Research Centre, Irrigation and Water Engineering Group (NL).

2.2.5 References

- Afonso, I. O. (2004): *Access to Clean Water in the Southern Region of Mozambique and Its Implications for Girls' Right to Education*. MSc thesis. University of Zimbabwe, Southern and Eastern African Regional Centre for Women's Law.
- Arnal, J. M.; Garcia-Fayos, B.; Sancho, M.; Verdu, G.; Lora, J. (2010): Design and installation of a decentralized drinking water system based on ultrafiltration in Mozambique. In: *Desalination*. vol. 250, no. 2, pp. 613 – 617.
- Artur, L. (2008): *Adapting to Climate Change Related Natural Hazards on the Lower Zambezi Valley*, Mozambique. WUR, UEM, Wageningen, Maputo. pp. 18.
- Asante, K. O.; Macuacua, R. D.; Artan, G. A.; Lietzow, R. W.; Verdin, J. P. (2007): Developing a flood monitoring system from remotely sensed data for the Limpopo Basin. In: *Ieee Transactions on Geoscience and Remote Sensing*. vol. 45, no. 6, pp. 1709 – 1714.
- Baptista, J. A. (2010): Disturbing 'development': the water supply conflict in Canhane, Mozambique. In: *Journal of Southern African Studies*. vol. 36, no. 1, pp. 169 – 188.
- Brito, R.; Famba, S.; Munguambe, P.; Ibraimo, N.; Juliaia, C. (2009): Profile of the Limpopo Basin in Mozambique, a Contribution to the Challenge Program on Water and Food Project 17 "Integrated Water Resource Management for Improved Rural Livelihoods: Managing Risk, Mitigating Drought and Improving Water Productivity in the Water Scarce Limpopo Basin". In: *WaterNet Working Paper 11*, WaterNet, Harare.
- Chan, J. H. (2004): *Water Quality Modelling and Assessment in Maputo, Mozambique*. University of Cambridge, Dept. Engineering, Centre for sustainable Development.
- Chilundo, M.; Kelderman, P.; Okeeffe, J. H. (2008): Design of a water quality monitoring network for the Limpopo river basin in Mozambique. In: *Physics and Chemistry of the Earth*. vol. 33, no. 8 – 13, pp. 655 – 665.
- Gallego-Ayala, J.; Juizo, D. (2010): *Strategic Implementation of Integrated Water Resources Management in Mozambique: A 'Wot Analysis*. *WaterNet Symposium, Victoria Falls, Zimbabwe*.
- Godfrey, S.; Timo, F.; Smith, M. (2005): Relationship between rainfall and microbiological contamination of shallow groundwater in Northern Mozambique. In: *Water SA*. vol. 31, no. 4, pp. 609 – 614.
- Gumbo, B.; Juizo, D.; Van Der Zaag, P. (2003): Information is a prerequisite for water demand management: experiences from four cities in Southern Africa. In: *Physics and Chemistry of the Earth*. vol. 28, no. 20 – 27, pp. 827 – 837.

- Hahn, M. B.; Riederer, A. M.; Foster, S. O. (2009): The Livelihood Vulnerability Index: a pragmatic approach to assessing risks from climate variability and change-a case study in Mozambique. In: *Global Environmental Change – Human and Policy Dimensions*. vol. 19, no. 1, pp. 74 – 88.
- Hall, A.; Valente, I. M. C. B. S.; Davies, B. R. (1977): The Zambezi river in Mozambique. In: *Freshwater Biology*. vol. 7, no. 3, pp. 187 – 206.
- Hanlon, J.; Frances, C. (2002): Preparedness Pays Off in Mozambique. In: *World Disasters Report*, International Federation of Red Cross and Red Crescent Societies, Geneva. pp.
- Hugman, S. J. (1984): Objectives of a water-quality monitoring program for the international river basins in a developing-country in Southern-Africa, Mozambique. In: *Water Science and Technology*. vol. 16, no. 5 – 7, pp. 33 – 39.
- Juizo, D. (2008): *Methods for Transboundary Water Resources Management in Water-Stressed Regions – Case Study: Southern Africa*. Lund University, Dept. Water Resources Engineering.
- Juizo, D.; Hjorth, P. (2009): Application of a district management approach to Southern African river basin systems: the case of the Umbeluzi, Incomati and Maputo River Basins. In: *Water Policy*. vol. 11, no. 6, pp. 719 – 730.
- Juizo, D.; Lidén, R. (2008): Modelling for transboundary water resources planning and allocation. In: *HESSD*. vol. 5, pp. 1 – 35.
- Kampfer, K. (2009): Situationsbericht zur Katastrophenvorsorge in Buzi – Aktivitäten Im Katastrophenmanagement (Krm), 2008. In: *Strengthening of national Disaster Risk Management Systems in Mozambique*, gtz.
- Matondo, J. I.; Mortensen, P. (1998): Water resource assessment for the Zambezi river basin. In: *Water International*. vol. 23, no. 4, pp. 256 – 262.
- Matsinhe, N. P. (2008): *Challenges and Opportunities for Safe Water Supply in Mozambique*. Lund University, Dept. Water Resources Engineering.
- Matsinhe, N. P.; Juizo, D.; Macheve, B.; Dos Santos, C. (2008): Regulation of formal and informal water service providers in peri-urban areas of Maputo, Mozambique. In: *Physics and Chemistry of the Earth*. vol. 33, no. 8 – 13, pp. 841 – 849.
- Matsinhe, N. P.; Juizo, D.; Rietveld, L. C.; Persson, K. M. (2008): Water services with independent providers in peri-urban Maputo: challenges and opportunities for long-term development. In: *Water SA*. vol. 34, no. 3, pp. 411 – 420.
- Muiuane, E. (2007): *The Quality of Groundwater in and around Maputo City, Mozambique*. WaterNet Symposium, Zambia.
- Nare, L.; Love, D.; Hoko, Z. (2006): Involvement of stakeholders in the water quality monitoring and surveillance system: the case of Mzingwane catchment, Zimbabwe. In: *Physics and Chemistry of the Earth*. vol. 31, no. 15 – 16, pp. 707 – 712.

- Nyenje, P. M.; Foppen, J. W.; Uhlenbrook, S.; Kulabako, R.; Muwanga, A. (2010): Eutrophication and nutrient release in urban areas of Sub-Saharan Africa – a review. In: *Science of the Total Environment*. vol. 408, no. 3, pp. 447 – 455.
- Ribeiro, N.; Chauque, A. (2010): *Gender and Climate Change: Mozambique Case Study*. Heinrich Böll Foundation Southern Africa, Cape Town.
- Ronco, P.; Fasolato, G.; Nones, M.; Di Silvio, G. (2010): Morphological effects of damming on lower Zambezi river. In: *Geomorphology*. vol. 115, no. 1 – 2, pp. 43 – 55.
- Scodanibbio, L.; Manez, G. (2005): The World Commission on Dams: a fundamental step towards Integrated Water Resources Management and poverty reduction? A pilot case in the lower Zambezi, Mozambique. In: *Physics and Chemistry of the Earth*. vol. 30, no. 11 – 16, pp. 976 – 983.
- Scott, L. (2010): *Freshwater Ecoregions of the World: 556: Upper Zambezi Floodplains*. <http://www.feow.org/ecoregion_details.php?eco=556> 2010).
- Slinger, J. H.; Hilders, M.; Juizo, D. (2010): The practice of transboundary decision making on the Incomati river: elucidating underlying factors and their implications for institutional design. In: *Ecology and Society*. vol. 15, no. 1, pp.
- Timberlake, J. (1998): *Biodiversity of the Zambezi Basin Wetlands: Review and Preliminary Assessment of Available Information*. The world conservation Union, Office for Southern Africa (IUCN-ROSA), Zambezi Society, Biodiversity foundation for Africa, Harare.
- Twomlow, S.; Love, D.; Walker, S. (2008): The nexus between integrated natural resources management and Integrated Water Resources Management in Southern Africa. In: *Physics and Chemistry of the Earth*. vol. 33, no. 8 – 13, pp. 889 – 898.
- Van Der Zaag, P.; Juizo, D.; Vilanculos, A.; Bolding, A.; Uiterweer, N. P. (2010): Does the Limpopo river basin have sufficient water for massive irrigation development in the plains of Mozambique? In: *Physics and Chemistry of the Earth, Parts A/B/C*. vol. 35, no. 13 – 14, pp. 832 – 837.
- Vaz, A. C. (2000): *Coping with Floods – the Experience of Mozambique*. *Water-Net Symposium: Sustainable use of water resources*, Maputo.

2.3 Evaluation of the scientific questionnaire for experts

The following questions have been formulated in order to help in further shaping the scope and mission of UNU-FLORES and to outline the work plan for the start-up phase. They were distributed among invitees to the 1st International Scoping Workshop. The evaluation of received responses is reported separately for each question. First, a brief summary is given highlighting common themes among sin-

gle responses. The latter are also included in condensed form, separately for each stakeholder group: UNU, TUD and partners, as well as African stakeholders.

2.3.1 General questions addressed to all stakeholders

1. What would you expect from the establishment of UNU-FLORES, specifically in terms of its research directions, educational focus and capacity development?

Summary of responses:

Within all stakeholder groups the general expectation is that both research and education and capacity development in the field of material fluxes and resource management will be strengthened and enhanced. New models and concepts are anticipated leading to upscaling and redefinition of existing expertise. Concerning the education component, both UNU and TUD stakeholders emphasized on the aspect of internationalization, strengthening and complementing of the existing Master and PhD programmes. African stakeholders focus on the opportunities of expert exchange and capacity development.

Single responses: UNU

The expectations of UNU can be summarized within the following points:

UNU-FLORES should bring about new concepts and mathematical models of processes (physical, chemical, biological, socio-economic) inherent in material and resource cycles – with the goal of improved management of these cycles.

UNU-FLORES should become a strong research capacity-building pole, enhancing internationalization of education programmes of TUD and UNU Institutes and Programmes and the capacity development in developing countries.

UNU-FLORES should promote the realization of sustainable societies, especially in developing countries through research and education (circulation of clean water, prevention of soil erosion, control of water and soil pollution caused by waste and sustainable use of organic matter).

UNU-FLORES should result in broadening UNU postgraduate programmes on Master and PhD levels, strengthening the presence and impact of UNU in Germany and fostering significant new research and capacity-building activities that focus on the flow of materials between ecosystems and human society.

Single responses: TUD

According to TUD, research activities of UNU-FLORES should be directed to the integrated assessment of material fluxes and of resources, i.e. natural resources (water, soil, vegetation, atmosphere, solar) and human resources (skills, adaptability, science, etc.) in a complex system or systems, highly coupled by natural fluxes (energy and mass) and man-made fluxes. Teaching activities should also strengthen existing programmes with international focus at TUD and in Mozambique and enlarge the part in matter management (complete life cycle assessment) with the aim of sustainable management of matter and energy fluxes.

It was also acknowledged that UNU-FLORES should concentrate on a combination of stakeholder trainings (as done by UNEP) and PhD programmes (need to be installed, cooperation with the existing International Water Research Alliance Saxony (IWAS), HIGRADE and International Postgraduate Studies in Water Technologies (IPSWaT) serves for synergies) in research and educational fields identified above. Cooperation with UNU-FLORES should also foster knowledge transfer based on teaching of state of the art expertise, providing examples for successful transfer from scientific to the legislative level and exchanging international experience. It should also "redefine" sustainability and bring new concepts and research results in the respective high level academic education. Similarly, UNU-FLORES is to provide decision support for various target groups such as ministries, governmental organizations, municipalities, enterprises, NGOs and other stakeholders integrating research and education activities in close cooperation with the network of UNU Institutes.

Generally, TUD expects the fostering and enhancement of its existing comprehensive, fundamental and interdisciplinary research on environmental issues on an international level, notably concerning cross-linking of national and European activities on a global scale. Thus, methodologies and approaches can be transferred and tested under different natural and socio-economic conditions (i.e. developing and emerging countries).

In conclusion, it was stressed that the educational focus of UNU-FLORES should lie on graduate studies (Master and doctoral programmes). With regard to capacity-building, TUD expects versatile synergies with existing study programmes at FGH (i.e. Master courses Hydro Science and Engineering, Tropical Forestry and Management and existing and planned PhD schools). This applies to knowledge transfer on the international level as well as the acquisition of international skills for TUD graduates and university staff. As far as management is concerned, with CIPSEM, TUD has already established a system of capacity-building that includes (1) teaching the state of the art on a specific topic, (2) transfer of scientific knowledge into political and legislative systems, and finally (3) the exchange of international experiences with developing and emerging countries. Thus, it appears consistent that UNU-FLORES emphasizes on the transfer of scientific knowledge.

Single responses: African stakeholders

As one of the main expectations, African stakeholders stressed the development of a specifically directed scientific cooperation, with the broad goal of strengthening and enhancing research capacities, primarily through research and capacity-building in water.

Sustainable soil and water management for food security in Mozambique can constitute a very important research area providing also room for capacity-building. Hence, UNU-FLORES should focalize on Africa's main challenges, such as rural development, unlocking of available resources, agriculture and agricultural engineering. In addition, it should support the exchange of skilled lecturers. By firstly identifying other players and existing initiatives on water in Africa, UNU-FLORES should try to align its programmes with these initiatives, e.g.

the NEPAD Centres of Excellence initiative on Water Sciences and Technology, WATERnet network, Southern African Development Community (SADC) Water, SPLASH (the European Union Water Initiative Research Area Network), African Monitoring of the Environment for Sustainable Development (AMESD), etc.

2. a) Which joint topics could you envisage in the field of research, education and capacity development with UNU-FLORES?

b) In this regard, where would you see your focus/contribution and in your opinion what should be the core focus of UNU-FLORES?

Summary of responses:

All stakeholders obviously were invited for an appropriate reason, since all of them could envisage joint topics with UNU-FLORES, according to their respective area of expertise. Different aspects of material flow and water quality in potential joint research projects and extending and establishing research networks were notably stressed. One of the raised questions concerned the level of integration of UNU-FLORES into the existing research and capacity development environment in Saxony. Would UNU-FLORES be more integrated than earlier established UNU Institutes? It was also suggested that the envisaged Master and PhD programmes should have a specific "UNU stamp" e.g., obligatory internships in UN agencies. African stakeholders emphasized on the scope of local research needs and the associated necessity for capacity development. It was proposed to establish a grants system and make efforts in getting local stakeholders and the general public involved in resource management strategies.

Single responses: UNU

The large scale analysis of water fluxes, surface water, groundwater, water vapour and the transition between these phases could be of eminent interest. Large-scale analysis of water fluxes involves continental scales, large river basins and aquifers. In the framework of this cooperation, UNU-FLORES could focus on better modelling of multidimensional and multiattribute matter fluxes.

Another area of cooperative action in research and education can eventually be waste management in developing countries. Joint research can also focus on risk and vulnerability in coastal zones and with respect to freshwater systems, including exchange of teaching modules on Master and PhD levels. The educational component can be strengthened in collaboration with the Disaster Management Training and Education Centre for Africa (DiMTEC) and the UNU-EHS envisioned Twin in Namibia. As UNU-INWEH is the primary focal point on water in the UNU system, water and related ecosystems are likely to be the area of collaboration with UNU-FLORES.

Master and PhD programmes should be designed in a manner that enables them to have a specific UNU stamp, as opposed to conventional universities. This can be done by requiring PhD research to be focused on developing countries' issues, entailing students to spend time at a UNU affiliated institution in a devel-

oping country or providing the opportunity for Master students to spend time as interns within a United Nations agency.

Single responses: TUD

Joint research can focalize on the effects of land use change, migration (internally and outside), agriculture, forestry, mega cities, climate change, water resources and waste water resources, etc. One of the first steps taken should be to raise the awareness on dangers of improper waste management and its effects on air, water, soil and human health. Secondly, a waste management which produces save fertilizer, energy and secondary material for new products should be established. Emphasis should be on the link between water, air, soil use, food, production and the material flow from private, public and industrial effluents, as well as on the proper use of technology and technical equipment.

Cooperation with UNU-FLORES is ought to result in synergies and mutual exchange in the field of capacity-building. In this respect, the aim of UNU-FLORES should be the integration into and close interaction with existing structures and TUD networks.

One of the cooperation areas could be water quality assessment also through biological water monitoring, assessing hydro morphological structures and environmental toxicology to identify hotspots of pollution – the first necessary step for water quality management. Joint research should result in the integration of existing competencies and expertise of research and education sites contributing to the improvement of management efficiency of (natural) resources such as water, soil and waste – under the consideration of multi-complex stakeholder requirements (socio-economic aspects).

The five “core” sections as currently planned for UNU-FLORES are well represented at FGH. Thus, manifold synergies from a complementary alignment of UNU-FLORES can be expected. In research, TUD envisages mutual benefits in the application, testing and optimization of methods and procedures at an international scale, especially in developing and emerging countries. In education, a special focus can be made on the transfer of sophisticated methods and concepts in the analysis, use and management of resources like water, soil and waste. This can lead to an effective implementation and sustained application of these sophisticated methods and concepts in developing and emerging countries. It is important to note that capacity development is an integral part of currently running research programmes. Furthermore, there are many networks resulting from international teaching activities (e.g., Tropical Forestry and Management, Hydro Science and Engineering). Here, the alumni also play a crucial role. This is particularly valid for CIPSEM, which has established a dense network of local and regional contacts for collaboration as well as a network of international experts.

Due to its unique structure (and its tight links to relevant institutions such as UFZ and the Leibniz Institute for Ecological and Regional Development (IÖR)), TUD FGH is an appropriate and powerful partner for UNU-FLORES and may act as an effective bridge and platform for the activities of UNU-FLORES at regional and

international scales. TUD is likely to play a considerable role in the integration of UNU-FLORES into the local and regional research and capacity-building environment. Hence, the core focus of UNU-FLORES should be on the development of methods and approaches related to the transfer of scientific knowledge as acquired in basic research, but also in interdisciplinary joint research programmes with major contribution of TUD and related institutions.

Single responses: African stakeholders

According to African stakeholders, one of the important elements of cooperation can eventually be the set-up of a grants system destined to conducting and stimulating research. PhD and Master programmes should be established on water resources and floods, sustainable water supply, sustainable agriculture, sustainable farming and systems irrigation. UNU-FLORES should focus on the research initiatives related to water, enabling the research cooperation and the implementation of specific programmes or projects, dealing for example with integrated management strategies of resources (water, soil, land use, waste). An important contribution of local partners would be to provide the basis for research field work and take part in the training programme of young Mozambican scientists and to make sure that the project on integrated resources management will reach local and regional stakeholders and the general public. Site-specific and site-adapted water management strategies could be an important field of cooperation, as well as agriculture, agricultural engineering and risk reduction planning.

Improving conservation and utilization of the African continent's water resources and improving the quality and quantity of water available to rural and urban households could be further fields of joint research. This should generally strengthen national and regional capacities for water resources management, reduce impacts of water-related disasters, enlarge the range of technologies for water supply and improve access to affordable quality water. Therefore, core focus should be human capital development, technology transfer, infrastructure and research in this order of priority.

3. Which additional topics – that are not included in the programme – do you feel should be included in the discussions of the scoping workshop?

Summary of responses:

Issues mentioned several times were governance and the socio-economic aspects of resource management. This might be given more priority within the workshop programme or in a follow-up workshop where keywords such as urbanization and planning can be discussed. It was also suggested to put a stronger emphasis on introducing the research environment of UNU-FLORES both with respect to UNU and TUD. From the African perspective, the link between global climate change and food security and the elaboration of other linkages between relevant institutes in Africa was put forward.

Single responses: UNU

One could also discuss mutual synergies of natural science, engineering and global governance and management approaches to grasp, describe and control the material and resource fluxes and cycles. Additional topics might enclose resource mobilization, assessment of needs for postgraduate programmes, the exchange of experiences and lessons learned in establishing Twin Institutes.

Single responses: TUD

The role of governance, participation, economic and social constraints should be additionally discussed along with the focus on natural sciences and engineering. Integrated land use, land use change management and land consumption seem to be underrepresented and the influence of urbanization and sub-urbanization processes on water, soil and organic matter fluxes are also to be covered. Planning aspects, as well as remote sensing techniques for the analysis play an increasingly important role, in particular in developing countries. The UNEP initiative on Mainstreaming Higher Education for Sustainability at African Universities (MESA) could be included in the preparation, discussion and development of the twinning partner's role.

A more specific introduction of Dresden as natural resources research and projected site of UNU-FLORES might be appropriate, just as a classification of UNU-FLORES within the UNU concept of activities. Integrated land use (cross-sectoral approaches to analyse, model-based describe, and to establish and/or to optimize systems of ecosystem services) could be an additional topic; this also includes land use planning and risk assessment as part of an overall environmental planning. For the analysis and as a requirement for spatial modelling, geo-monitoring, remote sensing, "data mining" and regionalization techniques should also be more emphasized. The effects of increasing urbanization and sub-urbanization on water, soil and matter fluxes must also be pointed out in more detail.

Single responses: African stakeholders

A relationship needs to be established between climate change and food security in Africa as well as the socio-political and economic impacts thereof. The linkages between the UNU-FLORES Twin and other institutions within Africa are also to be explored and lead to building networks through the implementation of common activities at national and regional levels. Further topics can include fostering the link between research, high education and the policymaking level, knowledge management and development and finally, gender issues.

2.3.2 Specific questions addressed to the three stakeholders groups

The three stakeholder groups are UNU, TUD and Mozambican and African stakeholders. It should be noted that summaries are not provided concerning specific questions.

1. UNU

Where do you view potential for synergies and in strengthening cooperation with UNU-FLORES within the UNU system?

UNU-FLORES could have a pivotal role in developing a unique intercontinental PhD programme involving UNU-FLORES, UNU-INWEH, UNU-EHS, UNU-ISP, UNU-IIST and UNU-INRA. A science-based but policy relevant international PhD programme offering global connections, views and the experiences of the participating UNU Institutes and their respective local partners would fill a niche. Graduates of this programme could be sought after experts for international organizations and think tanks thus contributing to the goal of making UNU the university which caters for the needs of intergovernmental and international organizations and governments. UNU-ISP is conducting research concerning waste management in the Asian area. We expect a wide range of synergy effects in research through cooperation with UNU-FLORES, which will be conducting research concerning waste management in European and African regions. In addition, strengthening of synergies and cooperation is expected with UNW-DPC, UNU-INWEH and UNU-EHS on water-related topics. There is also a potential for cooperation with UNU-INRA.

2. Mozambique and African countries

What would you consider to be the most pressing research questions to be addressed by the Twin considering also its future role as a potential regional hub?

Addressing problems in Africa by and with African scientists should be the priority. Network building and strong long-term support is needed for African universities and research institutes in order to achieve a critical mass of well educated scientific staff. Involving institutions of the network and Twin(s) in the intercontinental PhD programme could be one of the first steps.

Education and knowledge transfer in the field of water, waste and soil use should also be considered as a priority. Research programmes should be reinforced alongside with building up the research capacity. This can mainly be done by recruiting and training local staff and attracting external capacity from abroad through international linkages focusing on the:

- occurrence of floods and droughts
- requirement of water to supplement agricultural water needs
- need for reliable drinking water supply and sanitation
- access to technology, knowledge and information
- management of groundwater
- development of a multidisciplinary approach in the water sector

- analysis of soil, water and vegetation management systems, evaluating how they cope with global change (climatic, demographic, technologic and socio-economic). Solutions are to be found and developed in order to increase water yield and soil fertility in Mozambique by taking into account climate conditions and socio-economic contexts.

Environmental and socio-economic constraints leading to crisis situations concerning food security and soil and water degradation need to be identified. The focus should be on the degradation of key factors, drivers and thresholds concerning e.g., deforestation, loss of nutrients, soils, etc. under conditions of global change. Through NEPAD, Mozambique and African countries have identified the following challenges which need to be addressed in water science and technology:

- assessment of the resource (surface and groundwater)
- water and food production, including agriculture, fisheries, aquaculture and livestock
- sustainable and equitable allocation of water to the environment and to domestic, agricultural and industrial uses
- water use and production of energy
- waste water management, treatment and recycling as well as non-conventional sources of water
- water-related diseases, including sanitation and hygiene issues
- water and climate (short and mid-term forecasting, impact and adaptation to climate change)
- identification of and solutions for local and regional water-related competition or conflicts
- water and sustainability of ecosystems (terrestrial, aquatic, coastal)
- sustainable water resource management in coastal zones and lakes
- policy or governance issues on water.

3. TUD

What would you consider as added value of UNU-FLORES in relation to Dresden University of Technology, Faculty of Forestry, Geo and Hydro Sciences (FGH) and associated institutes?

UNU-FLORES could foster international networking and add value to the national and regional water research initiatives in Saxony. TUD students get international exposure and could have access to interesting international themes for PhD and Master theses. Through joint staff appointments, TUD staff will be able to develop further its international profile and capabilities. UNU-FLORES could strengthen

the already existing partnerships inside (Dresden Water Centre, etc.) and outside (see research networks with UFZ like IWAS or training foci like UNEP or the existing Master programmes). This partnership would also contribute to the increase of exchange with Africa, in particular lusophone countries. Additional African partners from the cooperation field, as well as further international partners with strong relations to Southern Africa can also be eventually included.

TUD and FGH will be able to globalize research and education activities together with UNU-FLORES and the Twin Institute as well as to focus on new challenges in sustainable water resource management. FGH is a proven platform and institutional frame for manifold activities related to research and education on the interdisciplinary analysis and sustainable management of natural resources like water, soil and waste. Both the scope and application areas can be extended considerably by the establishment of UNU-FLORES. This will also considerably increase the international visibility of TUD as a major centre of modern environmental science and resource management technologies. Graduate study programmes offered jointly with UNU-FLORES could be a promising opportunity to attract highly qualified students from all over the world. The special character and organization of UNU will also foster international cooperation both in education and research fields, thus opening new dimensions for capacity-building.

3. Documentation of the 1st International Scoping Workshop

3.1 Workshop concept note

3.1.1 Workshop objectives

In the framework of this workshop, targeted introductory speeches on selected topics shall trigger exchange and discussion among experts. Within working groups, the participants are expected to further elaborate on the topics proposed in the programme.

The workshop pursues the below formulated objectives and aims.

UNU-FLORES:

- to further shape the scope and mission of UNU-FLORES and identify its niche
- to outline the work plan for the start-up phase
- to pin-point potential synergies, intensify cooperation and define interfaces in complementary areas with the water network within UNU, Germany, Saxony and internationally
- to identify opportunities for Master and PhD programmes in the areas of the expertise of UNU-FLORES.

Mozambique Twin of UNU-FLORES:

- to identify and prioritize research questions to be addressed by the future Twin
- to develop a tailor-made strategy for the relation between the Mozambique Twin and UNU-FLORES Dresden
- to assess the current status of water-related research in Mozambique
- to outline future strategies and structures for the implementation phase.

3.1.2 Background

The soon to be established UNU-FLORES will be dedicated to research, postgraduate education and training of professionals to contribute to integrated management and capacity development for material flow and resources management, dealing first and foremost with environmental resources, such as soil, water and waste with the perspective to address other geo- and energy resource flows as the Institute develops. UNU-FLORES shall contribute as a fulcrum point to the development of global sustainable management strategies. The Institute will be closely working with TUD and other Dresden and Saxony-based relevant research institutions, thus exploring the potential and contributing to the international up-scaling of what may be called "Competence Centre Dresden". Its core scientific task is to develop a "linked cycle management" replacing traditional input-output models for the management of water (as resource, dissolver and transport agent), soils, recyclable organic matter and nutrients in order to foster efficient and sustainable use of these resources. Based on this integrative research approach, innovative concepts for target- and region-specific knowledge transfer and capacity development will be put into action. Together, these activities will provide the basis for decision support for various target groups (governmental organizations, NGOs and other stakeholders).

The internal impact assessment within UNU revealed a geographical skew in the distribution of the location of UNU Institutes. While expertise in core challenge areas such as natural resource management, adaptation to the adverse effects of climate change and unsustainable economic practices are available in the more than a dozen Institutes of UNU, most of them are located in the so-called developed countries.

In order to rectify this mismatch between the locations of available knowledge and the biggest needs for it, UNU has embarked on a process called "twinning" which would imply the establishment of additional campuses of its existing and future institutions. Twin Institutes (indeed 2nd or 3rd campuses of existing ones) should be located in developing and transitional countries. They should be demand-driven and receive financial, in-kind and moral support from the new host countries.

Water is a crucial factor of development and several UNU Institutes have substantial knowledge in different aspects of water and its management. Mozambique has faced several serious water-related problems with a series of devastating

floods and aggravation of droughts during the last decade. The Government is prepared to address those challenges. The capacity needed both at individual and institutional levels could to a great extent be provided and strengthened through collaboration and sustained presence of UNU in Mozambique. Establishing a Twin Institute of UNU-FLORES in Mozambique would not only be of great help for Mozambique, but could also have a strong regional impact.

3.1.3 Expected outcomes

Different stakeholders will be invited to the workshop in order to contribute to the discussions related to the above formulated objectives. The programme of the workshop, including individual working groups, will be designed to engage all the participants in discussions on the different topics.

The workshop should result in:

1. identification of possible areas for cooperation and generation of synergies
2. identification of the core areas of UNU-FLORES and its Mozambique Twin
3. draft work plan and outreach strategy for the start-up phase of UNU-FLORES
4. strategies and concepts for the implementation of the feasibility study in Mozambique.

Proceedings of the workshop will be published by UNU and distributed to all stakeholders afterwards.

3.2 Opening

In the opening ceremony, the hosts of the workshop, the Rector of UNU, Prof. Konrad Osterwalder, the Saxon State Minister for Higher Education, Research and the Fine Arts (SMWK), Prof. Sabine von Schorlemer, and the Rector of TUD, Prof. Hans Müller-Steinhagen welcomed the participants.

3.2.1 Opening speech: Rector of UNU

On behalf of UNU, Prof. Osterwalder elaborated on the following points: He firstly emphasized the fact that mankind faces global problems and in order to find solutions, the globalization of policy and science is a crucial necessity. As an ambitious institution and instrument, UNU is determined at strengthening research and education in developing countries. Clearly, the idea that underlies the Twin is that it belongs to the UNU entity and is composed of 50 per cent joint projects (research and teaching) enabling students to share time between institutions. Prof. Osterwalder observed that the ultimate goal of this initiative is to educate the next generation of scientists, ready to face global challenges. Finally, he thanked the participants for their interest and invited them to actively participate during the workshop.



UNU Rector Konrad Osterwalder and Saxon State Minister of Higher Education and the Fine Arts Sabine von Schorlemer at the opening of the scoping workshop. Photo: UNU-ViE

3.2.2 Opening speech: Saxon State Minister of Higher Education and the Fine Arts

Prof. Sabine von Schorlemer, SMWK, started her speech with three introductory remarks: political, historical and personal. As a political remark, she reminded that we are in the midst of the “Decade of Education for Sustainable Development”, launched by the United Nations in 2005. Historically, sustainability as concept and term has its roots in Saxony. Prof. Schorlemer also specified that as former Chair of international relations at TUD (UNESCO Chair), she personally endorses United Nations initiatives and institutions whenever possible. Noting that the government of Saxony is particularly honoured and challenged by hosting the second UNU Institute in Germany, she focused on the fact that Saxony and Dresden offer a very special research environment with a dense network of universities and research institutions. In this respect, she concluded that UNU plays a considerable role in extending this network by providing an international dimension and that UNU-FLORES is destined to instruct and teach new elites, preparing them to tackle worldwide problems, through the translation of science into practical applications and capacity development, for instance via PhD programmes. In conclusion, she expressed her hope that the workshop strengthens the enthusiasm of all parties to work on the establishment of UNU-FLORES.

3.2.3 Opening speech: Rector of TUD

Prof. Müller-Steinhagen on behalf of TUD stated that it is an honour for TUD to be considered as a partner of UNU. He particularly acknowledged that the initiative is considered with interest, joy and anticipation by TUD. Some other features of mutual interest, such as the interdisciplinary perspective (particularly the characteristic of FGH), the importance of global aspects and integrated management that are particularly strong at TUD were also underlined by Prof. Müller-Steinhagen. In this connection he stated that TUD is proud and content to offer these key competences that are perceived as essential for UNU-FLORES. Multidisciplinary platforms that exist beyond TUD can be extended by UNU-FLORES resulting in expected benefits for TUD. These benefits are notably the strengthening and internationalization of TUD that will ultimately lead to knowledge transfer to developing countries. Prof. Müller-Steinhagen stressed to take into consideration cultural, social, political aspects for solving human problems. Bearing in mind that capacity development is a key aspect, the translation of science into application is essential in this process. Finally, he emphasized on the strong synergy potential inherent in the concept note for UNU-FLORES.



From left to right: TUD Rector Hans Müller-Steinhagen, UNW-DPC Director Reza Ardakanian, Saxon State Minister Sabine von Schorlemer, UNU Rector Konrad Osterwalder. Photo: UNU-ViE

3.3 Summary of keynote talks

On the first day of the workshop, the keynotes were intended to set the stage by providing important background information on the three key players involved in the process of establishing UNU-FLORES: UNU, TUD and the Government of Mozambique, the latter being the potential host country of the Twin Institute. In the following section, brief summaries are provided of the three keynote talks highlighting the aspect of how UNU-FLORES fits into the general strategy of each key player.

3.3.1 Keynote 1: TUD

Prof. Gerhard Rödel, Vice Rector for Research at TUD:

TUD looks back at 182 years of history, starting as a small technical school and becoming a technical university in 1961. Since 1990 it has been offering a comprehensive range of scientific disciplines hosting about 36.000 students and 7.000 staff today. Fourteen faculties cover four main scientific areas: medicine, natural, social sciences and engineering, the latter predominating in terms of student numbers. The Dresden concept is characterized by strong cooperation of TUD with Dresden-based research institutes, libraries and museums. Among the five key research areas, water, energy and environment are closest to UNU-FLORES, represented mainly by FGH, and several study programmes within FGH are of important relevance to UNU-FLORES. As an interdisciplinary platform concerning soil, water and waste, the Dresden Water Centre can be considered as additional partner beyond FGH. Strong partnerships and double appointments have been established between UFZ and TUD. An international programme for environmental management is also offered by CIPSEM; in collaboration with UNEP, UNESCO, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the Federal Environment Agency (UBA). The target groups are experts from developing countries. This programme includes one course on environmental management (six months) and three specialized courses on soil and water management.

3.3.2 Keynote 2: UNU core strategies, focusing on postgraduate programmes and the Twinning concept

Prof. Konrad Osterwalder, Rector of UNU:

As the academic arm of the United Nations, UNU is devoted to the needs of the United Nations and the overall topic of sustainable development, focusing on social, economic and ecological problems. One of the particularities of UNU is notably its global structure and implementation of different programmes in 13 countries. Despite the fact that presently many of these programmes are in the developed world, the mission of UNU is to develop capacities in developing countries. It is important to note that UNU is the only United Nations agency that is not financially supported by the different member states. This particularity of UNU encloses both advantages and disadvantages. UNU is independent from political influences; nevertheless, it depends on host countries for the financing of its programmes, the latter being considered as a pre-requisite. For instance in the case of UNU-FLORES,

the Mozambique Twin will have to be financed by the Free State of Saxony, BMBF and to some extent by the Government of Mozambique.

As the academic arm of the United Nations, UNU has access to all the other agencies of the United Nations and this is particularly helpful in networking and establishing strong links with relevant specialized agencies. In this regard, UNU graduates will acquire good knowledge of the functioning of the United Nations system, and are likely to become potential candidates of United Nations agencies or of the government of their home country. UNU has outstanding opportunities to collaborate with the best universities worldwide. UNU Institutes focus on problems and therefore there are no divisions into faculties. The multidisciplinary approach that is put forward by UNU leads to different types of teaching and research methodologies. Research conducted by UNU is policy relevant, signifying that there is a particular focus on future users when approaching research, teaching and training.



UNU Rector Konrad Osterwalder delivers keynote speech on UNU core strategies. Photo: UNU-ViE

In order to better fulfil these goals, UNU has developed new strategies emphasizing on Twin Institutes, postgraduate programmes and quality control. A Twin can be defined as a UNU institute with all the privileges and characteristics of UNU. There is a strong collaboration between Twins and at least 50 per cent of all projects are joint projects. The exchange of students and scientists is one of the central characteristics of a Twin. After being generated, research and teaching projects are submitted to funding agencies in the host country of the developed world. The main idea that underlies the implementation of a Twin is building true

partnerships in research and education and working against brain-drain; this is done by founding a strong Twin Institute that has a substantial link with the programme in the developed country.

Supposed timeframe for establishing the UNU-FLORES Twin Institute:

1. established and running in three years from now (by the end of 2013)
2. next workshop in Mozambique to be held in 2011
3. appointment of the Director by the end of 2011.

With respect to postgraduate programmes, the United Nations General Assembly has voted two amendments on 21 December 2009 enabling UNU to offer postgraduate programmes and degrees as well as to have the right to raise study fees. The first Master programme was launched in Tokyo, Japan, in 2010 and the first PhD programme in Maastricht, Netherlands. Consequently, all other Institutes plan to introduce their programmes within the next two years. The goal of UNU's postgraduate programmes is to have double or joint degrees with local partner universities. Quality control is another important element covered by the UNU strategy. The aim of quality control is to ensure the same level of quality everywhere by developing a handbook in order to define minimum standards. Quality control can play an important role in increasing fund-raising. The following map illustrates potential future Twin Institutes for UNU:



Potential future Twin Institutes for UNU. Source: UNU

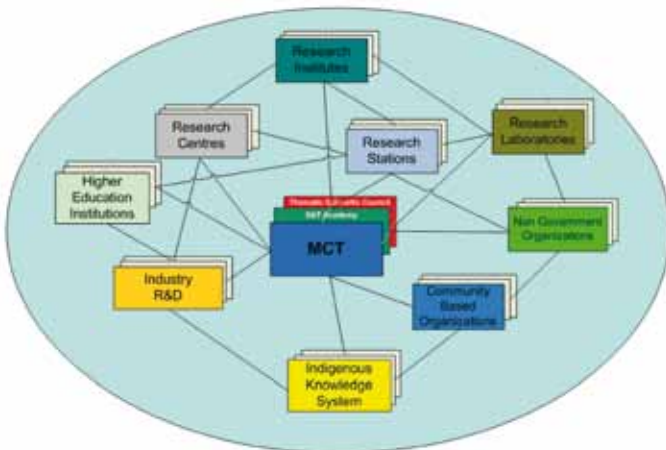
3.3.3 Keynote 3: Science, technology and innovation in Mozambique: addressing water issues

Mrs. Roda Nuvunga Luis, Deputy National Director, Ministry for Science and Technology of Mozambique:

On behalf of the Minister, Prof. Venancio Massingue, this keynote first provides basic facts about Mozambique, its population, governmental structure, economic indicators and the hydrological situation. Science and Technology (S&T) are considered crucial for development and poverty eradication. MCT was established in 2005 to promote planning, regulating and monitoring S&T development in the country, and in 2006 the government approved the Science, Technology and Innovation Strategy, which defined three pillars for S&T: scientific research, technology transfer and innovation and ICT programmes. Human capacity development is the key, targeting priority areas of S&T. These strategic areas include:

- vertical areas: agriculture, energy, fishing, water, education, health, etc.
- cross-cutting areas: environment, ethno-botany, gender, equity, HIV and human resource development
- enabling areas: biotechnology and Information & Communication Technology (ICT).

MCT implemented coordination mechanisms for S&T, such as the National Council for S&T, the Mozambique Academy of Science and Thematic Scientific Councils on water, agriculture, health, ethnobotany and energy. The National Research Fund supports S&T through various budget lines. The “Human Capacity Development Programme” aims at achieving 6500 graduates at BA and MA levels by 2025.



Schematic Diagram on Mozambican System of Science and Technology. Source: MCT

Water is an essential resource for development, human well-being and the environment. It has to be properly managed (based on sound scientific analysis) to ensure its availability in good quality and to ensure fair usage between different regions, countries and demands. Mozambique is highly vulnerable to floods and droughts, such extreme events are likely to be enhanced and occur more frequently due to climate change.

As a response to these challenges, the Water Research Institute (IIA) was established in August 2010. Its mission is to support decision-making for management of sustainable use of water resources. IIA will undertake research and develop and promote new technologies and management strategies for the sustainable use of water. Challenges while establishing IIA include building institutional capacity (human and technical resources) and building partnerships in the region. One such strategic partnership could be the one with UNU-FLORES.



H.E. Ambassador of Mozambique to Germany Carlos dos Santos and Saxon State Minister of Higher Education Sabine von Schorlemer engage in discussion. Photo: UNU-ViE

3.4 Introduction to UNU-FLORES

Dr Reza Ardakanian, UNU Focal Point on the establishment of UNU-FLORES, and Prof. Peter Krebs, Spokesman of the Hydro Sciences Department of TUD, gave an introduction to the proposed area of focus of UNU-FLORES, the suggested structure of the Institute and the envisaged cooperation potential and interfaces with partners.

It was emphasized that resource management faces serious challenges, such as resources depletion and deterioration, incomplete recycling, diffuse distribution and complex, increasing and accelerated flux patterns of resources and complex

coupling of water, land use and waste on an international level. These challenges occur under dynamic boundary conditions (population growth, climate, land use, behaviour), which must be respected.

To address these challenges one needs to develop tools and models that enable the understanding of complex and interacting matter and water fluxes and overcome static input-output approaches. Based on such a systems and flux analysis, one may develop management options under various scenarios of global change (climate, land use, socio-economic, etc.).

The goal must be to develop truly integrated resources management strategies, which can be adapted in a target- and region-specific manner via detailed implementation concepts. The foreseen structure of UNU-FLORES reflects the truly interdisciplinary approach with two overarching departments, systems and flux analysis and global change and three departments dealing with specific resources: water, soil/land use and waste.

Besides research, education and capacity development are crucial for the strategy implementation and will be an integral part of each department:

- education on Master level in close collaboration with TUD and other partners (CIPSEM/ UNEP courses)
- on PhD level in a joint effort within the UNU family (UNU-INWEH, UNU-EHS, UNU-INRA) and their local partners and within a Dresden-based graduate school.

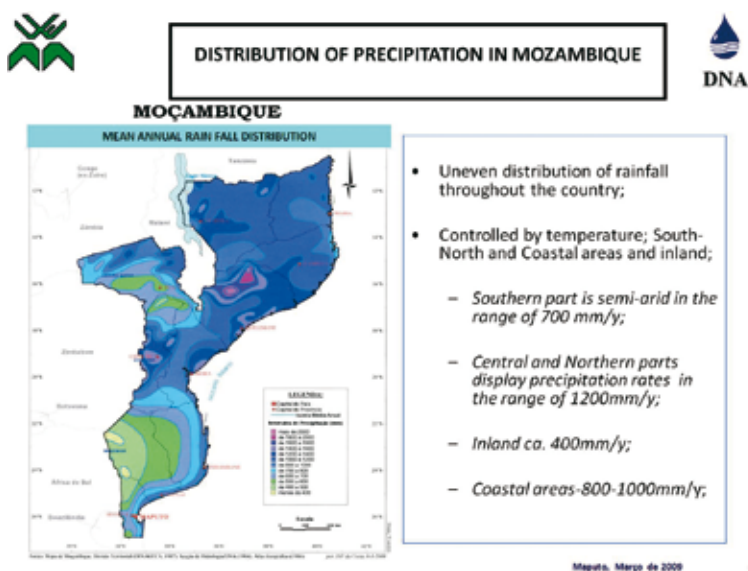
TUD and its affiliated partner institutes (UFZ, IÖR, CIPSEM, Dresden Water Centre) have a pronounced profile in water, soil and waste (see Keynote 1) and experience in international cooperation (IWAS, further projects). TUD will share infrastructure and human resources with UNU-FLORES to cooperate in teaching and research, to have joint projects on integrated resources management is an ultimate goal.

The concept of “twinning”, as outlined in Keynote 2, aims to improve the presence of UNU in developing countries, to intensify research and teaching interaction with those countries and to build a sense of ownership of these joint activities. The UNU-FLORES Twin in Mozambique would be the first Twin Institute being established entirely new and which is not based on an existing partnership. Moreover, it would be unique in being established concomitantly to the establishment of UNU-FLORES in Dresden.

3.5 Integrated Water Resources Management in Mozambique – the role of groundwater component

Prof. Elonio Muiwane, Department of Geology, Faculty of Sciences of UEM first provided an overview of water resources and precipitation patterns, as well as the general climatology (intertropical convergence zone and precipitation patterns) in Southern Africa.

In Mozambique, most large rivers are shared with neighbouring countries and Mozambique is located downstream in all cases. More than 50 per cent of mean annual run-off originates from upstream countries and 75 per cent of mean annual run-off is concentrated in Zambeze basin. Rivers are mostly used for water supply, irrigation and Hydropower (Zambeze). A highly uneven distribution of precipitation can be observed in the country. The North and the coastline of Mozambique have a high rainfall rate and semi-arid conditions can be noticed in the South. Please refer to the graph below provided by UEM on the distribution of precipitation in Mozambique:



Distribution of precipitation in Mozambique. Source: UEM

Existing infrastructures have a poor storage capacity and more than 90 per cent (Zambeze) of the storage capacity is concentrated in the Cahora Bassa dam. This leads to the loss of large quantities of water to the sea. Therefore, there is a crucial necessity to construct more dams destined to manage surface water. Groundwater yield and quality is dependent on Geology which is highly variable throughout the country. In the following, pictures illustrate examples of rural water supply and major threats, such as floods, droughts, pollution and saltwater intrusion along the coastline. Therefore, the main challenges are mainly the reinforcement of IWRM, disaster management, pollution management and improvement of sanitation and water supply. In the case of the latter, underground dams could be an interesting option.







Drought, pollution and floods. Photo: iStockphoto (p. 43), United Nations Photo (p. 44 and 45)

3.6 Capacity development within UNU, in Southern Africa and the German water sector

In a set of three presentations an overview was provided on principles and the status of capacity development related to water within UNU, Southern Africa and Germany.

3.6.1 UNU

Dr Zafar Adeel, Director of UNU-INWEH, reported on general ideas and principles of capacity development within UNU and further on provided some examples from

the UNU family. Capacity development within UNU is focused mainly on: self-sustained learning, generation of new knowledge, accumulation of knowledge and the implementation of development activities.

A special attention is given to e-learning, with UNU acting as a virtual university. Although most Institutes are located in developed countries, capacity development measures are clearly distributed in developing countries. They rely on four pillars which include the capacity to educate and train (human resources), measure and undertake research (reliable information), legislate, regulate and govern (institutional development) and finally the capacity to provide services (sustained investment).

Below, examples of capacity development initiatives are provided by three Institutes of the UNU family:

UNU-INWEH (with various partners) is active in:

- Master Programme Integrated Dryland Management
- Water Without Borders (Master, PhD)
- course on Biodiversity in Mangrove Ecosystems
- graduate fellowships on Coastal Management
- extensive e-learning programme on IWRM

Postgraduate Education at UNU-EHS takes place within:

- Master course “Geography of Environmental Risk and Human Security” (as of 2012)
- training programme on Regional Ocean Governance
- involvement in various education and training programmes
- PhD programmes: Block Course, Summer Academy, etc.
- training programme on Disaster Risk Management

Examples of initiatives of **UNW-DPC** (supporting UN-Water) include:

- various capacity development services, from single to embedded activities
- workshops, trainings, seminars, etc.
- publications: e.g., UNW-DPC Proceedings
- series of regional workshops, e.g. on drinking water loss reduction.

3.6.2 Africa

On behalf of the African participants, Prof. Osmund Mwandemele, University of Namibia, provided an overview on water-related capacity development in Africa.

In Africa, major problems concerning water are related to drinking water supply, sanitation, waterborne diseases and pollution. In 2003, AMCOST decided to make water-related S&T one of the main programmes of NEPAD. The African Science and Technology CPA 2005 contains a water flagship programme that emphasizes on water supply, sanitation and water resources management. The NEPAD water initiative has several objectives such as research, education and training, information brokerage and networking. The creation of Centres of Excellence (CoE) for water research is one of the concrete examples of NEPAD water initiatives. The NEPAD Water Centres of Excellence Initiative is a consortium of institutes from the Southern African region, comprising universities from South Africa, Botswana, Malawi, Zambia and Namibia. Currently, the Secretariat of NEPAD CoE is hosted by the University of Stellenbosch and the Dean of the Faculty of Science is the Chair. The NEPAD CoE has four major research areas which are: conservation and utilization of water resources, quality and quantity of water for households, water resources management and disaster management, as well as technologies for water supply.

Challenges of water research in Africa include lack of adequately trained people, poor equipment and infrastructure, reduced access to literature, internet and travel funds. Capacity development in the broadest sense is essential and important investments are required in this domain and African countries should take the lead to address these challenges. The UNU-FLORES initiative was welcomed and seems to appear at the right moment complementing NEPAD activities on water issues. Key partner institutions besides UEM are to be identified and awareness for this initiative has to be raised in the region.

3.6.3 German water sector

Prof. Bernhofer, Chair of Meteorology, Speaker Dresden Water Centre, TUD, provided an overview on capacity development in the German water sector. He particularly emphasized on the existence of a strong link between capacity development and IWRM and stressed that capacity development is a key for the successful implementation of IWRM. However, he also underlined the necessity to have a multi-level approach in dealing with capacity development due to the fact that different target groups require specific instruments of capacity development.

Capacity development actors in Germany are mainly composed of academic institutions, public institutions dealing with cooperation in the field of development and associations. Precise examples from each category of involved actors are outlined below:

Academic institutions: international study courses:

- IPSWAT, Hydro Science and Engineering (TUD); FLOODrisk
- Postgraduate studies: CIPSEM (UNEP) and international projects: IWAS

Public institutions involved in cooperation in the field of development:

- BMBF: IWRM as a funding priority
- German Federal Ministry for Cooperation and Development (BMZ): water is one of the main areas funded; 40 per cent of German development cooperation funds are invested in Africa

Associations:

- German Association for Water, Wastewater and Waste (DWA), German Technical and Scientific Association for Gas and Water (DVGW): rules and standards.

Despite the outstanding quality of capacity development instruments, especially in the academic sector and a well functioning water management system, one of the weaknesses of capacity development in Germany is its lack of coordination. A new approach is the German Water Partnership, a common platform of actors in the water sector.

3.7 Summaries of working groups**3.7.1 Working group I: UNU-FLORES**

Facilitator: Prof. Peter Krebs

Rapporteur: Dr Stephan Hülsmann

Introductory remarks

UNU-FLORES should fill a unique niche within a network of cooperating institutions, thus avoiding competition and promoting cooperation. Within UNU, UNU-INWEH could become a primary partner concerning water, its main working areas being:

- Water-Health nexus
- Freshwater Ecosystems
- Coastal Zone Ecosystems
- Dryland Ecosystems.

According to the proposal (see Chapter 2.1), UNU-FLORES is supposed to provide something unique: concerning the research area this distinctive feature is the “linked cycle management”, which is to be developed. In order to be able to “close” cycles, oceans have to be considered, which goes beyond the capacity and

expertise of TUD. However, UNU-FLORES is not only bound to the competence of TUD, but it also includes other partners and the Twin for closing cycles.

Green economy <ul style="list-style-type: none"> • Analysis of the institutional and legal framework as well as the governance structure • Economic framework • Hydro power 	Resources quality and quantity <ul style="list-style-type: none"> • Monitoring schemes • Derivation of policymaking • Selection of indicators • Water inventory and fluxes • Extreme events: droughts and floods • Global change issues as a loading • Include Ocean in cycles • Virtual water as a transboundary issue, should be included in water inventory • How to use fossil groundwater (how renewable or non-renewable it is) 	Urban water/urban footprint <ul style="list-style-type: none"> • Influence on river basin management • Water resources depletion • Acute versus accumulative pollution • "Risk" • Re-use of water, biowaste and sludge (energy, fertilizer) • Residuals management/treatment (desalinization) • Influence of sealing in catchment • Contamination of river bed
Cycle and resources management <ul style="list-style-type: none"> • Metals • Organic compounds • Priority substances • P, N; P as a non-renewable element is particularly important • C inventory – land use • Monitoring: frequently without consequences 	Circular economy (Waste) <ul style="list-style-type: none"> • As few loss as possible • Zero emission (programme in UNU) • Waste and resource management • Bio waste management (fertilizer, energy) • Substance flow management 	Land use management <ul style="list-style-type: none"> • As a control option for water cycle and soil loss • Land grabbing and water grabbing • Monoculture and energy crops • C; Nutrients management and monitoring • In urban area (loss of soil function) • Remediation and rehabilitation

Collection of thematic areas to be dealt within UNU-FLORES. Source: UNU

Summary

Prioritizing is not considered appropriate at this point, but it is important to try to find a story-line as well as digest and extract the above-mentioned topics. The ongoing procedure consists in sending a report to the working group and expecting a response until the end of 2010. Topics listed above should be integrated into proposed sections of UNU-FLORES and provide brackets between sections.

3.7.2 Working group II: Mozambique Twin

Facilitator: Dr Reza Ardakanian

Rapporteur: Ms. Jessica Johmann

In the framework of this working group, discussion points and concerns were raised about building on existing capacities and initiatives not only in Mozambique but also in the region. How can we involve other partners in the establishing process of the Twin e.g., NEPAD and the African Union? Water has been identified as one of the flagship areas by CPA. Therefore, the type of Twin has to be defined. The initial project is not to propose an identical Twin, but rather a Siamese twin with a symmetrical administrative structure, co-directorship between UNU-FLORES and its Twin. This would bring both Institutes to a close level of cooperation eventually.

Opportunities for the Twin

The Twin has the opportunity to continue building on an already established network and to have a coordinating role in the region. There are several added-values of the UNU Twin for Mozambique and the region in terms of the training of trainers, its function as a regional hub, but also on a global scale facilitating the involvement and contribution of governments, joint research programmes and human resource capacity development. Identification of research areas and of challenges of Mozambique and the neighbouring countries is essential. In this respect, the UNU-FLORES Twin should be perceived as an opportunity not only for Mozambique but also for the region. Focus and drive should come from Mozambique and linkages and cooperation from other regional countries.

Challenges

Major challenges with which the Mozambique Twin is confronted concern mainly curriculum development, the lack of major investments made in infrastructure, laboratories, etc. of Mozambican universities and the implementation of a co-supervisory process.

Proposed research areas

Several major research areas were proposed and water quality was considered a key focus area due to the fact that it affects on a multitude of other aspects (sanitation, health, etc.). Moreover, drought and food security or more precisely how to use water optimally to make African countries food secure (South Africa is the only food-secure country in Africa) were also put forward. As a major regional organization, the African Union has identified water quality, sanitation and water resource management (governance, crossboundary water resources) as the main focus areas of research in Africa.

Education

As mentioned previously, main issues concern education by training of trainers, linking training and education with the prevention of brain-drain and the development of PhD programmes.

Shaping of a core working group

Experts at policy level should be part of the working group and other key actors from neighbouring countries can also be involved; identification of a core group of “champions” in order to accelerate the process is crucial. The engagement of the government is considered decisive and will eventually facilitate the funding commitment of the host country.

3.7.3 Working group III: postgraduate programmes

Facilitator: Max Bond

Rapporteur: Dr Stephan Hülsmann

The third working group particularly raised issues on postgraduate programmes.

Introductory remarks

As the first introductory remark, it was acknowledged that UNU has only recently been establishing postgraduate programmes. In this respect, UNU should make use of being an international body. The vision of UNU is to provide extensive international experience to students and to have a strong research component. UNU postgraduate programmes are composed of Master (minimum 18-month course, overall two years) and PhD (three years) programmes. One of the advices of the Governing Council concerning UNU postgraduate programmes is to advance slowly and considerably concentrate on the quality of the offered programmes. Cooperation with local higher academic institutions is crucial: both in Dresden and Maputo, strong cooperation links have been established with local universities. Due to differences between the countries in terms of political and academic institutions, there might be differences in the time required to implement programmes between the Twins.

However, the English language is a common requirement in Twin Institutes and this criterion can be considered as an element of competition among students. It is also important to note that the chosen approach does not necessarily have to be exactly the same in both Twins.

General issues, relevant for both Twins

As a general issue, it was reminded that there has been a requirement to provide something unique in UNU-FLORES. In fact, besides research, UNU-FLORES also holds for education. However, the proposed multi-nodal PhD programme raises certain questions: where would the African node be located, within UNU-INRA or the UNU-FLORES Mozambique Twin? The strategy that was put forward within UNU consisted in starting a strong programme with local partners, multi-nodal programmes being envisaged subsequently. Another issue raised concerns the fact that education, more than research, is always related to national regulations, and this can raise several problems. For instance, no tuition fees are allowed in Saxony and there might be some legal difficulties to have two seals on the diploma. In addition to this, there could also be differences between UNU and the cooperating universities in terms of formal requirements for lecturers (e.g., can certain types of courses be offered only by professors?).

UNU has already developed a template set of rules on different levels; according to UNU experiences, it is less complicated to deal directly with faculties rather than the university Rector. Within existing international programmes at TUD, there is relevant experience in involving external teachers at Master level. At PhD level, this process can be more complicated. There could also be roadblocks for joint

degrees and UNU is presently working on this issue, while the option of having joint degrees would be clearly preferred over double degrees. Experience from the German Federal State of North Rhine-Westphalia proves that legal obstacles can be overcome rather quickly (change of laws within three months) and Prof. von Schorlemer from SMWK is aware of this issue. In conclusion, students would have both a UNU degree and an additional university degree.

Mozambique issues

In Mozambique, mainly two faculties at UEM are dealing with water: the Faculty of Engineering which is offering a new Master course and the Faculty of Agronomy that does not provide any undergraduate teaching anymore, focusing only on Master and PhD programmes. In addition to this, the Faculty of Science, Department of Geology deals with groundwater. The process of implementing postgraduate programmes has begun slowly due to the fact that curricula development takes time. It is possible to start with PhD and Master programmes simultaneously, since graduates from current Master programmes might pursue their academic career. Initiating research projects can also provide various opportunities for PhD students. However, having access to research funding is crucial for graduates as they follow-up (PhD and Post-Doc level). The supervision of PhD students as well as the training of university staff (at all levels) are important and should also be taken into consideration. The exchange of lecturers between Twin Institutes might be helpful in this respect.

It can also be noted that most Master programmes are in Portuguese and only few English courses are available.

What would be the crucial issues in Mozambique's study programmes? In fact, UNU should be ahead of the government in defining topics. The main issues covered will mainly concern: pollution (from pesticides, gold mining and coal mining), water supply, sanitation, floods and droughts, IWRM as a link between various topics and groundwater as a main source of water in Mozambique (hardly studied).

Regarding water storage, infrastructures such as dams are mainly needed for storage capacity, but are mostly built for energy. At present, different ministries are involved in planning and managing these two functions.

How does policy advice function in Mozambique? Could it be a role for UNU? There are several problems concerning human capacity: the World Bank rules stipulate the recruitment of external experts. Nevertheless, politicians should learn that local advice might be valuable. In addition to this, institutional and equipment capacities are also important to human capacity.

TUD issues

Several relevant programmes presently exist at TUD. One of them is the Master of Hydro Science and Engineering (HS&E) and students can start either with an engineering or science background. This programme can be used as a model and be extended in the future. Amongst others, TUD also offers a Master on Tropical

Forestry and Management (including hydrology, soil use, governance, etc.) and a Master on Waste Management (currently not offered in English). CIPSEM provides a course on different related issues such as circular economy and its courses can be used as a basis for the extended future Master and PhD courses. It is to note that establishing new Master programmes (such as the Master Waste Management in Hanoi) takes about two years.

A similar approach can be pursued as in the case of UNU-EHS that initially focused on introductory courses that were then followed by specialization. Hence, faculties have to be involved from the very beginning. However, there is a danger of overloading the curriculum and the teaching load.

Summary

It can be generally concluded that programmes have to be generated in the place where they take place and be built on existing experience and courses (at TUD and in Southern Africa). The development of exchange programmes and multi-nodal courses can be envisaged later. Some modules which are unique to UNU should be included in the programmes (e.g., complementing HS&E), emphasizing the worldwide perspective of UNU. The Mozambican side has identified several problems and prioritizing of problems is now the next key step. UNU has a preference for founding strong links with UEM, but this does not exclude any further partners. The existing nodes and cooperative study programmes between African Universities should be made use of and recognized. Based on present discussions, a more structured approach will be prepared concerning both research priorities in Mozambique and existing teaching programmes to build upon. Recruiting Mozambican students at existing Master programmes at TUD (and graduated people to CIPSEM) would certainly accelerate the process, since UNU-FLORES has not yet been established.

3.7.4 Working group IV: Mozambique and the region

Facilitator: Dr Reza Ardakanian

Rapporteur: Ms. Jessica Johmann

Research priorities identified by the working group are essentially water resources management, food security, integration of fluxes, waste management and economic and social issues.

1. Water resources management

This concerns several issues such as groundwater recharge, underground dams, storage in underground aquifers, shared water, IWRM, cycling of resources (nutrients and pollutants), salination and sea level rise. However, it is also related to early warning systems and monitoring of floods, droughts, water and sanitation. The exploitation of synergies with UNU-INWEH, given the strong expertise and the global network, was also emphasized.

2. Food security

Food security depends on optimal water use but also on water productivity in general. It addresses competition between agriculture and industry as well as water harvesting in water stressed African countries (e.g., South Africa, Namibia).

3. Integration of fluxes

The topics of soil, vegetation and water management in climate change scenarios were raised as well as assessment of resources. Coping with the aftermath of mining and other new exploitations have also been mentioned in this context.

4. Waste management

This is related to safe waste water use in agriculture (e.g., semi-open areas in Africa) that lack proper waste management systems. A perceived opportunity for Africa is to introduce a new mode of waste economy (recycling).

5. Economic and social issues

Environmental and social constraints (e.g., water and gender) and institutional aspects of water management in general (e.g., water user associations) are considered as socio-economic issues.

3.7.5 Final discussion

During the final discussion, several issues from the working groups were re-iterated and partly clarified. There were also several addenda and suggestions for the further process:

- important to recognize that UNU-FLORES is not a local university, neither in Dresden nor in Mozambique; students will come from all over the world
- selection of students is an important issue, since grades from different countries may be difficult to compare. Procedures have to be developed (one possible topic of next workshop)
- development of a core curriculum with broad applicability would be helpful to foster student exchange
- there is also a need for postgraduate programmes for people who are already employed and have a position; there might be different Master programmes on the same topic according to qualification, working experience and other requirements – but not all at the same time and from the beginning.

While study programmes may be clearly defined and developed already during the implementation phase of UNU-FLORES, research areas should only be broadly defined now and details should be left to the recruited researchers. In order to avoid compiling too ambitious academic wish lists, one may also consider inviting potential donors and funding agencies to the next workshop in order to develop feasible and fundable research programmes.



Participants listen to the closing remarks of the workshop. Photo: UNU-ViE

A generally positive attitude towards the contents and the outcomes of the workshop became obvious in the participants' responses to the workshop's questionnaire. Positive accounts were also expressed in three closing remarks given by Prof. Krebs on behalf of TUD, the Mozambican Ambassador to Germany, Mr. Carlos Dos Santos on behalf of the participants from Mozambique, and the Rector of UNU, Prof. Osterwalder, who also reminded the participants to

- maintain things simple and small, but start soon as it is the general recipe for successful projects
- keep in mind the difference between UNU and other universities: internationality, theme- and user oriented, bringing together unusual combinations of aspects
- be ahead of politics and not involve them when defining topics (but later), since approach and focus are different
- find a balance between being of interest for Germany and Mozambique (and respective funding bodies), but also keeping in mind the international perspective, which should not be difficult given the topic of UNU-FLORES.

3.8 Evaluation of the questionnaire for participants of the 1st International Scoping Workshop

In a questionnaire asking for the general satisfaction of workshop participants, over 90 per cent of the participants (22 responses) rated the workshop as excellent or very good and the most frequently mentioned drawback (rated good or moderate by about 20 per cent of participants instead of very good or excellent) was that

there had not been sufficient time for discussions. Incoming responses to a more detailed questionnaire (from eight participants) are summarized below.

Evaluation of the responses revealed that the workshop succeeded in bringing together an effective and dynamic group of stakeholders, which created both a political and professional momentum to the initiative. The opportunity to exchange views and facilitate contact between the different groups of participants was acknowledged, as were the achieved results, namely the identification of research topics and the exchange of ideas on postgraduate education.

It was noted by several stakeholders that a discussion of funding strategies, especially for the Twin Institute, might have been included as an additional topic into the programme. Furthermore, it was stressed that some technical and administrative details (e.g., required staff, equipment) as well as some specific research topics of potential relevance (e.g., domestic waste water minimization, socio-economic issues) were not yet discussed.

The UNU-FLORES concept note was overall considered as good in providing an overview of the proposed profile of the Institute, especially with regard to its strong foundation in the available expertise at TUD. The draft concept note is at present being revised according to the specifications and results of the workshop and in line with the implementation plans. It was criticized though that the initial draft did not provide specific steps for the start-up phase and that implementing both Twins during a short period of time might be difficult to achieve.

Concerning the key research areas which should be addressed by the future Twin in Mozambique, mainly those were mentioned which comply with the proposed research departments of UNU-FLORES: water management (especially for urban areas, flood risk management, IWRM, water for food, shared river basins, water governance, water economics), land use management (in relation to water management, food security) and waste management (including remediation of sites and groundwater), global change (extreme events like floods and droughts) and systems and flux analysis (life cycle analysis of material, energy and water flux). Additional issues were green energy and finally capacity development as an overarching topic. Research should, in compliance with the general UNU philosophy, be policy relevant, also covering the science-policy interface.

As means of information exchange to foster cooperation between the Twins in Dresden and Maputo all available channels were considered useful: regular workshops at several levels (from students to decision makers), intranet/blogs, joint research projects, student exchange (also between UEM and TUD, potentially already before UNU-FLORES is operational), mentorships and the installation of a joint secretariat. Moreover, it was suggested during the workshop that the Rector of UNU should visit Mozambique and that the UNU-FLORES initiative should be propagated in the region.

Responding stakeholders expected from the next scoping workshop that the discussed items and ideas concerning research, teaching and twinning will become more concrete and focused, eventually resulting in an implementation plan.

During the next workshop also institutional issues (legal and formal ones) and the issue of donors should be addressed. With respect to research topics, natural disasters might be further elaborated on in cooperation with African partners such as DiMTEC; the unique profile of UNU-FLORES compared to UNU-INWEH might be shaped and relations to NEPAD/CPA initiatives should be worked out. Concerning teaching, postgraduate programmes of the Mozambique Twin should be developed, based on a needs assessment. Overall, the workshop should create regional and political awareness for the UNU-FLORES initiative.

3.9 Important outcomes and lessons learned

The 1st International Scoping Workshop revealed as one key outcome the commitment and dedication towards the initiative by all partners involved. The establishment of such an Institute was perceived to have great potential for synergies that were identified during the workshop. Furthermore, the occasion provided an excellent platform to establish relevant contacts and to strengthen cooperation. It was agreed that the blog page designed for the scoping workshop will be further used as an information and exchange platform (<http://www.unu-flores-mozambique.blogspot.com/>).

During the workshop, Dr Carlos Lucas from UEM and Ms. Roda Nuvunga Luis from MCT were nominated as focal points of UNU-FLORES in Mozambique. The stakeholder group reached a general agreement on the consequent steps and a common understanding on the below outlined aspects:

- twinning strategy of UNU
- scientific potential of TUD and Saxony
- science agenda and institutional status on water research in Mozambique
- main ideas about UNU-FLORES
- water-related problems in Mozambique and the region
- existing expertise and programmes on capacity development within UNU, TUD and Southern Africa.

In addition, the working groups identified:

- potential research topics based on expertise at TUD
- opportunities and challenges for the Twin in Mozambique
- entry points for developing educational programmes in Dresden (TUD) and Mozambique (UEM and further partners)
- mapping research priorities of the Mozambique Twin.

4. Next steps and perspectives

Based on the signed MoU, the next step in establishing UNU-FLORES in legislative terms is the adoption of a funding agreement. As the Rector of UNU, Prof. Osterwalder, announced during the workshop, UNU strives at posting the position of the funding director as early as possible in 2011. A working group was nominated, consisting of Mr. Max Bond and Dr Reza Ardakanian on behalf of UNU and Prof. Krebs on behalf of TUD, being responsible for the implementation of the start-up phase of UNU-FLORES in Dresden.

Conceptually, concerning the link to TUD, involved chairs will work both on defining research areas and study programmes until the next workshop. Based on the results of the working groups of the 1st International Scoping Workshop, the listed issues will be shaped and focused, eventually resulting in more clear-cut recommendations and implementation strategies to be discussed during the next workshop in Mozambique.

Concerning the Mozambique Twin it was clarified that the governmental responsibility would be at MCT. At UEM first steps towards an organizing committee for the next workshop were initiated and the initiative was introduced to relevant faculties. Before the next workshop will take place, it will be an important task to gather a good and more complete overview of existing study programmes in the field of resources management, since several programmes have just – or are about to be – established. In addition, possibilities for collaboration in research and teaching with potential partner institutes in the region (see Chapter 2.2) need to be explored.

5. Appendices

5.1 List of relevant online resources

5.1.1 UNU

UNU main page: <http://www.unu.edu/>

UNU-ViE: <http://www.vie.unu.edu/>

UNU-EHS: <http://www.ehs.unu.edu/>

UNU-INWEH: <http://www.inweh.unu.edu>

UNW-DPC: <http://www.unwater.unu.edu>

UNU-FLORES blog: <http://www.unu-flores-mozambique.blogspot.com/>

Photos of 1st International Scoping Workshop, November 2010, Dresden:
<http://www.flickr.com/photos/unubonn/sets/72157625270288005/>

5.1.2 TUD

Faculty of Forest, Geo- and Hydrosience, TUD:

http://tu-dresden.de/die_tu_dresden/fakultaeten/fakultaet_forst_geo_und_hydrowissenschaften/index_html/document_view?set_language=en

Faculty of education, institute of vocational education, TUD:

http://tu-dresden.de/die_tu_dresden/fakultaeten/erzw/erzwibp/index_html/document_view?set_language=en

Dresden Water Centre:

<http://tu-dresden.de/forschung/forschungskompetenz/kompetenzzentren/wasser>

Information on international MSc Course "Hydrosience and Engineering":

http://tu-dresden.de/die_tu_dresden/fakultaeten/fakultaet_forst_geo_und_hydrowissenschaften/fachrichtung_wasserwesen/Studium/studiengaenge/stg_hse?set_language=en&cl=en

CIPSEM:

http://tu-dresden.de/die_tu_dresden/fakultaeten/fakultaet_forst_geo_und_hydrowissenschaften/cipsem

UFZ, Division of Water and soil sciences:<http://www.ufz.de/index.php?en=13995>

5.1.3 Mozambique and the region

Ministry of Science and Technology, Mozambique: <http://www.mct.gov.mz/>

University Eduardo Mondlane, Maputo: <http://www.uem.mz/>

University Zambeze, Beira: <http://www.unizambeze.ac.mz/>

NEPAD: <http://www.nepad.org/>

Southern Africa NEPAD Water Centres of Excellence:
<http://www.nepadwatercoe.org/>

University of Namibia: <http://www.unam.na/>

University of Nairobi, Kenya: <http://www.uonbi.ac.ke/>

DiMTEC: <http://www.ufs.ac.za/dimtec>

WATERnet, Building Capacity for Water Resources Management in Southern Africa: <http://www.waternetonline.ihe.nl/>

5.1.4 Potential future funding agencies

BMBF: <http://www.bmbf.de/en/index.php>

German Academic Exchange Service (DAAD):
<http://www.daad.de/ausland/index.en.html>

5.2 MoU on UNU-FLORES**MEMORANDUM OF UNDERSTANDING****BETWEEN THE FEDERAL MINISTRY FOR EDUCATION AND RESEARCH
OF GERMANY, THE FREE STATE OF SAXONY, THE TECHNISCHE UNIVERSITÄT
DRESDEN AND THE UNITED NATIONS UNIVERSITY**

THE FEDERAL MINISTRY FOR EDUCATION AND RESEARCH OF GERMANY, hereinafter referred to as the "FEDERAL MINISTRY",

THE FREE STATE OF SAXONY, hereinafter referred to as "SAXONY",

THE TECHNISCHE UNIVERSITÄT DRESDEN, hereinafter referred to as the "TUD",
and

THE UNITED NATIONS UNIVERSITY, hereinafter referred to as the "UNU", an autonomous organ of the General Assembly of the United Nations,

CONSIDERING the Parties' common principles, complementary objectives and mutual interest in cooperation in research, advanced training and capacity development towards sustainable material use and environmentally sound resource management,

DESIRING to provide a hub for the development of global sustainable management strategies and to integrated management and capacity building for material flow and resources management focusing primarily on environmental resources (soil, nutrients, water and waste) with the view to concentrating also on other geo- and energy resources flows at a later stage,

BEARING IN MIND the common desire to establish a UNU research and training programme in the above-mentioned subject areas to be designated as the "UNU Institute for Integrated Management of Material Fluxes and of Resources (UNU-FLORES)" in Dresden, Germany,

BEARING IN MIND that this Memorandum of Understanding (MoU) is a statement of intent which does not create legal obligations between the Parties,

HAVE REACHED the following understanding:

Article I**General**

The Parties will cooperate in preparing the establishment of the proposed UNU Institute for Integrated Management of Material Fluxes and of Resources (hereinafter referred to as the "UNU-FLORES") from 2010, and will aim, within their

respective terms of reference, as detailed in Article IV of this MoU, to provide the necessary facilities and assistance, including financial provisions, for such cooperation.

Article II

Objectives

1. A “start-up phase” is envisaged to establish the institute before entering the second phase in which the institute would commence its regular operation with continuous research activities and regular capacity building. This MoU explicitly refers to the start-up phase of the institute.

2. The start-up phase would consist of the following major tasks:

- a) to develop the institutional work plan of the new institute by advancing and elaborating its policy-relevant research topics and its postgraduate capacity development activities at M.Sc. and Ph.D. level, establishing close synergies with similar programmes offered by the TUD Faculty of Forest, Geo and Hydro Sciences.
- b) to identify suitable candidates for the position of the Director of the UNU-FLORES and for the Scientific Advisory Committee to be appointed by the Rector of UNU after consultation with the Chair of the UNU Council.
- c) to quickly establish close links with other UNU institutes whose first research priority lies on water-related issues and to build interfaces with other UNU institutes and programmes such as the Institute for Environment and Human Security (UNU-EHS), the UN-Water Decade Programme on Capacity Development (UNW-DPC), the UNU International Network on Water, Environment and Health (UNU-INWEH), the Institute for Natural Resources in Africa (UNU-INRA).
- d) to establish links to other non-UNU partners such as the Centre for Environmental Research Leipzig (UFZ), the German Research Centre for Geosciences (GFZ) and the University of Bonn amongst others.
- e) to build up joint projects of the UNU-FLORES and the TUD and to further develop the planned multi-nodal PhD programme, which aims at attracting high-calibre students from developing countries, offering study phases at different UNU locations including UNU-EHS in Bonn, the UNU Centre in Tokyo, UNU-INWEH in Hamilton and the envisaged Twin Institute of UNU-FLORES to be established in Mozambique.

Article III

Methods of Cooperation

In order to develop and implement this initiative, the Parties shall undertake to set up a Working Group to be responsible for the implementation of the start-up phase as mentioned in Article II above, consisting of experts to be designated by the Rector of UNU, in consultation with the other Parties to this MoU.

Article IV

Contributions of the Parties

1. The UNU will aim to:

- a) appoint the members of the Working Group;
- b) appoint the scientific Advisory Committee of the UNU-FLORES;
- c) establish the terms of reference and recruit the founding Director of the UNU-FLORES;
- d) assist in building a strong international scientific network with other UNU institutions and within the UN agencies and
- e) report on salient activities of the UNU-FLORES;

2. The Federal Ministry will aim to:

- a) provide financial support for the start-up phase;
- b) facilitate cooperation of the new UNU institute during the start-up phase with academic and other relevant institutions in the host country and
- c) prepare for the establishment of the UNU-FLORES as a UNU research and training programme;

3. Saxony will aim to:

- a) provide the same amount of financial and in-kind support for the start-up phase as the Federal Ministry;
- b) facilitate cooperation of the new UNU institute during the start-up phase with academic and other relevant institutions particularly in the region of Saxony and the region of Eastern Germany and

- c) prepare for the establishment of the UNU-FLORES as a UNU research and training programme;

4. The TUD will aim to:

- a) enable the rapid and effective linking of the UNU-FLORES to the TUD in order to develop joint educational programmes and
- b) cooperate with the UNU-FLORES in teaching, research and notably with regard to a shared infrastructure;

5. The items referred to under 2.a) and 3.a) will be subject to a separate bilateral agreement between the respective Parties.

Article V

Duration and Extension

1. This MoU shall be signed by all the Parties and shall take effect for a period of one year on the date of receipt of the last such signature.
2. The Working Group will report to the Parties of this MoU on the progress made no later than July, 1st, 2011.
3. Further progress reports may be prepared by the Working Group upon request of the Parties to this MoU.

Article VI

Amendment and Interpretation

The provisions of this MoU may be amended at any time by mutual consensus in writing.

IN WITNESS WHEREOF, the undersigned, duly authorized thereto, have signed this MoU.

DONE in quadruplicate, in the German and English language, both texts being equally authentic.

For the Federal Ministry of Education
and Research of Germany

Berlin,

For the Free State of Saxony

Dresden,

For the United Nations University

Tokyo,

For the Technische Universität
Dresden

Dresden,

5.3 Participants of the 1st International Scoping Workshop

Official Opening

Name	Position/Affiliation	Contact
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UNU and related institutes		
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5.4 Programme of the 1st International Scoping Workshop

First International Scoping Workshop

on UNU-FLORES and its Twin Institute in Mozambique

Integrated Management of Material Fluxes and of Resources

11 – 12 November 2010

Dresden, Germany

PROGRAMME

10 November 2010

P.M – Arrival of guests and hotel check-in:

STEIGENBERGER HOTEL DE SAXE

Neumarkt 9

01067 Dresden, Germany

Phone +49 351 4386-0

Fax +49 351 4386-888

<http://www.steigenberger.com/en/Dresden>

20:00 hrs **Welcome Dinner**

Restaurant “Italienisches Dörfchen”

Theaterplatz 3

01067 Dresden

Tel. + 49-351 49816-0

<http://www.italienisches-doerfchen.de/>

PROGRAMME

11 November 2010

08:30 – 09:30 **Workshop registration** at the International Scoping Workshop
hospitality desk

09:30-10:30 Official opening

1. Rector of UNU, Prof. Konrad Osterwalder
2. Saxon State Minister, Saxon Ministry for Higher Education,
Research and the Fine Arts, Prof. Sabine von Schorlemer
3. Rector of TUD, Prof. Hans Müller-Steinhagen

10:30 – 11:00 Coffee break (Press Conference)

11:00 – 12:30 Keynote speeches

Under-Secretary-General of the United Nations, Rector of UNU,
Prof. Konrad Osterwalder

Presentation on UNU and its core Strategies focusing on Postgraduate Programmes
and the Twinning Concept".

Vice-Rector of TUD, Prof. Gerhard Rödel

"Introduction to TUD, its potentials and scientific network in Dresden and Saxony".

Deputy National Director, Ministry of Science and Technology of Mozambique,
Dr Roda Nuvunga Luis

"Mozambique and its Science and Technology agenda; Choice of Maputo as loca-
tion for the UNU-Twin-Institute and its regional envisaged impact".

12:30 – 14:00 Lunch break in restaurant on 1st Floor

14:00 – 15:00 **Introduction to UNU-FLORES** and its key area of focus –
an interface with partners

Vice Rector in Europe a.i. of UNU, Dr Reza Ardakanian

Spokesman Hydro Science Department, TUD, Prof. Peter Krebs

15:00 – 16:30 **Working group I:** UNU-FLORES (Room No. 5 on 1st Floor)

Discussion on research directions, educational focus and capacity development

Identification of synergies and potential cooperation

Reshaping core focus of UNU-FLORES

Working group II: Twinning (Room No. 6 on 1st Floor)

Discussion on research direction, educational focus and capacity development of the UNU-FLORES Twin institute in Mozambique

Identification of synergies and potential cooperation with partners in Mozambique and the region

Shaping of core focus of Twin institute

16:30 – 17:00 Coffee break

17:00 – 17:30 Wrap-up and report of Working Group sessions in plenary

17:30 – 19:30 Guided city tour – historic centre of Dresden

PROGRAMME

12 November 2010

09:00 – 09:15 **Welcome** and outline of 2nd workshop day

09:15 – 09:45 **Mozambique and regional perspective** on resource flux and management

Faculty of Sciences, Universidade Eduardo Mondlane

Prof. Elónio Muiwane

09:45 – 10:45 **Capacity development in Mozambique**, the region as well as within UNU and the host country of UNU-FLORES:

Chair of UN-Water, Director of UNU-INWEH, Dr Zafar Adeel

Pro-Vice Chancellor, University of Namibia, Prof. Osmund Mwandemele

Director, Dresden Water Centre, Prof. Christian Bernhofer

10:45 – 11:15 Coffee break

11:15 – 12:45 **Working group III**: "Postgraduate programmes of UNU-FLORES and its Twin Institute in Mozambique" (Room No. 5 on 1st Floor)

Working group IV: Mozambique and the region (Room No. 6 on 1st Floor)

Research focus of UNU-FLORES Twin and its envisaged role as a regional hub

12:45 – 14:15 Lunch break in the restaurant on 1st Floor

14:15 – 15:15 Report on working group outcomes in the plenary

15:15 – 15:45 Coffee break

15:4 – 17:00 Final discussion and closing remarks

Summary of outcomes by the Rector and consequent steps

5.5 List of acronyms

AdeM:	Águas de Moçambique, <i>Waters of Mozambique</i>
AMCOST:	African Ministerial Council on Science and Technology
AMESD:	African Monitoring of the Environment for Sustainable Development
BMBF:	Bundesministerium für Bildung und Forschung, <i>Federal Ministry of Education and Research</i>
BMU:	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, <i>Federal Ministry for the Environment, Nature Conservation and Nuclear Safety</i>
CIPSEM:	Centre for International Postgraduate Studies of Environmental Management
CoE:	Centre of Excellence
CPA:	Consolidated Plan of Action for Science and Technology for Africa
CRA:	Conselho Regularador da Agua, <i>Water Regulating Council</i>
DiMTEC:	Disaster Management Training and Education Centre for Africa
DNA:	Direcção Nacional de Aguas, <i>National Water Directorate</i>
DVGW:	Deutscher Verein des Gas- und Wasserfaches e.V., <i>German Technical and Scientific Association for Gas and Water</i>
DWA:	Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e. V., <i>German Association for Water, Wastewater and Waste</i>
FGH:	Faculty of Forest, Geo and Hydro Sciences of TUD
FIPAG:	Fundo do Investimento e Património do Abastecimento de Água, <i>Heritage Investment Fund for Water Supply</i>
HIGRADE:	Helmholtz Interdisciplinary Graduate School of Environmental Research
HS&E:	Master of Hydro Science and Engineering at TUD
IIA:	Instituto de Investigação em Águas, <i>Water Research Institute</i>

INGC:	Instituto Nacional de Gestão de Calamidades, <i>National Institute for Disaster Management</i>
IÖR:	Leibniz-Institut für ökologische Raumentwicklung, <i>Leibniz Institute for Ecological and Regional Development</i>
IPSWaT:	International Postgraduate Studies in Water Technologies
IWAS:	Internationale WasserforschungsAllianz Sachsen, <i>International Water Research Alliance Saxony</i>
IWRM:	Integrated Water Resource Management
MCT:	Ministério da Ciência e Tecnologia, <i>Ministry of Science and Technology, Mozambique</i>
MESA:	The UNEP initiative on Mainstreaming Higher Education for Sustainability at African Universities
MoU:	Memorandum of Understanding
NEPAD:	The New Partnership for Africa's Development
NGO:	Non-Governmental Organization
NUFFIC:	Nederlandse Organisatie voor internationale samenwerking in het hoger onderwijs, <i>Dutch Organization for International Cooperation in Higher Education</i>
R&D:	Research and Development
SADC:	Southern African Development Community
SMWK:	Staatsministerium für Wissenschaft und Kunst, Sachsen <i>Saxon Ministry of Higher Education and Fine Arts</i>
SPLASH:	European Union Water Initiative Research Area Network
S&T:	Science & Technology
TUD:	Technische Universität Dresden, <i>Dresden University of Technology</i>
UBA:	Umweltbundesamt, <i>Federal Environment Agency</i>
UEM:	Universidade Eduardo Mondlane, <i>Eduardo Mondlane University</i>
UFZ:	Helmholtz-Zentrum für Umweltforschung, <i>Helmholtz Centre for Environmental Research</i>

UNESCO-IHE:	Institute for Water Education
UNDP:	United Nations Development Programme
UNEP:	United Nations Environment Programme
UNU-EHS:	United Nations University Institute for Environment and Human Security
UNU-FLORES:	United Nations University Institute for Integrated Management of Material Fluxes and of Resources
UNU-IIST:	United Nations University International Institute on Software Technology
UNU-INRA:	United Nations University Institute for Natural Resources in Africa
UNU-INWEH:	United Nations University Institute for Water, Environment and Health
UNU-ISP:	United Nations University Institute for Sustainability and Peace
UNU-LEH:	United Nations University Landscape and Ecosystem Health
UNW-DPC:	UN-Water Decade Programme on Capacity Development

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53113 Bonn, Germany



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