United Nations
Educational, Scientific and
Cultural Organization

Natural
Sciences
Sector

NATURAL SCIENCES SECTOR BIENNIAL REPORT

UNESCO REGIONAL OFFICE FOR EASTERN AFRICA

Implementation Period: 2018 – 2019

UNESCO Science for Sustainable Development in Africa

APRIL 2020

Sector Staff

Dr. Jayakumar Ramasamy, Senior Programme Specialist
Dr. Samuel Tetteh Partey, Programme Specialist
Dr. Alice Auma Ochanda, National Programme Officer
Mr. John Ngatia, Research Assistant
Ms. Xinhong Li, Sponsored Trainee

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Natural Science Sector at the UNESCO Regional Office in Nairobi, supports 13 Member States in Eastern Africa and the adjacent Indian Ocean Islands to address formidable development challenges such as climate change, destruction of natural resources, biodiversity loss, water scarcity, food insecurity, natural hazards and disasters etc. These challenges are addressed through the design and implementation of activities that cover diverse fields: freshwater resource management, geodiversity conservation, natural disaster reduction, capacity building in science, technology and innovation (STI) and Science, Technology, Engineering and Mathematics (STEM) Education. The implementation of activities is supported by the mobilization of resources and effective partnership with our extensive national and international networks. In this report, we highlight significant results, lessons learnt, challenges and opportunities emanating from activities implemented between 2018 and 2019. Few of the notable results from our activities include - the development of a regional STI policy for the East African Community; the mentorship of over 2000 secondary school girls across 43 counties in Kenya through UNESCO'S Girls' mentorship program in STEM; the enabling of policy decisions and institutions through capacity building in disaster risk reduction, management of biosphere reserves and groundwater management; the development of mobile applications on rainwater harvesting and water education. Experiences over the last biennium also point to the need to mobilize more resources, strengthen partnership, improve visibility and communication of results and design activities in response to the new UN reforms.

1. BACKGROUND AND INTRODUCTION

Eastern Africa faces daunting development challenges - climate change, destruction of natural resources, biodiversity loss, water scarcity, food insecurity, natural hazards and disasters, rising human population etc. In order to sustainably develop, these challenges would have to be addressed by using science-evidenced technologies, innovations and policies. The Natural Sciences Sector of UNESCO supports Member States to appropriately package and apply technological innovations and polices that foster sustainable development.

The Natural Science Sector of the UNESCO Regional Office in Nairobi serves as a Multi-Sectoral Regional Office responsible for 13 Member States in Eastern Africa and the adjacent Indian Ocean Islands. Countries covered include: Comoros, Djibouti, Ethiopia, Eritrea, Kenya, Madagascar, Mauritius, Rwanda, Seychelles, Tanzania, Somalia, South Sudan and Uganda. The Sector design and implements its activities in relation to the International Science Programmes (ISP) of UNESCO: Intergovernmental Hydrological Programme (IHP); Man and the Biosphere Programme (MAB); International Geoscience and Geoparks Programme (IGGP); and International Basic Sciences Programme (IBSP). For activities pertaining to IHP; Ecological and Earth Sciences; and Disaster Risk Reduction, this office has a coordination role for all sub-Saharan African countries with other Regional Offices. The Science Policy and Capacity Building programme caters for its regional countries in addition to handling the African Network of Scientific and Technological Institutions (ANSTI).

Between 2018 and 2019, a number of activities were conducted to spearhead the advances and application of science in confronting development challenges in Eastern Africa. The following are the cluster of activities implemented by the office under the ISP.

- Science Policy and Capacity Building (IBSP)
- Ecological and Earth Sciences (MAB and IGGP)
- Water Science (IHP)

The objective of this report is to highlight key achievements and lessons learnt from the activities implemented during the 2018/2019 biennium.

2. SCIENCE POLICY AND CAPACITY BUILDING

2.1 Activities

2.1.1 Science, Technology and Innovation (STI)

African countries already acknowledge the critical roles that Science, Technology, and Innovation (STI) could play in their pursuit of global and continental development plans such as the UN Agenda 2030 Sustainable Development Goals as well as the aspirations of the African Union's Agenda 2063. Between 2018 and 2019, the UNESCO Regional Office for Eastern Africa Office in Nairobi provided Member States with guidance in developing or revising their national STI policies; promoting the development of science governance structures and mechanisms; and fostering closer linkages between Technical and Vocational Education and Training (TVET), universities and industry within its longstanding University–Industry Partnerships programme. The sub-sections below give a narrative of major activities and their outcomes.

(a) Development of a Guidebook for the Preparation of STI for SDGs Roadmap

A Guidebook developed by UNESCO and multiple stakeholders to provide a framework for using roadmaps as a policy tool to harness Science, Technology and Innovation (STI) as means to achieve the Sustainable Development Goals

The 2030 Agenda for Sustainable Development, unanimously adopted by developing and developed countries, reaffirmed STI as key means of its implementation and launched the Technology Facilitation Mechanism (TFM) to support the 17 Sustainable Development Goals (SDGs). The TFM is composed of the collaborative Multi-Stakeholder Forum on STI for the SDGs (STI Forum), Online Platform, and the United Nations Inter-Agency Task Team on STI for the SDGs (IATT- STI) together with a group of 10 high-level representatives from civil society, the private sector and the scientific community (10-Member Group).

An Experts' Group Meeting (EGM) on Science, Technology and Innovation (STI) Roadmaps for the Sustainable Development Goals (SDGs) held in Nairobi contributed to advancing the piloting phase of the roadmaps and making recommendations for the finalization of a Guidebook on Development of STI roadmaps.

A sub-working group of the IATT launched a draft of a resource on preparing "STI for SDG" roadmaps. The guidebook is aimed at national and local governments, agencies and institutions that seek to use roadmaps as a policy tool, and takes a focus on the design stage as crucial for effective implementation and monitoring. The guidebook – currently in "draft for consultation" form – articulates STI roadmaps as being at the intersection of three areas: 1) a country's national development plan; 2) an STI plan; and 3) an SDGs plan. It notes that an STI for SDGs roadmap can be either a standalone document or integrated into other planning tools. The draft guidebook is structured with chapters dedicated to step-by-step guidance for the development and implementation of STI for SDGs Roadmaps, international partnerships to facilitate effective design and implementation, and recommendations for the international community.

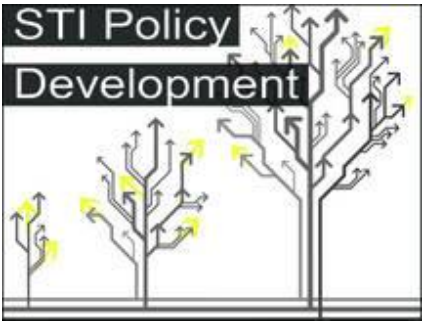
The guidebook is meant to a provide a framework and common language and step by step advice for the practical policymaking and communication purposes. The Guidebook is addressed to interested national and local governments, agencies and institutions that wish to use roadmaps as a policy tool to harness STI as means to achieve SDGs. It can also be of interest to the stakeholders taking part in the dialogue that is an essential part of the whole process of design, implementation, monitoring and adjustment of STI for SDGs Roadmaps and to the wider public that wants to advance global and national SDG agendas and observe the progress. The guidebook focuses on the design stage of the Roadmaps, while showing that the design underpins effective implementation and monitoring.

(b) Development of a Regional STI Policy for the East African Community (EAC)

To achieve socio-economic development and regional integration as enshrined in the Vision 2050 of the East African Community (EAC), the East African Science and Technology Commission (EASTECO) in collaboration with UNESCO and other partners developed the Science, Technology and Innovation Policy for adoption by the EAC.

Following the aspirations and priority areas of the Vision 2050 of the East African Community (EAC) and in consonance with actions towards the African Union's Agenda 2063, the UN Agenda 2030 Sustainable Development Goals and the STI Strategy for Africa (STISA-2024), the East African Science and Technology Commission (EASTECO) in collaboration with key stakeholders including UNESCO developed the STI Policy for adoption by EAC Member States. The final drafted policy was validated in a workshop organized from 15th to 16th October 2019 in Arusha, Tanzania under the auspices of UNESCO.

The EAC Regional STI is expected to ensure that universities are enhanced to be centres of excellence for investments in education, technical competencies and training, particularly in science technology and education. Essential elements will be to update data on STI, policy making and strategic planning. UNESCO Institute for Statistics can provide statistics and gender disaggregated country specific statistics on STEM for the region. The policy is anchored on the following pillars: i) Capacity building for skills and STI Infrastructure; ii) Research, Innovation and Entrepreneurship; iii) Resource mobilization, partnerships and collaborations; and iv) Enabling environment. On the other hand, the priority (sector) areas for the East African Regional Policy for Science, Technology and Innovation (STI) are: (1) Agriculture and Food; (2) Health and Life Sciences; (3) Human Resource Development/ Education; (4) Infrastructure; (5) Energy; (6) ICT and Big Data (7) Industrialization and Trade; (8) Environment and Natural Resources Management; (9) Climate Change; (10) Traditional and Indigenous Knowledge; and (11) Space Science and Technology.



With the existence of an inclusive and gender responsive STI policy for the EAC region, UNESCO is planning to expand and pilot the Global Observatory Science Policy Network (GO-SPIN) at both national and regional levels. GO-SPIN aims to fill this information gap by providing key information on STI governing bodies, legal frameworks, policy instruments and long-term series of indicators for evidence-based policy analysis, design and foresight studies. GO-SPIN is an online, open access platform for decision-makers, knowledge- brokers, specialists and general-public, with a complete set of various information on STI policies.

(c) Forum for African Women Vice Chancellors

With gender as a global priority, UNESCO along with DAAD and JICA supported the organization of the second Forum for African Women Vice Chancellors (FAWoVC) on October 21, 2018 in Nairobi. The preeminent leadership and net-working event with a continental reach was founded in 2016 as a way of helping women surmount the prevailing societal and cultural barriers to women leadership in Africa.

Specific objectives that informed the founding of the Forum include: understanding leadership and management of universities in Africa; mentoring of female senior staff members in Universities and Research Institutions; exploring impact of Women Networks in supporting women leaders in Higher Education and sharing of experiences and bench-marking with peers from other parts of the World. Under the theme of Aligning African Universities to Accelerate the Attainment of Transformation Agenda 2063, the Nairobi forum which attracted over 30 participants was held as a side event of the RUFORUM Biennial Conference. FAWoVC that started out with 10 women vice chancellors now has close to 40 members drawn from universities in Kenya, Uganda, Nigeria, South Africa, Malawi, Sudan, Cameroon, Tanzania, South Sudan, Ghana, Liberia, Botswana and Algeria.

Out of the 1,500 universities in the continent, only 40 are headed by female vice chancellors. The figures don't hold well beyond African boarders too. Globally, only 34 of the top 200 universities, have women at the helm. Often times, even the most knowledge women in Africa don't make it to the decision-making table simply because of their gender. Those who manage to break the glass ceiling in various professional fields have, therefore, had to deal with an inexhaustible list of personal and patriarchal laden challenges, prevalent in Africa.

Identified bottlenecks to women advancement in academics include balancing career with motherhood, lack of funding, a prevailing gender bias and few mentors. The Nairobi meet therefore provided the participants an opportunity to share experiences and chalk new ways of bringing female voices to bear on Africa's development.

2.1.2 Gender and Science

Globally, women account for a minority of the world's researchers. Data from UNESCO Institute for Statistics shows that girls in Science, Technology, Mathematics and Engineering (STEM) represent only 35 % of STEM students in higher education, and, as their studies progress, girls leave STEM in disproportionate numbers. Social, cultural and gender norms continue to hold girls back. This is a major concern due to the continued decline, lack of interest and low enrolment of young people (particularly girls) in STEM courses at University level. In Kenya for instance, only 9 % of women are engineers. At the UNESCO Regional Office in Nairobi, various programs and activities aimed at increasing the participation of women in science are implemented. The sub-sections below give a narrative of major activities and their outcomes for the 2018/2019 biennium.

(a) The Celebration of the International Day of Women and Girls in Science

The International Day of Women and Girls in Science celebrated in Kenya and the Eastern Africa Region for increased participation of women in science

UNESCO Regional Office for Eastern Africa continued to work in close collaboration with its partners in Science Technology, Engineering and Mathematics (STEM), namely, Microsoft, the Forum for African Women Educationalists (FAWE) and universities to give visibility to the importance of women's participation in science by organizing celebrations for the International Day of Women and Girls in Science in Kenya and encouraging countries in the region to do the same.

The 2018 celebrations included showcases by young scientists and secondary school students on some of their innovations and talks on challenges and opportunities in Science for Women and Girls. Female scientists and role models who have excelled in STEM fields to pursue their passion in the male-dominated field were also present to mentor the students by sharing their experiences and how they countered the prevailing gender stereotypes in STEM.

While UNESCO organized the 2018 celebrations at the UN Complex in Nairobi, the universities took ownership of the event with Kenyatta University organizing the 2019 celebrations and using the occasion to launch a STEM Club for students at the university. UNESCO also supported the celebrations at Kenyatta University. Both events brought together student scientists from secondary and tertiary institutions, practicing women scientists, as well as teachers and lecturers who

contribute to making the difference in girls' participation in Science, Technology, Engineering and Mathematics (STEM). The celebrations at Kenyatta University involved the presence of the University Vice-Chancellor and other senior managers of the University in the celebrations and launch of the University STEM Club.

Following UNESCO's guidance, the Ministry of Education in Rwanda, FAWE Rwanda Chapter, Rwanda Women in Science, Engineering (RAWISE), and African Institute for Mathematical Sciences (AIMS) also organized celebrations for the International Day of women and Girls in Science 2019 in Kigali, Rwanda. The occasion was used to recognize Rwanda's first female scientist to get a PhD in Physics and to have round table discussions on reasons for women's low participation in STEM in the country.

(b) Unlocking the potential of Girls in Science, Technology, Mathematics and Engineering for a Sustainable Future for all

Over 2000 secondary school students across 43 counties in Kenya received mentorship through UNESCO'S Girls' mentorship program in Science, Technology, Mathematics and Engineering for a Sustainable Future

In 2014, UNESCO initiated and introduced the Mentorship in STEM Programme through Scientific Camps of Excellence as a means to promoting the participation of women in science. Jointly implemented in partnership with the Ministry of Education, the National Commission for Science, Technology and Innovation (NACOSTI), the Kenya National Commission for UNESCO, Universities and Industries. The programme aims to inspire secondary school students (particularly girls), and nurture them to embrace STEM subjects for better performance and eventual enrolment into STEM courses at the university level.

During the 2018/2019 biennium, the office continued to organize STEM mentorship activities through its scientific camps of excellence to inspire and nurture the passion for science, technology, engineering and mathematics in young people with particular emphasis on girls. In 2018, a STEM Mentorship Camp was organized in April for Upper Eastern Region of Kenya at Machakos Girls' High School where 136 secondary school girls were mentored while 542 secondary school girls were mentored in Western and South Rift regions of Kenya in 2019. This brought the number of the schools and students reached to 161 and 1600 respectively. Additional 602 students were mentored during the 3rd UNESCO Africa Engineering Week 2018 celebrations in Kenya, where UNESCO also established close working relationships with the Institution of Engineers of Kenya (IEK) for continued provision of mentorship to students by professional engineers in the country.

UNESCO also partnered with Interswitch Ltd. to introduce a STEM debate Challenge for all secondary school students in Form three level of education. The best three students from the STEM Debate Challenge were awarded with University Scholarships together with laptops and stipends to cover the period of their study at the University.

2.1.3 Local and Indigenous Knowledge Systems

The UNESCO Local and Indigenous Knowledge Systems (LINKS) programme acts to support the inclusion of local and indigenous knowledge in science education, biodiversity conservation and climate change adaptation. Guided by the 2007 UN Declaration on the Rights of Indigenous People, UNESCO is also engaging with indigenous communities to elaborate a UNESCO-wide policy to ensure that all its programmes address the specific needs and rights of indigenous people.

(a) SANDWATCH: Adapting to Climate Change and Educating for Sustainable Development

More than 80 people (50% women) including school principals, students and representatives from relevant government departments in Comoros and Madagascar received training on SANDWATCH for evidenced-based decisions that address beach-related challenges and promote climate change adaptation.

In collaboration with various stakeholders, SANDWATCH training workshops were held in October 2018 and December 2019 in Madagascar and Comoros respectively. The main objective of the workshop based on a scientific and civic approach was to provide and strengthen knowledge of the coastal environment for increased capacity of participants to respond to environmental and climate change challenges. In addition, the training served as a platform to enhance the lifestyles and habits of children, youth and adults at the community level in order to help them adapt to changes while strengthening the resilience of ecosystems. The relevance of such a project no longer needs to be demonstrated, because it is well known that, for a few years, questions linked to climate change have become one of the national priorities of the different governments of Comoros and Madagascar. For both countries, the training welcomed about 80 participants (50% women), including directors of public primary schools located in coastal areas, as well as agents from the ministries of education and the environment who received training on (1) how they can monitor their coastal environment by taking measurement of key parameters (e.g. water quality, debris, erosion, waves, plants and animals etc.), (2) analyzing results obtained, (3) sharing and communicating findings in a local context; and (4) taking appropriate actions by planning, implementing and evaluating a beach-related activity that fulfils one or all of the following: addresses a particular beach-related issue; enhances the beach; and promotes climate change adaptation.

The training program is expected to promote the development of a SANDWATCH program that will be integrated into the education systems of both countries and the establishment of a SANDWATCH network for different schools.

2.2 Lessons Learned

- Considering the above achievements, national policymakers should align their respective national STI policies with the East African Regional Science, Technology and Innovation Policy to translate the regional policy to national action.
- In order to be more effective, the programme needs to be evaluated during its planning and implementation stages by a committee comprising of different stakeholders. Such a committee

would potentially subject the planned activities to rigorous review in the developmental stage and later oversee the integration of project-specific results into the programme.

- The involvement of the national institutions and their ownership of the programme is critical for its success. Moreover, UNESCO can tap into the financial resources of the National Commissions for the success of its national activities;
- Overcoming the gender stereotypes and ensuring attitude change is a long-term activity, which needs the full commitment of all the stakeholders.

2.3 Challenges

- Mobilizing funding for a regional initiative of STI is also getting difficult as we have very much limited donors for such regional priorities.
- Limited capacities and resources (human, technology and funding) for STI initiatives in general.
- The region needs to address three critical challenges to resolve how science, technology and innovation can enable development in the region. First there is need to bridge the existing gap through access to technologies between and within the individual countries.
- To reduce the technology gap, member countries need to invest in researching on ways to expand information infrastructure, and reduce the cost of service, especially for internet access. Further, there are very few platforms for sharing experiences, between individual countries in the region as well as with the development partners, of what technology works and what does not.
- Moreover, to promote inclusive innovation within individual countries, there is need to enact national policies for innovation capacity that make it possible to reduce inequality through labor and employment opportunities for all.
- There is also the underfinancing of innovation efforts. Financing innovation is key in promoting technological change, which supports structural diversification and reduces the dependence of countries and economies on commodity boom/bust cycles. As such, there is need to develop structural avenues for mobilizing such financial resources for technological development.
- There are insufficient STI partnerships in sectors of public importance including education, natural resources management, health among others. There is need to further develop these collaborations and alliances through strengthening existing STI partnerships and developing new ones, particularly South-South collaborations.
- The Government has very high expectations of UNESCO but the financial resources are limited and do not allow us to reach out to more students as they would wish us to do with the STEM programme.

2.4 Opportunities

- The two multi-stakeholder activities have provided a favorable environment and a great opportunity for a multi-sectoral approach to solving the regions' pressing STI challenges. This approach provides a bold, integrative, transformative and creative approach to spur towards an innovation-led knowledge-based economy, sustainable job creation and improve the quality of life for citizens of the individual countries.
- The challenge of underfinancing of STI efforts in the region provides an opportunity for partnership between academia, the private and the public sector at different levels including policy development and implementation of activities. Additionally, this presents the STI programme with a chance for working with individual specific national institution to empower them in management of research while ensuring effective coordination of research.
- The interest of partners such as Microsoft to train students in coding and robotics during the UNESCO STEM mentorship camps is a good opportunity for UNESCO to increase the interest of female students in science.

- The offer by Eutelsat to connect schools that have participated in the UNESCO mentorship programme to internet will enhance participation of girls in STEM through a more interactive teaching and learning of the science subjects.

3. ECOLOGICAL AND EARTH SCIENCES (MAB and IGGP)

The burgeoning challenges posed by climate change, biodiversity loss, sea level rise and natural hazards and disasters call for pragmatic measures to drive the environmental sustainability agenda and strengthen the disaster risk reduction and preventive approaches of vulnerable Member States. Programmes and projects under the Ecological and Earth sciences are designed to address the aforementioned challenges. The programmes and projects implemented under Ecological and Earth Sciences include: Man and the Biosphere Programme (MAB) and the International Geoscience & Geoparks Programme (IGGP).

The sub-sections below give a narrative of major activities and their outcomes for the 2018/2019 biennium.

3.1 Activities

3.1.1 Man and Biosphere Programme

(a) Biosphere Reserves in Mauritius

Mauritius has only one Man and Biosphere (MAB) Reserve, the Macchabee/ Bel Ombre Biosphere Reserve, which was nominated by the Mauritian Government in 1977 and is one of the oldest BR globally. It comprised of the two Nature Reserves (Macchabee and Bel Ombre), presently found in the Black River Gorges National Park. It covers an area of 3594 hectares but do not have any buffer and transition zones.

However, Mauritius did not carry out the periodic review as required by the UNESCO MAB due to lack of expertise on the subject and was thus not in line with the current Strategy for BR. Currently, the Macchabee/Bel Ombre BR does not have a dedicated buffer and transitional zone. Consequently, UNESCO MAB agreed to carry out a mission in order to revitalize the Macchabee/Bel Ombre Biosphere Reserve so as to keep the biosphere reserve status. A mission was held in December 2017 where the main recommendation was made for the re designation of Macchabee/Bel Ombre Biosphere Reserve to include the whole BRGNP as Core Zone together with dedicated buffer and transitional zones. Mauritius is now required to submit a fresh nomination.

A drafting team has been set at the National Parks and Conservation Service headed by Mr. V. Gopal as the National Focal Point for Mauritius BR. An implementation plan has already been approved by the Ministry of Agro Industry and Food Security. Drafting has already started together with consultation with relevant stakeholders.

During the mission, the team met with the UNRC and briefed her about the initiatives. Under GEF biodiversity programme, the national implementing partner received some support to rework on this nomination.

(b) Biosphere Reserves in Seychelles

We organized our first meeting with the President of UNESCO National Commission for Seychelles and Minister for Education during which she agreed to initiate the process for formulating MAB National Committee for Seychelles. She instructed the Ministry of Environment, Energy and Climate Change to work with the authorities by calling all relevant stakeholders, Ministries, departments, community group organizations and National Commission to take the necessary action to establish the committee based on the cabinet decision. The National Commission for UNESCO shall work with UNESCO MAB Secretariat to formalize the committee and the Nairobi office will do the needful to make it part of Africa.

Principle Secretary of Environment appreciated the helping hand of UNESCO in establishing MAB National Committee and further deliberations on possible nomination of biosphere reserve sites from Seychelles. Followed by the meeting with the PS, the Ministry of Environment organized a stakeholder consultation meeting with all relevant Ministries, community groups, national and international NGO. UNESCO made a presentation on what constitutes a biosphere reserve and the formalities to be followed for the nomination of a reserve, the benefits of nominating the MAB National Committee etc. There was lively discussion among the stakeholder ministries and community groups with UNESCO on biosphere reserves most of the community group interested to know what the new restrictions for community movement are once the site is declared as a biosphere reserve. Basically, we clarified that this nomination is not for full protection, but it gives the opportunity for community to take the ownership and how best both sides of the conservation and socio-economic activities can co-exist. Various stakeholders suggested about three to four sites for consideration out of which two natural heritage sites were suggested for a short field visit to inspect the marine national park close to Mahe Island.

We undertook a field visit to St. Anne Marine National Park in the protected area in which the core zone is well protected with all forms of restriction. The outer part of the buffer area on the Island is where the resorts and hotels are maintained by private owners. Several non-functioning hotels with all ruined building are left over on the islands because removing all the waste might affect the marine protected area, therefore it needs to be worked on with care. Also, the island has windmill power generators and there is also a possibility for localized solar power. The private owner is expected to invest in the renewable energy sources and needs to come out with a suitable policy for waste removal which is another main concern and threat to the marine national parks. When all these concerns have been addressed a possible biosphere, including marine and terrestrial areas could be installed.

Most importantly we have been able to establish a drafting team at the National Parks and Conservation Service to oversee nomination of re designation of Macchabee/Bel Ombre Biosphere Reserve; and organized the first meeting with the President of UNESCO National Commission for Seychelles and Minister for Education to initiate the process for formulating MAB National Committee for Seychelles.

(c) Biosphere Reserve nomination in Comoros

Through the UNDP / GEF project 'Development of a national network of terrestrial and marine protected areas representative of the unique natural heritage of Comoros and co-managed with local village communities (RNAP), the Union of the Comoros aims to conserve its biodiversity Marine and terrestrial importance by

establishing a larger and more functional system of protected areas in three of the Comoros Islands: Ngazidja (or Grande Comore), Mwali (or Mohéli) and Ndzuani (or Anjouan). This network should be both representative of the country's biodiversity richness and offer prospects for a sustainable future. Conscious that the biodiversity of the Comoros continues to be strongly affected by human activity, and convinced that Conservation and Development are the face of the same coin, the Comorian authorities have opted within the framework of the project e RNAP the vision to create for the creation of a biosphere reserve on the island of Moheli based on the existence of the Mohéli Marine National Park, the first protected area of the Comoros created in 2001.

UNESCO has been involved in this biosphere reserve project since its inception and has been attentive to its evolution. The organization will contribute to the objectives of the RNAP through a partnership agreement signed with UNDP. UNESCO provided technical assistance for the preparation of a nomination of the island of Moheli as a biosphere reserve, capacity building of actors and the establishment of inclusive and participatory governance in accordance with the management of biosphere reserves. More specifically, it promoted a better understanding and ownership by stakeholders of the challenges of a biosphere reserve and its contribution to sustainable development, encourage dialogue and multi-stakeholder involvement and build capacity setting up the necessary consultation frameworks and prepared biosphere nomination dossier.

(d) Biosphere Reserve nomination in Rwanda

With support from the World Bank, UNESCO in collaboration with stakeholders in Rwanda initiated the nomination of a Biosphere reserve site in Rwanda. UNESCO provided technical assistance for the preparation of a nomination of the site, capacity building of actors and the establishment of inclusive and participatory governance in accordance with the management of biosphere reserves. More specifically, it promoted a better understanding and ownership by stakeholders of the challenges of a biosphere reserve and its contribution to sustainable development, encourage dialogue and multi-stakeholder involvement and build capacity setting up the necessary consultation frameworks and prepared biosphere nomination dossier

(e) National Training on Biodiversity in Rwanda

The Rwanda National Commission for UNESCO in partnership with the UNESCO Regional Office for Eastern Africa, and the Center of Excellence in Biodiversity and Natural Resources Management (CoEB) organized an intensive training workshop programme on biodiversity assessment and mapping to build technical capacity of different stakeholders the concepts and best practices learned from UNESCO –training. The training brought together 30 delegates (15 women and 15 men) from NGOs, academia, private and public institution and took place at University of Rwanda (UR), Huye Campus on December 11th -13th, 2019.

With staff turn-over, and rapid advancement of biodiversity assessment, the staffs in relevant sectors are in need of practical capacity building in understanding biodiversity, limitations and characteristics of existing tools, the importance and methods for maximum exploitation of available tools, techniques of data quality

control, and basic methods of data presentation and interpretation. This will fill gaps in understanding among staffs spanning field technicians to modelers who use and interpret biodiversity data.

Prof Beth Kaplin heading the Center of Excellence in Biodiversity and Natural Resources Management (CoEB) who emphasized that people have to know their relationship with the environment and therefore encouraged trainees to bring positive changes, join forces and knowledge to preserve and protect biodiversity

3.1.2 Earth Sciences Programme

(a) AfricaArray 2018

The 2018 AfricaArray International Geophysics Field School was held from 20 June to 14 July 2018. The field school is run by the School of Geosciences at the University of the Witwatersrand (Wits) and forms part of the core curriculum of the Wits Honours geophysics program. By expanding the program to include additional participants we are able to justify a longer, more in-depth field program that includes tackling real problems and developing the entire project workflow. The need for geophysics field training is readily apparent as exploration for hydrocarbons, minerals and water is rapidly expanding in Africa. This geophysics field school is one of the few available world-wide to include external participants and fills a critical training role in Africa.

It is part of the AfricaArray program, a training and research program established throughout Africa (www.africaarray.org). Funding provided by the Foundation of the Society of Exploration Geophysicists (SEG) through a grant from TGS, United Nations Educational, Scientific and Cultural Organization (UNESCO), and a Research Experience for Undergraduates of the US National Science Foundation (NSF) helps ensure that the program continues. In addition, there is substantial in kind support provided from many exploration companies.

The first week of the program is hosted at the GIS computer lab at Wits, the second week is spent in the field and the third week is spent back at the GIS lab at Wits. Specific goals include determining the depth of the overburden, location of potential ground water, identifying buried historical metal objects at archeological sites (e.g., farming implements and weapons) and examining the integrity of farm dam walls. Geological field trips to world class outcrops, such as the Pilanesberg alkaline complex are also included. These field trips showcase some of South Africa's world class geological heritage. A detailed schedule of activities is included with this report.

The field school is coordinated by Prof. Susan Webb from the University of the Witwatersrand, with administrative support provided by Ms Lesego Mookapele, supported by Mrs. Jamila Das (procurement), and Mr. Nicholas Chokoe (financial). In 2018 we hosted 35 participants in the field comprising 22 student participants, and 13 field instructors. There are four cohorts: Wits geophysics honours students (9), UNESCO sponsored young women participants (9), US sponsored participants (5) and instructors (13). The low ratio of students/instructors reflects our philosophy of providing graduate students instructors with teaching opportunities and student participants with accessible peers to facilitate learning.

(b) AfricaArray 2019

The 2019 AfricaArray International Geophysics Field School was held from 24 June to 13 July 2019. The field school is run by AfricaArray at the School of Geosciences at the University of the Witwatersrand (Wits) and forms part of the core curriculum of the Wits Honours geophysics program. By expanding the program to include additional participants we are able to justify a longer, more in-depth field program that includes tackling real problems and developing the entire project workflow. The need for geophysics field training is readily apparent as exploration for hydrocarbons, geothermal energy, minerals and water is rapidly expanding in Africa. This geophysics field school is one of the few available world-wide to include external participants and fills a critical training role in Africa. It is part of the AfricaArray program, a training and research program established throughout Africa (www.africaarray.org). Funding provided by the Foundation of the Society of Exploration Geophysicists (SEG) through a grant from TGS, the United Nations Educational, Scientific and Cultural Organization (UNESCO), and previously through the Research Experience for Undergraduates of the US National Science Foundation (NSF) helps ensure that the program continues. In addition, there is substantial in kind support provided from many exploration companies that provide equipment and expertise.

The purpose of the AfricaArray International Geophysics Field School is to provide hands on training with modern geophysical equipment to solve real problems using a well-planned workflow. We follow a workflow of a geophysical project including: survey planning with costing and risk assessment; collection of geophysical data in the field (gravity, DGPS, magnetic, resistivity, reflection and refraction seismic, EM31 and MT) with attention to safe procedures and quality control; and data interpretation, integration, resulting in a final formal PowerPoint presentation. An important component of our program is safety training, which is often limited in a University environment and in Africa in general. The combination of these activities is designed to give participants fundamental tools enabling them to design, conduct and interpret geophysical field projects. As part of an innovative two tier training scheme, graduate students serve as instructors, providing them with experience with equipment preparation, management, QC and logistics.

In 2019 we hosted 28 participants in the field comprising 18 student participants, and 10 field instructors (including one from Kenya). In 2019 there were three cohorts: Wits geophysics honours students (9), UNESCO sponsored nine young women participants, and instructors (10). The favorable ratio of students/instructors reflects our philosophy of providing graduate students instructors with teaching opportunities and student participants with accessible peers to facilitate learning.

(c) Advanced Training Course on "Geological Mapping and Mineral Exploration" held in Daejeon, Republic of Korea

A training course on Geological Mapping and Mineral Exploration was held in Korea from 8-19 July under the auspices of UNESCO and UNECA-AMDC (United Nations Economic Commission for Africa - African Minerals Development Centre) to enhance the competence of Young African Geologist on Geological Mapping and Mineral Exploration

An advanced training course on Geological Mapping and Mineral Exploration was organized in Daejeon, Korea by the International School for Geoscience Resources of the Korean Institute of Geoscience and Mineral Resources (KIGAM/IS-Geo) in collaboration with UNESCO and UNECA-AMDC. The training was held from 8-19th July 2019 involving 20 scientists (10 men and 10 women) from sub-Saharan African countries.

The main of objective of the training was to raise professionals from Sub-Saharan Africa in the fields of geological mapping and mineral exploration as well as to enhance the competence of the cooperating countries/organizations with Korea/KIGAM and to meet the high interest regarding "Geological Mapping" and "Mineral Exploration". The 12-day training course provided participants an interdisciplinary approach to explore the academic knowledge and practical skills on the expertise of the subject matter. The contents of this course comprised a general overview on principles and genetic concepts of geological mapping technique and geophysical methods into mineral exploration. A total of 11 Korean/Foreign instructors were involved in the course.

Participants gave presentation on their own countries' current geological mapping and/or mineral exploration status. Each of the participants delivered in-depth SWOT and Gap analyses. They also suggested solutions and estimated expected outcomes in terms of economy, technology and society and environment. They actively shared their own opinions to one another. They worked on future roadmap for implementing the Africa Mining Vision in the future. During the first three days of the first week, participants received training on how to utilize mapping techniques. Trainees were able to develop map-reading abilities based on the satellite images provided by Google Earth. Also, a two-day field excursion was provided on the Thursday and Friday of the first week of the training course (July 11th to 12th). Participants headed for Seosan, which is known for rocks, providing an opportunity for the trainees to conduct research on geologic structures of the periodic rocks. Trainees drew a deformation shape and geological boundary on the outcrop. Through this field practice, they learned how to compose geological map with clinometer and apply what they learned in the class on the field. Trainees were also able to learn how to utilize and apply geometrical techniques under the guidance of the international expert.

Testimonies from the participants showed the training raised the level of skills of Young African Scientists working in the field of geological mapping. Therefore, making the course successful and also meeting the participants' expectations. It was recommended that the international network of UNESCO, UNECA-AMCD and KIGAM be maintained and developed for further collaborative activities beyond the border. More advanced courses with increased hands-on activity, field practice, is recommended for consideration in the future.

(d) Geopark Kenya

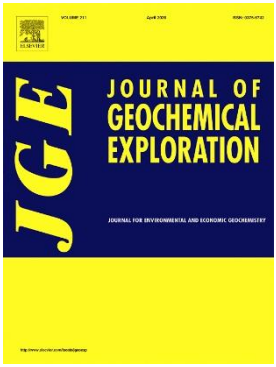
In December 2018, with support from German NATCOM, a two-day training for the National Geopark Committee members was conducted. Experts were from German Geoparks. This was followed by a six-day mapping of potential geosites. A total of 33 potential sites were visited. During the visits, using a checklist, the sites were assessed in terms of whether they meet the requirements for nomination including presence of infrastructure (e.g. presence of signage, roads, guard rails, education of information centres), local site-level governance and management arrangements, identified information sources and gaps. 13 of the 33 sites

visited were shortlisted to be part of the proposed Geopark. A meeting was held with the County Government (including the Deputy Governor and some elected leaders).

One of the main issues we noted is the need to fast track development of the requisite infrastructure including signage/panels, roads, capacity building for local tour guides and collating information (from grey literature etc.) in preparedness for the nomination. Funding is an issue and in as much as we continue engaging the County Government (still pursuing and consulting with them to secure their full commitments on needed interventions) there is the need to explore alternative funding mechanisms to enable us address some of these issues.

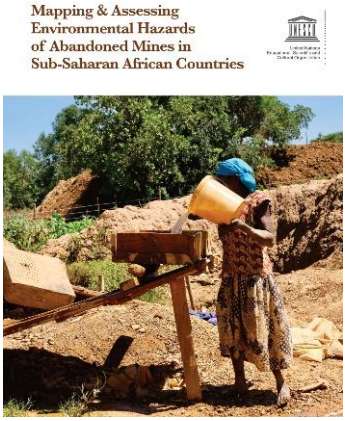
(e) Special Issue: Impacts of mining and mineral processing on the environment and human health in Africa

Over 40 years of implementation of the International Geoscience Programme (IGCP), a partnership and flagship programme between UNESCO and the International Union of Geological Sciences (IUGS), UNESCO realized that the involvement of Africa both in terms of projects devoted to the continent and leadership, was marginal. Between 2011 and 2013, UNESCO collaborated with the Swedish International Development Cooperation Agency (Sida) to support capacity-building activities aiming to increase the participation of Africa in IGCP. From this exercise, two projects (UNESCO/Sida IGCP-594 and IGCP-606) emerged as a research networking platform between scientists from Africa and Europe on the environmental and health challenges of mining activities in Africa. At the end of their implementation, the two projects jointly prepared and published a Special Issue on “Impacts of mining and mineral processing on the environment and human health in Africa” in the Journal of Geochemical Exploration in 2014 edited by Kříbek et al. (2014). However, it was obvious that the challenges facing African countries as a result of mining activities go well beyond simple IGCP projects, and need extensive mobilisation in terms of human resources, laboratory facilities and fund raising. The success of two major IGCP projects (IGCP-594 and IGCP-606) encouraged UNESCO to enter into a new Programme Cooperation Agreement with Sida for the period 2014–2018 to support an expanded project entitled “Mapping and Assessing the Environmental and Health Impacts of Abandoned Mines in Sub-Saharan African Countries”. The project aimed to reduce the adverse effects of mining activities on the ecosystem and health of adjacent communities while, at the same time, promote a peaceful mining atmosphere among industry, authorities and local communities. An important advancement in the mining sector is the legal obligation for mining companies to rehabilitate former operational mine sites and ensure that they are restored to a safe environmental state after the mine is closed. While this concept is well rooted in mining legislation in many developed countries, this is not always the case in developing countries, especially in Sub-Saharan Africa. Apart from poor environmental governance as highlighted in the Africa Mining Vision, many African countries lack a precise inventory and assessment of abandoned and derelict mines. It is therefore important to make an assessment of the true extent of the detrimental effects of metal and metalloid pollutants and their impact on human and animal health, as well as on ecosystems. This is a pre-requisite for appropriate legislation development and enforcement.



(f) Mapping and assessing environmental hazards of abandoned mines in Sub Saharan African Countries

An important advancement in the mining sector is the legal obligation for mining companies to rehabilitate former operational mine sites and ensure that the sites are restored to a safe environmental state after closure. While this concept is well rooted in mining legislation in many developed countries, this is not always the case in developing countries, especially in Africa.



Apart from poor environmental governance, many African countries lack a precise assessment of the impacts of old mining activities in their territories. Therefore, the assessment of the true extent of the detrimental effects of metal pollutants from old mining sites and their impact on the ecosystem as well as on human and animal health is crucial. It's a prerequisite for appropriate legislation development and enforcement.

In order to help decision makers, improve the management of adverse effects of mining activities, UNESCO collaborated with scientists from a variety of fields, including geoscientists, environmentalists, biologists, medical scientists, and social scientists, to develop projects that look into the various aspects of the environmental and health impacts of mining activities in sub-Saharan African countries. These projects contributed to:

- Understanding how past, present and future mining activities negatively affect ecosystems and health of the adjacent communities. This includes the mapping of present distribution of abandoned mine sites in the country and field works on targeted mine sites to assess the potential threats on environment (soil, surface and ground water, vegetation and crops) as well as animal and communities living around the mine sites);

- Identifying through experimentation, the most appropriate rehabilitation technologies and remedial actions for sites contaminated by trace metals from mining. This project intends to have a special focus on phyto-rehabilitation;

- Using science-based evidences to influence policies on issues of abandoned mines. It is important that local stakeholders (government officials, mining enterprises and local communities, and interested NGOs and associations) are involved and support the project, and facilitate the implementation of the outcomes. Policy Briefs to decision-makers and other interested stakeholders are expected to be an important outcome of the proposal dealing with this objective

3.1.3 Disaster Risk Reduction

(a) Disaster Risk Reduction: A platform for the Seismic Hazard Evaluation in the East African Rift System

The International Geoscience Programme (GCP), Working Group met in Dar-Es-Salaam, Tanzania, to discuss the possibility of integrating the Global Monitoring of Environment and Security (GMES) programme in the frame of the African Union and European Union agreement.

For the seismic hazard assessment, the seismotectonic characteristics of the Kenya and Ethiopia sections of the East African Rift System rely on the 3 – 5 mm/yr rates of active deformation and on the seismogenic structures previously identified in the Seismotectonic Map of Africa (IGCP-601 project; Meghraoui et al., 2016). Among characteristic earthquakes with surface ruptures, a study was conducted on the seismic source parameters of the 25 August 1906 earthquake (Mw 6.5) near Ginir, and the 6 January 1928 Subukia valley earthquake (Mw 7.0; Ambraseys, 1991; Ayele and Kulhanek, 2000). The previous Global Seismic Hazard Assessment Program (GSHAP) model, including part of the African region, was based upon classical probabilistic seismic hazard assessment (PSHA) principles (Giardini et al., 1999).

Recently, conventional PSHA has come under serious criticism for evident failures of sound evaluations (Stein et al., 2012; Kossobokov and Nekrasova, 2012; Wyss et al., 2012). In current case the working group tested the application of a scenario-based deterministic and PSHA approach applied to the East African Rift System (EARS; Ksentini & Romdhane, 2014). Although the earthquake recurrence period for large earthquakes (with Mw > 6.5) is poorly known for the study area, the International Geoscience Programme (GCP) Working Group observed that the occurrence of a 1928 earthquake size at ~150 km distance from the recently grown Nairobi urban region would generate 0.3 to 0.4g ground acceleration.

For this reason, the GCP Working Group met in Dar-Es-Salaam, in October 2018, to discuss the possibility of integrating the Global Monitoring of Environment and Security (GMES) programme, in the framework of the African Union and the European Union agreement. The GMES information was launched in July 2018 and the Working Group looks forward for a call in order to submit the SEISMOSHAF proposal.

The constitution of a robust database is the main component for the Deterministic Hybrid Seismic Hazard Assessment (DHA) and Probabilistic Hybrid Seismic Hazard Assessment (PSHA). Six topics were addressed, concerning the Earthquake catalogue compilation and updating, analysis and homogenization, the Morphotectonic/remote-sensing data compilation and analysis, the Compilation of active-fault database and seismic source characteristics, the compilation and updating of geodetic data for study region, the compilation of crustal structure models and the attenuation relationships and Ground Motion Prediction Equations.

The Working Group considered the work programme of PhD students (e.g., the contribution of Sophie Kipkwony) as a priority in the objectives of the IGCP-659 programmes. The proposed work will have to concentrate on seismic micro-zonation hazard studies within the capital cities of Nairobi (Kenya) and Addis Ababa (Ethiopia). The programme aims at studying the seismic source characteristics, local site effects (seismic ground response), subsurface characterization, seismic hazard and risk analysis (SHA and SRA).

These three main aspects will be investigated with the aim of generating a seismic micro-zonation map of the capital cities. During the working group meeting, almost 14 experts presented various research findings related to seismic activities in East African rift and adjacent areas.

The research topic is timely and will have an immense contribution to the safety of the East African community. There is a very good potential of human resources in the region who are capable of producing high-level science results in collaboration with the African and international experts pool. Involving postgraduate students (PhDs and MSc) and young researchers will have tremendous contributions. The meeting and discussions carried out gave the group the momentum to organize itself better as a SHA-SRA Working Group in order to conduct in depth investigations on the subject in question.

As recommendation, discussions on retreat meetings for selected experts for a period of two weeks to one month was discussed. With a prior preparation, the Working Group will be able to provide sound scientific reports on the status of the SHA - SRA and impact on the society of major cities in Africa.

(b) African Risk Methods School - Focus on Geophysical & Hydrological Urban Risks, Hazards & Vulnerabilities

The Second African Risk Methods School (ARMS II)1 jointly organised by UNESCO, and the Periperi U partners Stellenbosch University and Bahir Dar University, took place between 28 October and 1 November 2019 in Addis Ababa Ethiopia.

In total 30 participants (19 women and 11 men) along with nine teaching and administrative staff from Ethiopia and across the African continent took part in ARMS II modules. 18 of the participants were from Ethiopia, while the 10 African participants ranged from Algeria, Cameroon, Ghana, Nigeria, Madagascar, Sierra Leone, Uganda and Zimbabwe. Participants came from represented academic and research institutions, and public authorities (Ministry of Agriculture/Food Security/Irrigation, Ministry of Water, Ministry of Environment, Ministry of Energy), as well as the international development agencies such as the World Bank. The expertise of the participants varied including Disaster management, civil engineering, meteorology, risk analysts and consultants as well as a number of teaching and academic professionals from a variety or risk related fields. Participants were selected upon their online application forms and CVs which they provided when signing up to attend the ARMS. Participant applications were inspected and provided acceptance by the administrative and teaching staff of courses they had selected to attend.

Participants were obliged to take part in two of three modules offered by the ARMS organisers. The first module being a compulsory two introductory course to Disaster Risk, with participants deciding between one of two themed courses as their second module. The full list of participants and the modules they attended is available in the annexes, along with the course outline for the three modules as well as results of participants' evaluation of ARMS. Specifically, in partnership with UNESCO Ecological and Earth Sciences Division and UNESCO Regional Offices in Africa, Periperi U convened an ARMS II capacity-building course in Addis Ababa from 28 October – 1 November 2019. In recognition of rapidly accelerating urban risks within Africa, the six-day training programme focused on urban flood, as well as geophysical risks. Moreover, it gave priority to advancing capabilities of young African professionals/practitioners and emerging academics, especially women.

3.2 Lessons Learned

In relation to the activities and achievements, the key lessons learned are:

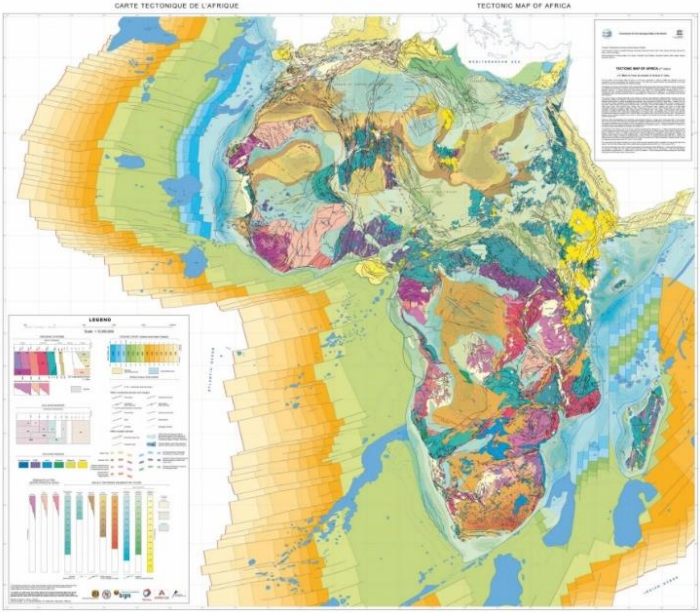
- Evaluation of Biosphere reserves is still very relevant and essential to decision-making for effective management of existing protected areas and for the expansion of the BR networks.
- There is need to invest in improving collective action capacity on the biosphere reserve evaluation within individual countries in the region

3.3. Challenges

Despite an increasing the number of protected areas in the region, biodiversity continues to decline dramatically, in part due to limited resources to maintain these areas as strictly protected and/or to enforce relevant legal frameworks. Further, although several surveys on reducing biodiversity loss have been conducted in the region, there are still large data and knowledge gaps on trends on drivers of species and habitat erosion. Finally, there is inconsistent and untimely evaluation of biosphere reserves in the region mainly due to challenges in obtaining sufficient funding as well as lack of technical expertise to conduct the evaluation.

3.4 Opportunities

There is need to align the current protected area networks within the region to account for climate change. This current situation presents an opportunity for developed countries to partner with the region to invest in developing climate-resilient societies within and beyond the biosphere reserves. Such partnerships would potentially focus on empowering institutions involved in operation of Biosphere Reserves to build up internal capacity to deliver internationally agreed mandates.



4. INTERGOVERNMENTAL HYDROLOGICAL PROGRAMME

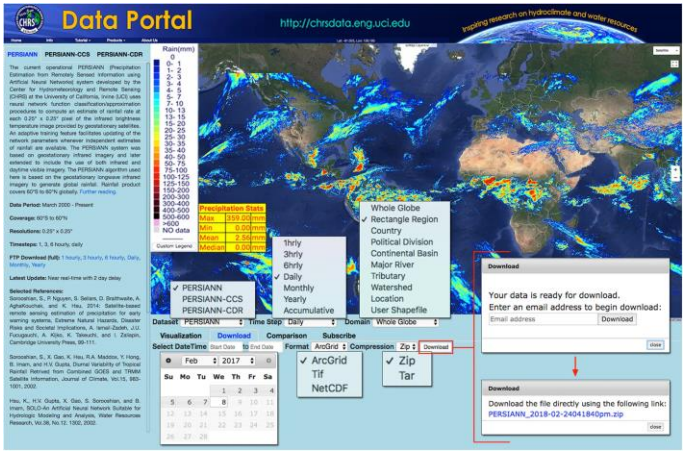
The Intergovernmental Hydrological Programme (IHP) stimulates and encourages hydrological research and assists Member States in research and training activities. Its eighth phase focuses on six thematic areas, namely, water-related disasters and hydrological changes; groundwater in a changing environment; addressing water scarcity and quality; water and human settlements of the future; ecohydrology, engineering harmony for a sustainable world; and water education, key to water security.

4.1 Activities

4.1.1 An iRain App for Eastern African Countries

Technical personnel from meteorological services together with experts from university/and research institutions trained on iRain for improved observation of rainfall data.

UNESCO Regional Office for Eastern Africa, under the International Hydrology Programme, jointly with the Department of Geography, Geo-informatics and Climate Sciences of Makerere University, organized a Regional Training Workshop on Precipitation Estimation from Remotely Sensed Information using Artificial Neural Network, in Uganda, in July 2018.



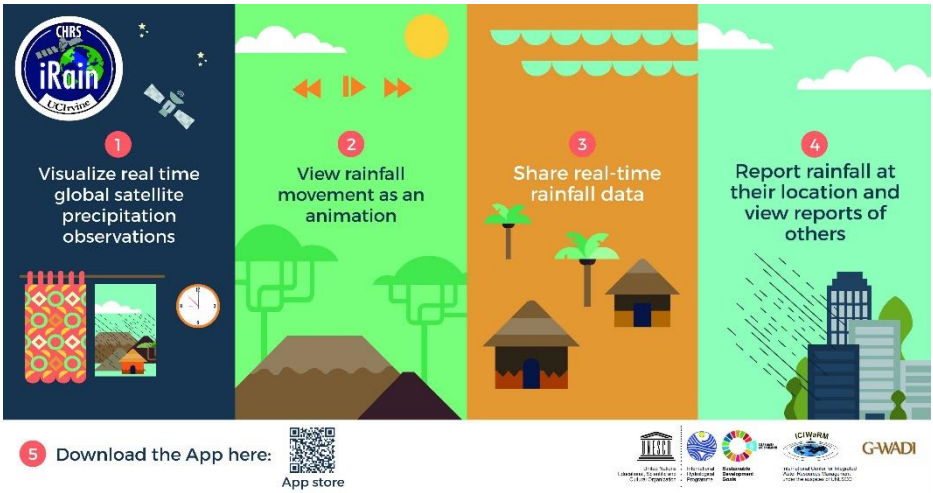
In the last decade, different satellite precipitation products have become widely available. These products, some of which are global and available in near-real time, integrate different estimates of precipitation from different sensors and satellites into a homogeneous format product, with a specific grid cell resolution and temporal aggregation. The use of these products in hydrologic applications has opened new venues to support water management globally. In poorly gauged basins and large basins with larger concentration times, satellite precipitation products may be the only input data timely enough to allow flow predictions downstream with enough lead-time to implement management and response actions based on such predictions.

The UNESCO-Intergovernmental Hydrological Programme (UNESCO-IHP) under the Global Network on Water and Development Information for Arid Lands (G-WADI network), is working closely with the Center for Hydrometeorology & Remote Sensing (CHRS) at the University of California, Irvine (UCI) in developing the PERSIANN System (Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks).

Since its early inception in 1997, PERSIANN has been a continuously evolving system, including the creation of two more PERSIANN systems, PERSIANN-CCS (Cloud Classification System) and PERSIANN-CDR (Climate Data Record). From the PERSIANN-CCS system, the iRain application was created, which allows users to visualize real-time global satellite precipitation observations and track extreme precipitation events globally.

iRain provides access to real-time global high-resolution (~4km) satellite precipitation products from the PERSIANN-CCS system. The building block of iRain rests on the satellite precipitation estimates generated by the PERSIANN algorithm which has been under development for over two decades.

The training workshop, supported by the Centre for Hydro-meteorology and Remote Sensing, University of California (Irvine) and international Center for Integrated Water Resources Management (ICIWaRM) under the Auspices of UNESCO, saw the presence of 30 participants from 11 countries representing the Intergovernmental Authority on Development (IGAD), the East African Community (EAC), the Intergovernmental Oceanographic Commission (IOC), and Regional Economic Commissions Member Countries. The experts gathered to learn to make real time rainfall measurement for their countries and to come out with proper flood warning measures.



"Climate data is not readily accessible in many countries, and, as a scientist and educator, this is a major obstacle which affects my research and training"- Associate Professor Manta Devi Nowbuth, from the Faculty of Engineering at the University of Mauritius shared. *"Through this training we got the opportunity to learn and use the CHRS Rain Sphere/IRain and Data Portal System and helped me better operate and appreciate the iRain System. The system enables rapid and easy access to rainfall data spatially at global level and up to hourly level, presenting a sound working tool for many scientists. I am thankful for the organisers of the workshop, as well as those who contributed to the development of the Data Portal"* concluded one of the participants.

The iRain mobile app is a complement to the iRain web application at http://irain.eng.uci.edu/. The mobile app allows users to not only visualize real-time global satellite precipitation observations and track extreme precipitation events globally, but also report their local rainfall information to supplement our data by using

the crowdsourcing functionality of the app. A useful feature of iRain is real-time rainfall observation data, which can easily be shared through social networks, i.e. Facebook, Twitter. In addition, rainfall events can be viewed as an animation to observe their change over time, as an accumulation of rain or as a time lapse. Precise measurement of rainfall at a given point can be observed by zooming in to the app.

Eastern Africa is a region facing multiple challenges when it comes to flood and drought management. Building capacity at regional level to reduce effects of disasters is fundamental for sustainable development. Until now, insufficient attention has been put on developing technical capacity across the region for improved knowledge in the use of remote sensing technologies for rainfall estimation. The training specifically focused on technical personnel from meteorological/hydrological services as well as scientist from training and research institutions. The technical personnel from meteorological services together with experts from university/ and research institutions joined to analyse the data from their countries. The experts were introduced to the theoretical background, followed by methodology to use the various operation in the iRain system on how to extract the rainfall information. A series of case studies using rainfall data and PERSIANN-CCS systems were also carried out, along with a short-session with students of Makerere University on using the iRain app function also taking place. Ensuring of knowledge at the technical level is communicated upwards to decision makers while horizontally across sectors is essential for mainstreaming of any hydrological extreme event. Therefore, any technical activity should go hand-in-hand with institutional capacity development at the policy level.

4.1.2 Seventh Africa Water Week

Africa Water week, themed: "Toward Achieving Water Security and Safety Managed Sanitation for Africa" was held in Gabon from 29 October to 2 November 2018 to discuss and seek solutions to Africa's water resources and sanitation challenges. The Africa Groundwater Map and Rainwater Harvesting Calculator and outreach materials for Pan Africa were also presented.

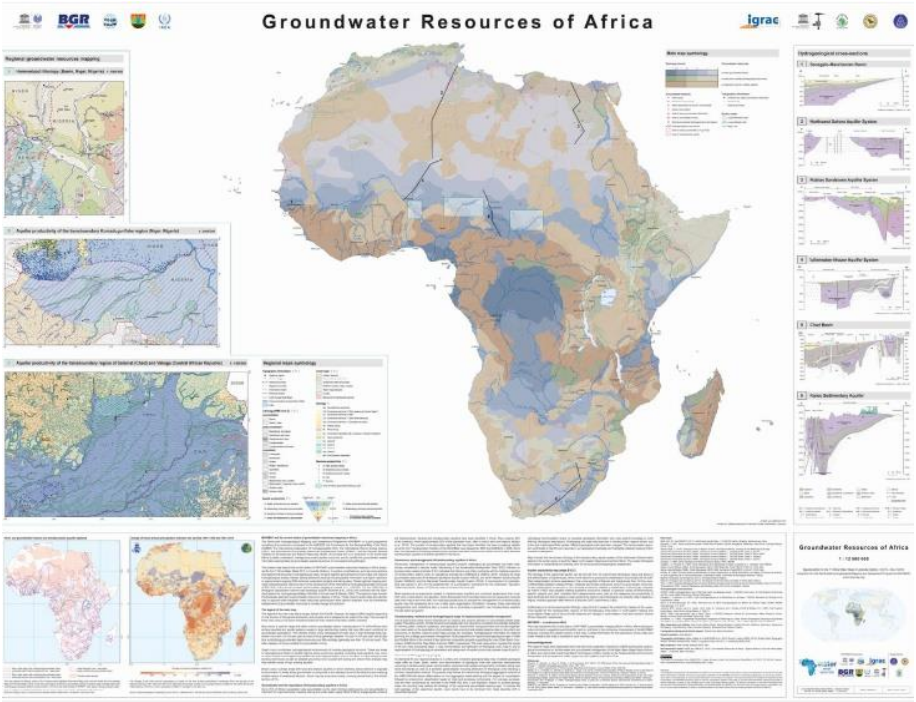
The African Ministers' Council on Water (AMCOW) was formed in 2002 in Abuja Nigeria, primarily to promote cooperation, security, social and economic development and poverty eradication among member states through the effective management of the continent's water resources and provision of water supply services.

In 2008, at the 11th ordinary session of the Africa Union (AU) Assembly in Sharm el-Sheikh, Heads of State and Government of the AU agreed on commitments to accelerate the achievement of water and sanitation goals in Africa and mandated AMCOW to develop and follow up an implementation strategy for these commitments. AMCOW has also being accorded the status of a Specialised Committee for Water and Sanitation in the African Union.

The Africa Water Week (aww) was convened by the African Ministers Council on Water (AMCOW) in conjunction with the African Union Commission and organized with other development partners. It represented a political commitment at the highest level with over 1000 participants from governments, regional institutions, international partners, the private sector, the scientific community, civil society, and the media from all over the world, and in particular Africa, meeting to discuss and collectively seek solutions to Africa's water resources, and sanitation challenges. It is now held biennially in keeping with the decision of the AMCOW to institutionalize AWW in order to build momentum on achieving the Sustainable Development Goals (SDGs) related to water security and sanitation by 2030, and the 2025 Africa Water Vision as well as crystalizing the way to actualizing Africa's Agenda 2063.

4.1.3 Groundwater Map of Africa (WHYMAP and Its Current status of groundwater resources mapping in Africa)

The World-wide Hydrogeological Mapping and Assessment Programme (WHYMAP) is a joint programme consisting of consortium composed by the UNESCO, the Commission for the Geological Map of the World (CGMW), the International Association of Hydrogeologists (IAH), the International Atomic Energy Agency (IAEA), the International Groundwater Resources Assessment Centre (IGRAC), and the German Federal Institute for Geosciences and Natural Resources (BGR). Its principle aim is to contribute to the world-wide efforts to better understand, manage and protect aquifer resources, and to transfer this groundwater related information appropriately to groundwater experts as well as to non-experts and politicians.



The present map depicts the current status of WHYMAP's groundwater resources mapping in Africa, prepared for the 7th Africa Water Week 2018 in Libreville (Gabon). It contains novel features, such as cross-sections and regional transboundary hydrogeological maps, bringing together generalised overview maps and regional hydrogeological studies, thereby adding additional value by including spatial information at a higher resolution in regions where ongoing BGR technical cooperation projects taking place.

Up to 75% of Africa's population uses groundwater as the main source, and groundwater is important for rural livelihoods, livestock rearing and urban water supply. Most of the Africa's large aquifer systems and transboundary. Seventy-two transboundary aquifers have been identified in Africa. They underlie 40% of the continent, where approximately 30% of the population lives often arid and semi-arid regions.

This map therefore represents the current status of the WHYMAP's groundwater mapping efforts in Africa.

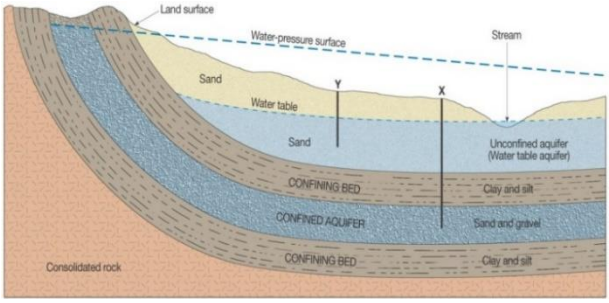
Comments, suggestions and scientific input can contribute to the continuous improvement of WHYMAP products, including the present version of this map. Contact information for the submission of any notes and drafts related to this map is available at www.whymap.org.

4.1.4 Regional Training on Integrating Groundwater Management within River Basins in Sub-Saharan Africa

A Regional Training Workshop on Integrating Groundwater Management with River Basins took place in Nairobi - Kenya, from 15 to 17 January 2019, to share country experiences and deepen research and information on groundwater resources for policy-making.

Groundwater management in Africa can be an essential component of climate change adaptation strategies. As a result of rapid population growth and the need for water in various economic sectors across the world, the role of groundwater is steadily expanding. Particularly in Africa, groundwater acts as a vital source for a vast rural population. As a matter of fact, 400 million people in Sub-Saharan Africa source their domestic water supply from groundwater. Yet, this often-abundant resource only accounts for 20 percent of total irrigation. More widespread irrigation could help reduce rural poverty, improve food security and counter droughts. The key point is understanding groundwater and characterizing the availability and distribution of groundwater resources for gauging the likely development potentials.

Thanks to recent research, UNESCO and its partners identified seventy-two transboundary groundwater zones in Africa, shared by two or more countries. They underlie 40 percent of the continent, where 33 percent of the population lives, often in arid or semi-arid regions. Inventory of such transboundary groundwater aquifers inventories have progressed since 2000 and remain work in progress. Cooperation among countries to develop transboundary aquifer resources will be needed if such resources are to be effectively developed.



For this, UNESCO Regional Office for Eastern Africa, UNESCO Category 2 Regional Centre for Groundwater Resources Education, Training and Research- Kenya, with the support from Kenya Water Institute, the Federal Institute for Geosciences and Natural Resources (BGR)- Germany, International Groundwater Resources Assessment Centre (IGRAC), The Netherlands, African Network for River Basin Organizations (ANBO), organized a Regional Training workshop on Integrating Groundwater management with River Basins, at the Kenya Water Institute, from 15 to 17 January 2019 in Nairobi, Kenya.

The delivery of the training course was based on the Manual of Integrating Groundwater in River Basin Organizations developed by Africa Groundwater Network (AGWNET) through the sponsorship of BGR. The topic of groundwater management in basin organizations is not completely new, and it has been discussed at intergovernmental events in Africa and other meetings. The participants were introduced to eights most important modules of the training manual. In addition, all the participants were given an opportunity to present their country status on groundwater, as well we had two presentations from two river basin commission

introducing their basin authorities and activities related to groundwater. The resources persons brought exercises on all the modules which was discussed during the training and participants were involved in solving the problems brought out during the exercises. This training ensured that the knowledge at the technical level is communicated upwards to decision makers and horizontally across sectors is essential for main-streaming for any hydrogeological mapping and assessment of groundwater, and so any technical activity should go hand-in-hand with institutional capacity development at the policy level.

On the side line of this training workshop, UNESCO Category 2 Centres: International Groundwater Resources Assessment Centre (IGRAC), The Netherlands, the Regional Centre for Groundwater Resources Education, Training and Research in Africa (RCGW), Kenya signed a formal Memorandum of Understating (MoU) in expanding the cooperation on Groundwater research and capacity building activities. Both institutes agreed to work jointly with UNESCO to generate further projects on groundwater resources and transboundary groundwater mapping in Africa.

4.1.5 International Training on Ecohydrology in Tanzania

UNESCO Offices in Nairobi and Dar es Salaam jointly with IHP Secretariat in Paris supported UNESCO Chair in Ecohydrology and Transboundary Water Management of Sokoine University of Agriculture in organising the International Training on Ecohydrology at Solomon Mahlangu College of Science and Education (SMCoSE) in Mazimbu, Morogoro, in Tanzania during 29th April to 3rd May 2019.

The beneficiaries of this training were BSc. and MSc holder in Environmental Sciences and Management, Marine Biology & Limnology; Environmental Engineering, Forestry and Wildlife, Education (Geography / Biology / Mathematics) and those with basic knowledge on ecology/environmental economics and/or water related sciences.

The aim of training was to equip trainees with detailed knowledge, critical understanding, strategies and the tools required to take an interdisciplinary approach towards Ecohydrology, biotechnology practices and valuation of ecosystem services.

The training helped to equip trainees with knowledge on environmental and natural resource economics applied in the valuation of ecosystem services and provide examples of Ecohydrological biotechnology solutions implemented in practical case studies in other parts of the African Continent and Europe.

Trainees were also imparted with theoretical and methodological debates in Ecohydrology and environmental conservation to better understand the complex emergence of water resources problems, ecosystem degradation and their implications for human-nature relations and how to deal with them in practice for ecological sustainability and societal needs.

A total number of twenty (20) trainees attended this training which include 10 female and male each and instructors came from Portugal, Malaysia, Ethiopia and Tanzania.

4.1.6 Eastern Africa Regional training workshop on Climate Risk Informed Decision Analysis

A training workshop on Climate Risk Informed Decision Analysis (CRIDA) was held to enable stakeholder's mainstream climate change considerations into the design and implementation of water supply infrastructure

Achieving and maintaining water security is increasingly challenging under current climatic variability and projected changes in climate especially for vulnerable ecosystems and communities in Sub-Saharan Africa. Therefore, there is a need to identify pathways to integrate the science-based understanding of increasing climate variability and climate impacts on water security into mitigation, adaptation policies and practices. In collaboration with the Alliance for Global Water Adaptation, the US Army Corps of Engineers, Deltares and the Dutch Ministry of Water and Infrastructure; UNESCO and the International Centre for Integrated Water Resources Management have recently developed a key publication on the 'Climate Risk Informed Decision Analysis (CRIDA): Collaborative Water Resources Planning for an Uncertain Future'. The CRIDA approach provides guidelines to assess water security vulnerabilities due to climate variability and change, and gives guidance on the development of adaptation pathways for robust water resources management.

Building further on these efforts, CRIDA case studies are needed to demonstrate the versatility of the approach under different contexts and to adjust the developed tools and methodologies to the local situations. If well applied, CRIDA tools can enhance the path towards resilient societies in SSA that are water secure. Therefore, a capacity building workshop was jointly organized by the UNESCO Regional Office for Eastern Africa, Makerere University (MAK) and the Ministry of Water and Environment of Uganda at the Water Resources Institute (WRI) in Entebbe, Uganda from 9 to 13 September 2019 to train key stakeholders on the different aspects of the CRIDA approach and to move towards the identification of potential case studies for demonstrative purposes. The training was organized in the framework of IHP (International Hydrological Programme) VIII, which addresses Water Security Responses to Local, Regional, and Global Challenges.

The workshop also served as a stakeholder meeting to identify the potential for developing full-scale project proposals for the semi-arid regions of Kenya and Uganda. This is particularly important as those regions have been suffering from severe water insecurity over the last decades. The evaluation of the use of CRIDA in such a context is therefore highly relevant, and builds further on initial efforts that already started in the region.

Participants expressed their appreciation for the workshop and testify of being enhanced with the skill and knowledge to apply CRIDA in making climate-informed decisions about water supply infrastructure.

4.1.7 East African Regional Workshop on Water-Energy-Food security (WEF) Nexus - Joint collaboration between UNESCO, GIZ and Strathmore University

A two-day training introduced participants to the Water-Energy-Food security (WEF) Nexus approach and provided the opportunity to apply "Nexus thinking" in interactive exercises

UNESCO in partnership with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) gmbH, Strathmore University and the Kenya Climate Innovation Centre organized a two-day training (24-25 September 2019) for participants from the East African Community and the Intergovernmental Authority for Development (IGAD) region (Burundi, Djibouti, Eritrea, Kenya, Rwanda, South Sudan and Uganda) on Water-Energy-Food security (WEF) Nexus; an approach highlighting the interdependencies between achieving water, energy and food security to achieving the global goals and Agenda 2063. The Training draw participants with relevant experience on water, energy, agriculture and food security and climate change initiatives either from an academic/research institution, public service (Ministry of Agriculture/Food Security/Irrigation, Ministry of Water, Ministry of Environment, Ministry of Energy) with a background knowledge on the nexus approach.

The training looked into details the importance of:

- Understanding the synergies and regulated negotiation of fair trade-offs between competing uses of water, land and energy related resources.
- Embracing a cross-sectoral, coherent and integrated perspective. It challenges existing structures, policies and procedures at global, regional and (sub) national levels.
- Promoting the integration of goals across sectors and reducing the risk of sector-specific SDG actions undermining each other.

Agenda 2063 and Sustainable Development Goals (SDGs): The SDGs and goals of Agenda 2063, are indivisibly connected with each other. The same holds for the specific objectives on climate change mitigation and adaptation according to the Paris Agreement (PA). These connections allow finding effective and efficient solutions to tackle the world's problems. SDG 6 (water), 7 (energy) and 2 (food security) are not only closely connected to each other but also eminently important for the Nexus approach. The three "supply securities" water, energy and food depend on ecosystems and on each other. The three resources land, water and energy (atmosphere) are part of this ecosystem and must be used and protected in a balanced manner.

Participants engaged with different perspectives, needs, priorities and values of other sectors and their interconnections in an interactive and participatory way. The training modules were designed in a way that ensured that participants had the opportunity to apply Nexus thinking to concrete examples within the context of regional case studies. As a result, participants should be able to identify nexus challenges in their respective countries and try to use the benefit from the nexus approach to find solutions. As part of the training, participants identified concrete projects in their countries aiming to increase water security, energy security or food security, the design of which could benefit from a nexus approach.

Participants expressed a realization that projects connected to natural resource planning and management of water, energy and food are often designed and implemented in a sectoral way. They also noted that resource scarcity, population growth and impacts of climate change increase pressure on existing natural resources and call for integrated solutions across sectors.

Participants reflected on the importance of negotiation, power balances, and the central role of sustainability in finding compromise between different sectors. Compromise was not just seen as negative, but actually led to a sustainable solution which benefits all interests in the long run and efficiency in the use of resources.

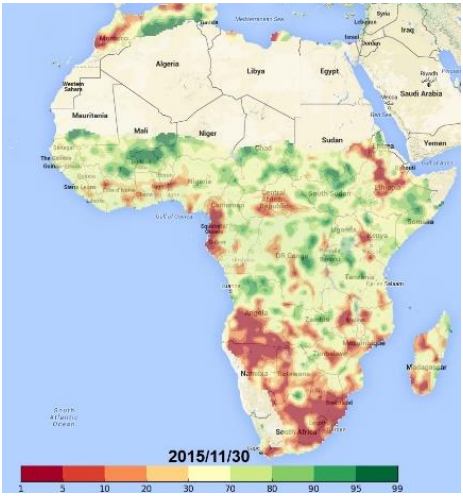
Participants used practical methodology to assess the impact of projects on different sectors in order to strengthen synergies and minimize trade-offs using the "Risks and Options Assessment for Decision-making" (ROAD), a tool to calculate the impact of the three case study projects on the four sectors (water, energy, food and environment).

Participants visited sites at Strathmore University where green ideas are already in use such as rain water harvesting, solar water heating, use of photovoltaic produced electricity, and the use of leftover food to produce biogas and green buildings.

4.1.8 East African Regional Capacity Building Workshop on Drought Monitoring and Forecasting

Under the auspices of UNESCO and the United Nations Economic Commission for Africa, selected national practitioners in Eastern Africa met in Addis Ababa, Ethiopia from 8th to 10th October 2019 to receive training on the application of state-of-the-art methods for drought monitoring and forecasting. The workshop also promoted broader learning on drought risk management and development of knowledge sharing networks.

Drought is a recurring natural hazard across East Africa and reducing its impacts requires a range of actions, including the development and use of early warning systems as part of an integrated drought mitigation plan. This workshop was therefore organized from 8th to 10th October, 2019 in Addis Ababa, Ethiopia to bring together national representative practitioners from across the region to learn and apply state-of-the-art methods for drought monitoring and forecasting.



The participants were then introduced to the East Nile Flood and Drought Monitoring (EN-FDM) and PCA research including the web portal, navigating the system and examples of applications by PCA. They received a lecture on high-resolution EN-FDM (Overview, data and methods, products, introduction to the EN-FDM interface) and had a practical session working with EN-FDM (navigating the system, selecting datasets, map animations, time series, forecasts, data access and integration with GIS/Excel).

The presentation that ensued highlighted the regional hydro-meteorological monitoring activities by the Eastern Nile Technical Regional Office (ENTRO) and ACPC. Presentations given were related to hydrological, flood and drought monitoring. For example: hydro-meteorological monitoring networks, crop monitoring, flood and drought monitoring, use of

short-term and seasonal forecasts, data sources, etc. What data are used for monitoring? What long-term climate data exist? How are they collected and how are they used?

The final presentation of the session introduced to Soil Moisture (SM) Remote Sensing (RS) through a lecture covering definitions, sensors, retrieval methods, data products and uses, limitations. This was followed by a practical session involving: working with remote sensing platforms to collate soil moisture data [Downloading and processing SM data, basic analyses].

Participants received training on the African Flood and Drought Monitor (AFDM). The AFDM is a powerful and versatile web-based tool that can monitor and predict periods of flooding and drought by providing up-to-date data for more than 20 different meteorological and hydrological variables, as well as allowing the user to visualize and download region-specific data.

In addition, they were introduced to Water Balance (WB) Application through a lecture covering: definitions, WB calculations with RS, uncertainties; and practical on estimating the water balance (Simple analyses of the water balance, estimating potential recharge, comparing dry and wet years).

This was followed by a lecture on Drought Analysis (covering concepts and methods, drought terminology, characteristics, indices, drought risk, drought monitoring) and went through a practical session on conducting drought analysis with the EN-FDM (i.e. drought identification, working with multiple data products and indices, estimating impact on agriculture).

Finally, the participants worked in groups implementing workshop learning for case study catchment (i.e. extract EN-FDM time series for catchments, drought analysis in Excel, compare with spatial data).

Participants continued to work in groups implementing workshop learning for case study catchment (i.e. extract EN-FDM time series for catchments, drought analysis in Excel, compare with spatial data). There were discussions on the utility and appropriateness of the system to water resources management and early warning in the region. Can it be used to provide useful warning on drought conditions? How does it interface with existing methods? Quick survey of expectations before the workshop started, and whether these were met afterwards.

Participants discussed what improvements were needed to be made to the system (upgrades, missing processes, data sources, forecasting). Other interesting matters arising included:

- Possible development of new products and training for future editions.
- System updates on site or at PCA?
- How do monitor users wish to communicate with Princeton?
- Approaches for incorporating validation/observations in the system?

4.1.9 Mobile applications launched to promote rainwater harvesting and water education in Africa

Two mobile applications – 'Rainwater harvesting for Africa' and 'Know water' developed under the International Hydrological Programme (IHP) of UNESCO in collaboration with various organizations were launched during the Seventh IHP Africa Steering Committee meeting in Praia, Cape Verde on 1st October

2019 to foster large-scale adoption of rainwater harvesting and improve knowledge on water use among high school students.

Africa has a combined population of over 1 billion people and represents about 16% of the global population. Its water resources are estimated to be nearly 9% of the world's freshwater resources. However, these resources are unevenly distributed, with the six most water-rich countries in Central and Western Africa holding 54% of the continent's total resources and the 27 most water-poor countries holding only 7%. Sustainable socioeconomic progress is therefore seldom possible without adequate development of water resources to support food production, industry, the environment and other human needs. In Africa, the uneven and unpredictable nature of water resources and climate change has determined the human condition and lifestyles of nomadism, migrations and displacement of people. Under the current realities of climate change and rising population in Africa, the need to adopt climate-smart solutions and sustainable water resources management practices is more crucial and urgent.

In response to this, the African Water Vision for 2025 outlines a number of innovative approaches to develop the full potential of Africa's water resources for sustainable growth in the region's economic and social development. Rainwater harvesting (RWH) and water education form a major component of this vision. In this vein, UNESCO in partnership with various stakeholders developed a smart phone application for RWH and water education to promote large-scale adoption of RWH in local climate change adaptation programmes and strategies and improve water knowledge among high school students.

The RWH App is currently available on android. UNESCO is working on an iOS version of the RWH App. There is also a dedicated website for it. This smartphone application is available in three languages: English/French/Swahili. This application contains rainwater calculator, where anyone can calculate how much water they can harvest in a given geographical location in an interactive mode by providing the necessary details. This application has more than 3500 rainfall records from all countries in Africa. Moreover, UNESCO produced advocacy videos (on 14 different topics) in animation format. The calculator works offline but the videos need internet connection.

The Know Water App is on both Android and iOS versions. It has four levels with 25 questions per level designed to enable edutainment for high school students and interest groups.

4.1.10 Groundwater National Training Rwanda

The Rwanda National Commission for UNESCO in partnership with the UNESCO Regional Office for Eastern Africa, Rwanda National Committee for the Intergovernmental Hydrological Program organized an intensive training workshop programme on integrated groundwater resources management. The training brought together thrity delegates (20 Women and 10 Men) from NGOs, academia, private and public institution and took place at University of Rwanda (UR), Huye Campus on December 11th -13th, 2019.

The objective of this training was to provide hands-on training on hydrology and groundwater in order to enhance the technical capacity of the participants from different sectors on the concepts and best practices learned from UNESCO trainings. Prof. Philip Cotton, the vice-chancellor of the University of Rwanda (UR) emphasized that people must know their relationship with the environment and therefore encouraged trainees to bring positive changes, join forces and knowledge to preserve and protect biodiversity and adequate water management.

4.1.11 Seventh International Hydrological Programme (IHP) Africa Regional Steering Committee Meeting

The Seventh IHP Africa Regional Steering Committee Meeting was held in Praia, Cabo Verde from 1 to 3 October 2019. At the opening were dignitaries including Ms. Deborah Mochothi (Chair, Africa IHP Committee); Mr. Hamet Baba Ly (President, UNESCO-IHP); Mr. Dimitri Sanga (Director, UNESCO Multisectoral Regional Office for West Africa Sahel); Ms. Ana Graca (Resident Coordinator, UN Systems in Cabo Verde;) and Mr. Gilberto Silva (Honourable Minister for Agriculture and Environment, Cabo Verde). All dignitaries present gave speeches aim at strengthening collaboration and increasing investments to tackle confronting challenges of water in Africa. The President of IHP recalled his election in June 2018 at the 23rd Intergovernmental Council (IGC) meeting of the IHP in Paris and admonished delegates to identify the key points in the 2020-2022 year of activities of IHP which marks the end of the 8th Phase, where Africa and gender are major focus. He also reminded delegates of the hosting rights offered Senegal for the 2021 World Water Forum, first of its kind in Africa, and the need to mobilize support of the people and governments of the region for this very important event.

At the meeting, the Honourable Minister of Agriculture and Environment of Cabo Verde jointly with the UN Resident Coordinator of Cabo Verde and the Director of the UNESCO Multisectoral Regional Office for West Africa (Sahel) launched the two Mobile Apps ("Rainwater Harvesting" and "Know Water') developed by the IHP in collaboration with other stakeholders to foster large-scale adoption of rainwater harvesting and improve knowledge on water use among high school students. After the opening ceremony, a new chair to steer the affairs of the African IHP Committee in the next two years was appointed from the host country as is customary with the rules and regulations of the Committee. The appointed Chair is Mr. Antonio Pina of ANAS. In his inaugural address, the new chair thanked all delegates and ANAS for appointing him and promised to discharge his duties diligently.

The technical sessions witnessed presentations by all the countries present (Botswana, Burkina Faso, Cabo Verde, Côte d'Ivoire, Ethiopia, The Gambia, Ghana, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mauritius, Namibia, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Togo and Zimbabwe) who presented various opportunities, challenges and initiatives regarding the water sector of their countries. Participants also received training on the Water Information Network System (WINS) of IHP, a tool aimed at supporting decision-making, deriving policy recommendations, and building capacity for sound, efficient, and scientific-based water resources management.

Among many outputs, a major outcome of the meeting was the adoption of the 'Praia Statement' (Box 1) which outlines the agreements and recommendations for future actions of IHP in Africa. It was agreed that the 8th IHP Africa Regional Steering Committee meeting will be held in Dakar before or during the World Water Forum in 2021.

Box 1: Praia Statement - The 7th IHP Africa Regional Steering Committee Meeting, BAI Center, Praia, Cabo Verde, 1-3 October 2019

In Praia, 60 (30 Cabo Verde and 30 International) representatives of the International Hydrological Programme (IHP) National Committees, focal points and observers from Sub-Saharan African Countries as well as various experts from the Government of Cabo Verde and representatives of UNESCO Offices (Dakar, Nairobi, IHP Secretariat, and Bamako) met, discussed on IHP activities under 2017-2019, proposals and priorities for 2020-2021 and proposed IHP IX themes. The country representatives presented country reports. The Honorable Minister for Agriculture and Environment, Mr. Gilberto Silva launched two smartphone applications (Know Water and Rainwater Harvesting for Africa) developed by UNESCO Secretariat. Discussions were held on IHP Phase IX and demonstration of the Water Information Network System (WINS) of the IHP and changes in the constitutions etc.
Resulting from an intensive and interactive process, the participants:

Extended special thanks and appreciation to the host of the meeting, the Government and people of Cabo Verde; they also extended their appreciation to the Ministry of Agriculture and Environment of Cabo Verde for its logistical support in hosting the meeting.
Underlined the urgent need for knowledge exchange and transfer of information as well as the sharing of experiences on Water Resources Management among member countries through their National Committees, relevant national partners, and water resource managers through exchange of experiences;

Supported the idea of:

- establishing National IHP Committees in countries where they do not exist;
- each National IHP Committee developing their own operating strategies outlining visions, objectives, institutional representation, partnership, resource mobilization strategies, definition of programmatic areas in relation to national and regional priorities, communication and visibility, knowledge and information sharing etc.;
- each National IHP Committee improving linkage with National Commissions for UNESCO (NATCOM) through clear Memorandum of Understanding;
- improving South-south cooperation and developing joint projects;
- develop a platform for knowledge sharing and learning; and
- each National IHP Committee improving communication and visibility of their activities through the development of communication tools/platforms. E.g. brochures/newsletters, dedicated websites if possible, social media page (Facebook, Twitter, WhatsApp); policy briefs, working papers, Info Notes, blogs etc.

Called upon the IHP Secretariat to enhance its technical support to the member states in establishing IHP National Committees and step up efforts to ensure periodic monitoring and evaluation;
Called upon the IHP National Committees and Secretariat to further strengthen its partnership with other related bilateral and multilateral organizations and institutions in the fields of water resources management and sustainable development in order to explore the possibility of regional projects and technical cooperation;
Called upon governments of member states to support their IHP National Committees and adequately fund them to meet international obligations.
Called upon the IHP Secretariat, Paris to mobilize additional funding for capacity building workshops, network meetings and other activities of IHP from all member countries, private sector and development partners;
Committed Member States to develop and enhance sub-regional transboundary cooperation among each other on surface and ground water management;
Agreed to encourage greater participation of water resource managers and gender and youth mainstreaming in IHP National Committee meetings;
Venue of 8th IHP Africa Steering Committee meeting:
It was decided that the next IHP Africa Steering Committee meeting will be held in Dakar during 2021 along with the World Water Forum.
There has been a request from the members to IHP Secretariat to update regularly a list of events related to water resources management and other main priorities of IHP and circulate to all members and experts in Africa on regular basis.
All the IHP National Committees are requested to provide the details of their activities to Regional Offices and IHP Secretariat in order to share with all other IHP National Committees.

4.2. Lessons Learned

In relation to the activities and achievements, the key lessons learned are:

- About 75% of the African population relies on groundwater as its major source of drinking water. More quantitative information regarding groundwater flow and storage is needed. Understanding the flow and storage properties of groundwater in various aquifer systems is key to their sustainable development and management. Groundwater monitoring systems should be established or expanded at country and basin scales to assess how groundwater responds to abstraction and climate variability.
- With 90 percent of water in Africa falling within 63 international river basin catchments crossed by multiple borders, water management in the region is inherently an international and cooperative endeavour. Transboundary cooperation in water management is proved to be critical
- Even though Africa is the least emitter of greenhouse gases, it is worst impacted by climate change mainly in water resources with recurrent flood and drought, changed rainfall distribution and drying-up of rivers. These effects have devastating impacts on ecosystems and communities, ranging from economic and social impacts to health and food insecurity. The improved estimation of rainfall and weather patterns along with Climate Risk Informed Decision Analysis would prove to be essential for Africa. The need to concentrate a lot of actions in IGAD countries and South Sudan particularly for the execution of a rapid integrated assessment of water resources to define entry points for designing interventions that deliver sustainable solutions for the management of water resources
- The urgent need for knowledge exchange and transfer of information as well as the sharing of experiences on Water Resources Management among IHP member countries through their National Committees, relevant national partners, and water resource managers through exchange of experiences;
- the need to ensure IHP committees improve communication and visibility of activities through the development of communication tools/platforms. E.g. brochures/newsletters, dedicated websites if possible, social media page (Facebook, Twitter; WhatsApp); policy briefs, working papers, Info Notes, blogs etc.

4.2 Challenges

Whereas the International Hydrological Programme has recorded significant achievements in the region, there are a couple of challenges that require to be resolved.

First, the importance of proper education and training in the field of groundwater hydrology is currently not well embraced in the region's academic institutions. For instance, fundamental courses on groundwater quantity, quality and modelling are not offered at undergraduate or postgraduate levels in many universities/institutes. It is therefore imperative that water managers, planners/decision makers, and local and regional governments get empowered through continuous training to effectively address their regions' groundwater needs.

Secondly, is the absence of long-term operational plans for groundwater development and management within individual countries. The existing plans, if any, are mostly short-sighted and ad hoc in nature. Moreover, scientifically sound, well-defined and action-oriented policies for the sustainable utilization of groundwater resources are lacking in the region.

Although the IHP has continued to actively integrated the theme of climate change adaptation to its specific projects / activities, much is still required to empower the member countries in reducing vulnerabilities and building resilience. Most notably, climate adaptation planning is lacking at subnational levels. This is evident since the capacity of sub-national governments to identify, prioritize, mainstream and implement adaptation

actions appears to be limited. Particularly in countries where decentralization is underway, more effort is needed to enhance the ability of sub-national governments, communities and local institutions to take on their devolved responsibilities. In other countries, greater emphasis may be placed on clarifying the roles and responsibilities of different levels of government and establishing effective institutional arrangements.

Finally, there is an absence of monitoring and evaluation (M&E) systems within most countries in the region. Presence of these systems would be vital in providing a platform to assess the effectiveness of current investments in adaptation action by development partners. In addition, comprehensive M&E plans would be handy in tracking progress in implementing adaptation policies, plans and programs and identifying gaps and areas for improvement.

4.3 Opportunities

Whereas current decision-making processes, at both regional as well as national level, are inadequate in managing the limited water resources, responding to climate change presents an opportunity to do things differently. As such, there is a clear need for the IHP to continue organizing climate change adaptation-oriented training courses for decision-makers and personnel involved in management of water resources. It is further important to supporting member states in developing research, responsive tools and policy capacity to increase climate change preparedness have positive impacts on management of hydrological resources in general.

Lastly, significant investment is needed to establish, manage and utilize monitoring and evaluation systems. This presents an opportunity for continued and intensified partnership between development assistance agencies and the individual countries through the IHP programme.

5. PUBLICATIONS

1. ASM Policy Document: https://unesdoc.unesco.org/ark:/48223/pf0000371674
2. The United Nations world water development report 2020: water and climate change. https://unesdoc.unesco.org/ark:/48223/pf0000372985.locale=en
3. Seventh International Hydrological Programme Africa Regional Steering Committee Meeting, Praia, Cabo Verde, 1-3 October 2019: final report. https://unesdoc.unesco.org/ark:/48223/pf0000371815
4. UNESCO science for sustainable development in Africa. https://unesdoc.unesco.org/ark:/48223/pf0000371813
5. A Guidebook for the Preparation of STI for SDGs Roadmaps. https://sustainabledevelopment.un.org/content/documents/25815Guidebook_STI_for_SDG_Roadmaps_Draft_for_STI_Forum.pdf
6. Climate change mitigation and adaptation: simple guide to schools in Africa. https://unesdoc.unesco.org/ark:/48223/pf0000372168?posInSet=1&queryId=ea2cf525-69c2-450f-937e-06e31ce34cde
7. Environmental, health and social legacies of mining activities in Sub-Saharan Africa, Journal of Geochemical Exploration: https://www.sciencedirect.com/journal/journal-of-geochemical-exploration/special-issue/10VC8MJDNV7

6. SMARTPHONE APPLICATION

1. Android Version:
    a. RWH Africa-Interactive Tool: https://play.google.com/store/apps/details?id=com.abc.rainfallcalculator&hl=en (English, French and Swahili)
    b. Know Water: https://play.google.com/store/apps/details?id=com.water.knowwater&hl=en (English)

2. IOS Version:

    a. RWH Africa-Interactive Tool: (English, French and Swahili) https://apps.apple.com/us/app/rwh-africa-interactive-tool/id1487418925
    b. Know Water: (English) https://apps.apple.com/us/app/know-water/id1486584127?ls=1

United Nations
Educational, Scientific and
Cultural Organization

Natural
Sciences
Sector

UNESCO Regional Office for Eastern Africa

UN Gigiri Complex, P.O. Box 30592 – 00100,

Nairobi, Kenya

Tel: +254-(0)20-7622356; Email: NAIROBI@UNESCO.ORG

https://en.unesco.org/node/315264