Federal Ministry of Education and Research

Water Security in Africa

Water Security in Africa (WASA)

Africa is a continent on the move, a continent of countless opportunities and some of the fastest growing economies in the world. To improve living conditions across the board and drive sustainable development, however, access to water is indispensable. Compared to other regions of the world, the population of sub-Saharan Africa currently has by far the lowest level of access to clean, safely managed water supply. The challenges faced by the African water sector are manifold: a rapidly growing population, climate variability and change, an increasing demand for water in industry and agriculture, and an underdeveloped water infrastructure.

The "Water Security in Africa" (WASA) program was launched to address these very issues and improve water supply. Building on the results of a German Federal Government´s round table, experts from the research community and the water supply sector, including the African Ministers' Council on Water (AMCOW) and the water ministries of Angola, Botswana, Namibia, Zambia, and South Africa, developed the program in a joint consultation process. On the German side, the program was spearheaded by the Federal Ministry of Education and Research (BMBF). The WASA initiative is part of FONA, the BMBF strategy for research for sustainability.

An essential part of the program is to contribute to the achievement of the United Nations Sustainable Development Goals (SDGs). The program also complements the national strategies of the participating countries in Southern Africa. An international Governing Board representing the participating ministries supports the implementation of the program. WASA is co-financed by the South African Water Research Commission (WRC).

May 2024 saw the launch of seven German-African cooperation projects, each with a four-year duration, addressing three main subject areas: sustainable water resources management, water infrastructure and water technology, and hydrological forecasts and management of hydrological extremes. The solutions explored include water reuse, early warning systems for extreme weather events, water-sensitive urban development, and groundwater exploration methods.

The networking and transfer project WASANet, which supports the implementation of the program, seeks to foster dialog between the various sectors and promote the transfer of research results into practice. The project is coordinated by the Karlsruhe Institute of Technology (KIT), which works closely with the German Water Partnership e.V. (GWP), the Stellenbosch University Water Institute (SUWI), and the AUDA-NEPAD Southern African Network of Water Centres of Excellence (SANWATCE).

Water Security in Africa (WASA)

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Contact at BMBF
Dr. Rainer Müssner
Federal Ministry of Education and Research (BMBF)
Division Resources, Circular Economy; Geosciences
53170 Bonn

Contact at Project Management Agency Karlsruhe
Dr. Leif Wolf; Dr. Sina Hale
Project Management Agency Karlsruhe (PTKA)
Email: leif.wolf@kit.edu; sina.hale@kit.edu

Website
watersecurityafrica.org

Networking and Transfer Project WASANet

Coordinated by
Dr. Jörg Helmschrot
Karlsruhe Institute of Technology (KIT)
Email: joerg.helmschrot@kit.edu

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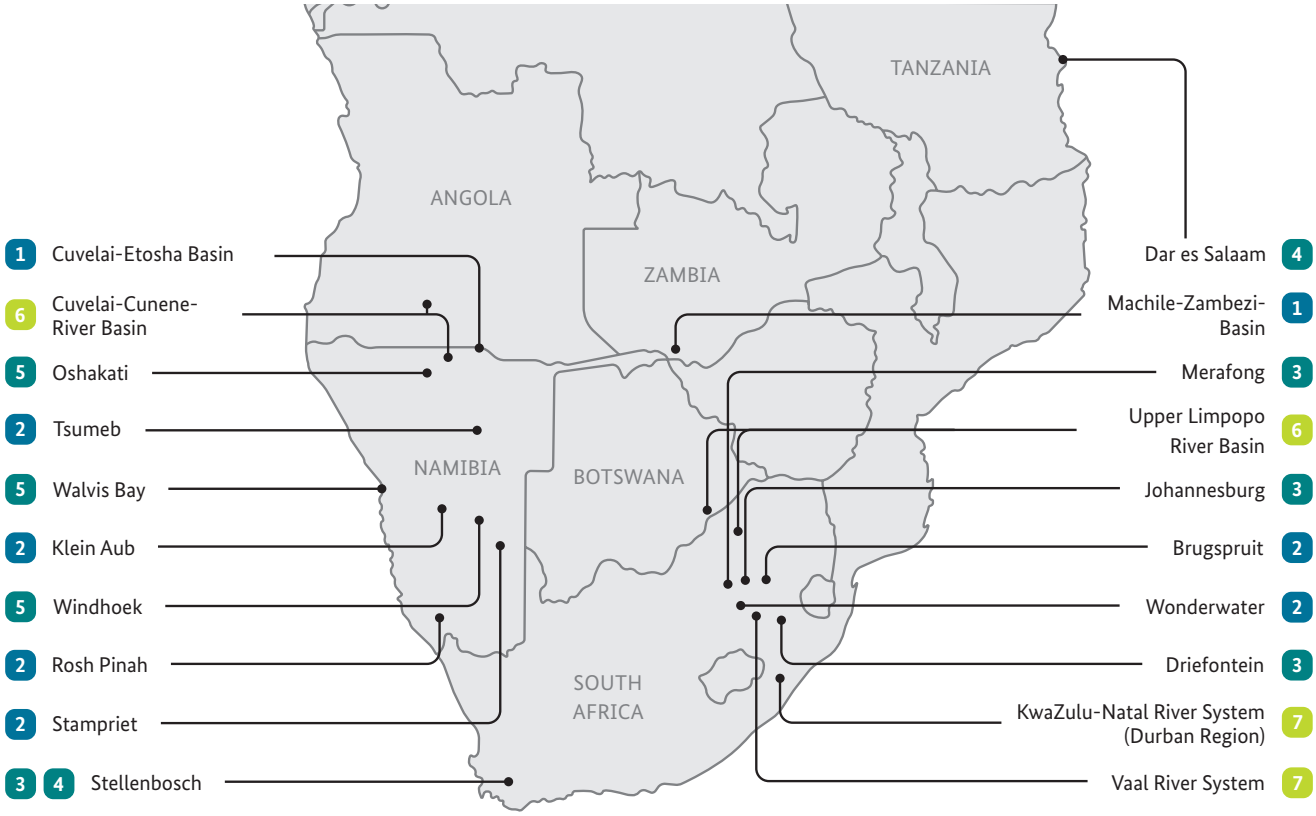
FONA
Sustainable Water Management

WASA Cooperation Projects and Study Areas



Thematic field 1:
Sustainable water resources management

SeeKaquA 1
Semi-Airborne Electromagnetic Exploration of Kalahari's Aquifers, Africa

WaMiSAR 2
Sustainable and Climate Adapted Water Management in Mining in the Southern African Region

Thematic field 2:
Water infrastructure and water technology

MAMDIWAS 3
Making Mining-Influenced Water a Driver for Change to Improve Water Security in South Africa

NEU-Water 4
Nature Engineered Urban Design for Water Recycling and Reuse

WaReNam 5
Multi-Scale Water Reuse Strategy for Namibia: Technology, Governance and Capacity Development

Thematic field 3:
Hydrological forecasts and management of hydrological extremes

Co-HYDIM-SA 6
Co-Design of a Hydrometeorological Information System for Sustainable Water Resources Management in Southern Africa

WaRisCo 7
Water Risks and Resilience in Urban-Rural Areas in Southern Africa – Co-Production of Hydro-Climate Services for an Adaptive and Sustainable Disaster Risk Management

Source: WASANet/PTKA

Federal Ministry of Education and Research

WASA Water Security in Africa

Co-HYDIM-SA – Co-Design of a Hydrometeorological Information System for Sustainable Water Resources Management in Southern Africa

Water Security in Africa (WASA)

Over the past two decades, Southern Africa has been affected by both extreme droughts and floods. Climate projections indicate that these two extreme weather events will become even more frequent and intense in the coming decades. To ensure better management of the region's water resources in the future, the participants in the Co-HYDIM-SA cooperation project are developing hydrometeorological information and early warning systems for individual river basins. Using an interdisciplinary approach, they combine scientific and practical expertise from the fields of meteorology, hydrology, and risk assessment with the specialist knowledge of local river basin authorities and dam managers.

Too few early warning systems for extreme water events

In the last two decades, Southern Africa has repeatedly experienced drought years or years in which the rains were significantly delayed. In fact, the extreme drought that affected parts of Namibia, Angola, Zimbabwe, Botswana, and Zambia in the austral summer of 2023/2024 is considered the worst in at least 20 years. In Zambia, this led to severe food and water shortages, resulting in a national state of emergency being declared in the country. At the same time, in January 2024, the aid organization CARE International reported that the droughts and floods experienced in Angola, which had received very little media attention, were among the ten forgotten global humanitarian crises of 2023.

Early warning systems are key to being better prepared for such extreme weather events. These systems, however, are seldom available to decision-makers in Africa - or those that do exist are of limited accuracy when it comes to when or where an extreme event will occur. In addition to established longer-term "seasonal forecasts," more detailed forecasts of hydrological and meteorological variables that cover periods of more than two weeks to two months are needed. The aim of the German-African cooperation project Co-HYDIM-SA is to adapt these sub-seasonal forecasts, as they are known, to the specific regional conditions of future areas of application. Building on this, the project participants plan to develop information and early warning systems for two cross-border regions in Southern Africa. The project takes a holistic approach, combining the expertise of the German partners with the needs and knowledge of local stakeholders.

Combining forecasts with local knowledge

The pilot regions for Co-HYDIM-SA are two transboundary river basins: the Cuvelai-Cunene, which is located between Angola and Namibia, and the Notwane in the Upper Limpopo basin, located in the border region between South Africa and Botswana. The researchers will begin by testing the accuracy of the new sub-seasonal forecasts for the weeks and months ahead, both for Southern Africa in general and for the specific transboundary catchment areas.

To this end, they link globally available satellite and model data for various hydrometeorological variables such as precipitation, temperature, and evaporation with climate station data from the region. These data are provided by

The Gaborone Dam in Botswana is part of one pilot region for the research conducted within the Co-HYDIM-SA project.

the river basin authorities as well as local water resource and dam managers. The project participants use the combined data to develop river basin-specific model systems, which can be used for meteorological and water management monitoring and also enable far more accurate long-term predictions to be made about the development of precipitation, water runoff and soil moisture. Along with an assessment of social and economic hazards and risks, these forecasts are incorporated into river basin-specific information and early warning systems which can then provide timely warnings of upcoming droughts and floods, significantly increasing the region's resilience in the face of extreme weather events.

Testing the system on the ground

The first pilot versions of the early warning and information systems will be trialed by the state water authority "Water Utilities Cooperation" (WUC) in Botswana and the "Cuvelai Watercourse Commission" (CUVECOM) in Namibia over the course of the project. The collaborative development process ensures that the systems have a holistic lens focusing on the needs of all stakeholders, thereby contributing to improved water resource management. The project is accompanied by the promotion of early-career researchers and cooperation with educational institutions in the region.

Diversion channel from the Cunene to the Cuvelai catchment in northern Namibia

Funding Measure
Water Security in Africa (WASA)

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Co-Design of a Hydrometeorological Information System for Sustainable Water Resources Management in Southern Africa (Co-HYDIM-SA)

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Contact in Germany
Prof. Dr. Andreas H. Fink
Institut für Meteorologie und Klimaforschung
Karlsruher Institut für Technologie (KIT)
76131 Karlsruhe
Email: andreas.fink@kit.edu

Project Partners
alitiq GmbH, Dinkelscherben
Deutscher Wetterdienst, Offenbach
Goethe Universität Frankfurt, Institut für Physische Geographie, Frankfurt a. M.
Internationales Zentrum für Wasserressourcen und Globalen Wandel (ICWRGC), Bundesanstalt für Gewässerkunde, Koblenz
Universität Bonn, Geographisches Institut, Bonn
Botswana International University of Science and Technology, Palapye, Botswana
Water Utilities Cooperation (WUC), Gaborone, Botswana
Cuvelai Watercourse Commission (CUVECOM), Oshakati, Namibia
University of Namibia, Windhoek, Namibia
Stellenbosch University, Stellenbosch, South Africa

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Federal Ministry of Education and Research

Water Security in Africa

MAMDIWAS – Making Mining-Influenced Water a Driver for Change to Improve Water Security in South Africa

Wassersicherheit in Afrika (WASA)

Mining-related water pollution, especially from the discharge of what is predominantly untreated mine water, causes major environmental problems and high costs in South Africa. Working closely with local stakeholders, the MAMDIWAS cooperation project develops sustainable solutions for water management in the mining industry which are not only environmentally sound and economical, but also benefit societies in the regions affected. Besides water treatment, the project also focuses on recovering usable raw materials from the mine water.

Turning a problem into a resource

The mining of raw materials such as gold, platinum, and coal often produces wastewater containing contaminants that pollute rivers, lakes, and groundwater with heavy metals, acids, and other toxic substances, endangering the environment and the health of people living in the mining regions. The cost of treating this wastewater, however, is in the billions. What is more, existing treatment processes are not only expensive, but are lacking efficiency, which is why they are not yet being used more widely.

The MAMDIWAS project is pursuing a new, comprehensive approach that utilizes this wastewater as a valuable resource. During the project, the participants will be developing effective and cost-efficient treatment methods to reduce water pollution and reuse purified water as drinking water, for agriculture, or for industrial purposes. They will also be investigating whether raw materials such as metals, sulfuric acid, and rare earths can be recycled from mine water for use in the construction industry and other industrial applications. The project aims to inspire innovation and encourage local communities and businesses to get actively involved.

MAMDIWAS combines three important areas: technological innovation, integrated water management, and the organizational framework. The project strives to improve the acceptance of water treatment processes, making it easier to introduce them.

Technology, water management, and governance

On the technology side, the researchers will be testing various treatment processes for mining influenced water that are combined to form a process chain. These include neutralization, a method used to increase the pH value of acidic mine water to a neutral level, the removal of heavy metals, and desalination. The main focus here lies on modifying and improving existing technologies as well as using modern membrane technologies to recover water and materials.

In order to enhance water management, the MAMDIWAS project focuses on the development of a regional concept that will help reduce the damage caused by mining influenced water and explore opportunities for reusing treated water.

Mine water is fed into a sedimentation tank where it is treated.

MAMDIWAS

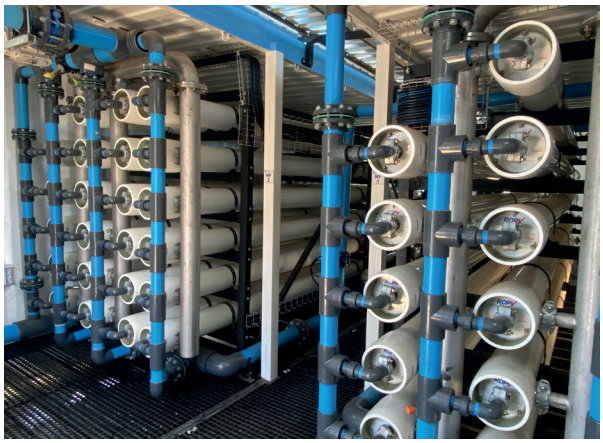
FONA
Sustainable Water Management

At an organizational level, the project examines the political, social, and legal obstacles and develops joint approaches for sustainable solutions.

Opportunities for mining sites worldwide

The MAMDIWAS project takes a whole new look at mining influenced water, unlocking the potential of a previously untapped resource. Innovative, cost-efficient, and sustainable technologies are used to treat the water, making it available in various quality levels for a wide range of applications such as drinking water, irrigation, and industrial processes. In addition, the economic efficiency of the purification processes is enhanced by recovering valuable raw materials from the mine water. The increased availability of clean and well-managed water resources improves water security in South Africa.

The project results can be used by mining companies, water treatment companies, municipalities, political decision-makers, and other interest groups and can also be transferred to other regions facing similar challenges. The transfer of knowledge is ensured through dedicated training, capacity building, and the involvement of local partners and stakeholders. The products and services developed, if marketed successfully, open up economic opportunities for both German and South African companies.



Nanofiltration modules are tested as part of the MAMDIWAS project to investigate the efficiency of membrane technology in mine water desalination.

Funding Measure
Water Security in Africa (WASA)

Project Title
Making Mining-Influenced Water a Driver for Change to Improve Water Security in South Africa (MAMDIWAS)

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Contact in Germany
Prof. Dr.-Ing. Stefan Panglisch
Universität Duisburg-Essen
47057 Duisburg
Email: stefan.panglisch@uni-due.de

Project Partners
IWW Holding gemeinnützige GmbH, Mülheim an der Ruhr
SIMA-tec GmbH, Schwalmtal
Wuppertal Institut für Klima, Umwelt, Energie gGmbH
Stellenbosch University, South Africa
University of South Africa, South Africa

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Federal Ministry of Education and Research

Water Security in Africa

NEU-Water – Nature Engineered Urban Design for Water Recycling and Reuse

Water Security in Africa (WASA)

Alternating droughts and floods jeopardize the supply of clean water in Southern Africa. Especially in densely populated urban areas with many low-income households, there is only limited access to water infrastructure. The aim of the NEU-Water project is to develop nature-based, cost-effective methods to reuse rainwater and greywater in these areas and ensure sustainable water use. Through cooperation between universities and local water suppliers in South Africa, Tanzania, and Germany, these approaches will then be further developed and integrated into long-term urban planning.

Water recycling partnership

In many regions of Southern Africa, the demand for water already exceeds the available supply, putting a significant strain on natural water resources. This has increasingly shifted the focus to alternative water sources such as rainwater or greywater – i.e., wastewater produced by showering or laundry that generally contains lower levels of contamination. In low-income urban areas, in particular, rainwater and greywater are currently discharged into rivers, usually untreated and often contaminated with additional waste products.

Given the high costs of large-scale rainwater and wastewater projects, the NEU-Water cooperation project is dedicated to developing cost-effective, decentralized, and nature-based approaches to purify and reuse this water. This prevents contaminated water from entering rivers, at the same time tapping into new water sources for the region. Water suppliers from Stellenbosch in South Africa and Hamburg in Germany are working together to develop solutions that can be adapted to local conditions in Southern Africa. The measures devised are aimed specifically at low-income urban areas.

In the NEU-Water project, these technologies are tested in pilot studies to find out how their effectiveness can be optimized in different environments. The aim is both to train local water management professionals to implement nature-based water recycling and to raise awareness about the benefits of these environmentally sound processes at an institutional level. This allows water-sensitive approaches to be systematically integrated into urban planning. Local communities, which are actively involved in planning and introducing the new systems, play a central role here.

Nature-based solutions in various locations

The NEU-Water project participants use three different approaches to test nature-based methods for reusing rainwater and greywater. First, at a test station on the Stiebeuel River in Franschhoek, South Africa, the greywater is purified using plant and sand filters. Microorganisms in the filters break down pollutants, improving water quality. The purified water is to be used for irrigation in agriculture, for example in regional viticulture.

The Stiebeuel River in Franschhoek in western South Africa is heavily polluted with greywater.

Second, various measures that prevent rivers from being contaminated with greywater are tested nearby residential areas. This part of the project also sees local communities involved in the planning process.

The third approach sees project participants investigate how nature-based methods can best be implemented in closed facilities such as schools and hospitals. Here, the researchers look at how existing systems are maintained

in facilities in Dar es Salaam, Tanzania, where rainwater is collected from roofs, cleaned with plant filters, and then returned to the groundwater.

In all three cases, primary goals are to establish local, institutional structures and to ensure environmentally and socioeconomically sustainable water use.

Holistic approaches to urban planning

In many cities in Southern Africa, heavy rainfall is increasingly causing rain and wastewater to mix, resulting in the need for treatment. In the NEU-Water project, nature-based processes for cleaning and reusing rainwater and wastewater are developed that specifically address problem areas in the urban water cycle and can be easily integrated into urban planning. The researchers, management teams, and water utilities will work together to develop a manual outlining the technical details of the processes, legal requirements, and financing options for local implementation. In the long term, it is planned that the solutions developed in the project should also be transferable to other low-income urban areas with minimal financial investment.

Plant filters are tested at Mburahati Secondary School in Dar es Salaam, Tanzania.

Funding Measure
Water Security in Africa (WASA)

Project Title
Nature Engineered Urban Design for Water Recycling and Reuse (NEU-Water)

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Contact in Germany
Prof. Dr.-Ing. Wolfgang Dickhaut
HafenCity Universität Hamburg 2
20457 Hamburg
Email: wolfgang.dickhaut@hcu-hamburg.de

Project Partners
Hamburger Stadtentwässerung AöR, Hamburg
Urban Waters Consulting GmbH, Lübeck
Stellenbosch Municipality, South Africa
University of Cape Town, Kapstadt, South Africa
Ardhi University, Dar Es Salam, Tanzania

Website
hcu-hamburg.de/research/forschungsgruppen/reap/neu-water

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Water Security in Africa

SeeKaquA – Semi-Airborne Electromagnetic Exploration of Kalahari's Aquifers, Africa

Water Security in Africa (WASA)

Southern Africa is one of the most arid regions in the world. Surface water from rivers and lakes is only available during the rainy season, especially in rural areas. The SeeKaquA cooperation project aims to improve the water supply in the long term by tapping into deep groundwater resources. SeeKaquA uses a drone-based electromagnetic measuring system to locate such aquifers in the Kalahari Basin, enabling an eco-friendly exploration of the subsurface. Using the results, the project participants can determine suitable locations to drill water wells, which, in turn, feeds into the development of strategies for sustainable water management in Southern Africa.

Large-scale, eco-friendly, and cost-effective

Water resources on the earth's surface are particularly sensitive to seasonal fluctuations in precipitation and are often contaminated. Especially in the rural areas of Southern Africa, aquifers are commonly the only source of water available year-round. But near-surface groundwater is particularly susceptible to contamination, which is why it is often of poor quality. In order to improve the water supply in arid regions in the long term, tapping into new groundwater resources at greater depths is crucial.

The aim of the SeeKaquA cooperation project is to explore such deep groundwater resources in two pilot regions in Southern Africa using what are known as semi-airborne electromagnetics or SAEM. This method provides information about subsurface structures over a large area without drilling. This reduces costs and is not harmful to the environment. The results can be used to develop strategies for sustainable, climate-resilient water management in Namibia and Zambia. A key component of the project is also the transfer of knowledge to local universities, companies, and government authorities in Southern Africa.

Detecting water deep underground

Geophysical electromagnetic methods have been used in groundwater exploration for decades. The new method employed in the SeeKaquA project involves the use of drones equipped with magnetic field sensors that fly over the area being explored and collect data that can be used to deduce ground electric conductivity. This in turn shows where water-bearing layers are located and whether they are freshwater or saline aquifers.

The magnetic field measurements require just a few power sources on the ground and can be taken from the air, covering a large area and enabling detailed analyses of aquifers down to a depth of several hundred meters. The results are used to determine suitable well locations, avoiding mistakes in well drilling. In addition, the researchers combine the geophysical measurements with data from existing boreholes, groundwater samples, and other chemical and geological analyses. This enables them to put together recommendations for a sustainable groundwater management strategy.

The SeeKaquA project uses a new drone-based measuring system to detect aquifers.

The new groundwater exploration method is being tested in two pilot areas: the Cuvelai-Etosha Basin in Namibia and the Machile-Zambezi Basin in Zambia, both of which

are believed to have deep water-bearing layers that have not yet been accessed but that could be located with the help of the new, advanced measurement technology. The project team is working closely with partners from Namibia, Zambia, and other countries in Southern Africa.

Long-term improvement in water supply

The exploration of deep aquifer systems carried out as part of the SeeKaquA project promises to deliver significant improvements when it comes to tapping into new groundwater resources. This can contribute to a more stable water supply in the long term and reduce dependence on surface water. Cooperation with local universities, institutions, and ministries ensures continuous knowledge and technology transfer, which in turn enables partner countries to independently apply the SAEM method to explore groundwater resources. This will improve water security beyond the scope of the project. In future, the technology could also be used in other regions of Africa or worldwide.

Water samples taken from the Cuvelai-Etosha Basin for geochemical analysis.

Funding Measure
Water Security in Africa (WASA)

Project Title
Semi-airborne Electromagnetic Exploration of Kalahari's Aquifers, Africa (SeeKaquA)

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Contact in Germany
Dr. Raphael Rochlitz
LIAG-Institut für Angewandte Geophysik
30655 Hannover
Email: Raphael.Rochlitz@liag-institut.de

Project Partners
Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Hannover
terratec geophysical services GmbH & Co. KG, Heitersheim
University of Namibia (UNAM), Windhoek, Namibia
University of Zambia (UNZA), Lusaka, Zambia
SADC Groundwater Management Institute (SADC-GMI), Pretoria, South Africa

Website
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Federal Ministry of Education and Research

WASA Water Security in Africa

WaMiSAR – Sustainable and Climate Adapted Water Management in Mining in the Southern African Region

Water Security in Africa (WASA)

The mining industry in Southern Africa consumes vast quantities of water. This is a major problem for regions that are already impacted by water scarcity and severely affected by climate change. Mine water is therefore a valuable resource that, once treated, can be reused for various purposes. The aim of the WaMiSAR cooperation project is to develop a holistic concept for sustainable water management in mining that is adapted to the specific environmental problems and challenges of individual regions. An important facet of this project is its strong focus on the economic and social needs of local communities.

Reusing water from the mining sector

Global warming as well as economic and social developments have left the water sector facing major challenges in the mining regions of Southern Africa. Water resources are often scarce and resource management is inefficient due to the lack of relevant data. One sustainable way of tackling this problem could be to treat and reuse mine water. This would make more water available for people, animals, and nature. In addition, the often heavily contaminated mine water would no longer pollute the surface water and groundwater in the mining regions.

The WaMiSAR cooperation project seeks to develop climate-adapted water management strategies that will help mitigate the negative impact of mining on the environment and ensure that water resources are used sustainably.

The mine in Tsumeb, Namibia, one of the pilot sites in the WaMiSAR project.

The main aims of this project are to improve environmental protection in general, develop strategies for water purification and water reuse, promote biodiversity, and support local communities in the mining regions.

Holistic approach to complex problems

The technologies and methods developed during the project will be tailored to the specific climatic and geological conditions of the respective site. In order to cover a broad spectrum of environmental and climatic conditions, WaMiSAR focuses on six mining sites: Tsumeb, Klein Aub, Stampriet, and Rosh Pinah in Namibia, as well as Wonderwater and Brugspruit in South Africa.

To ensure that the water management strategies are both scientifically sound and of practical relevance, the project researchers will first be creating a solid database on the water and groundwater situation in the regions under study. This will involve carrying out reference studies, improving water resource monitoring, and developing models to better determine the amount of water available and to protect groundwater resources more effectively from the impacts of mining.

Building on this, methods for purifying mine water and contaminated groundwater will be developed. At the Tsumeb site, for example, the arsenic contaminating the groundwater will be removed by injecting oxygen. As to the filter media used to treat the mine water, the project participants seek to utilize locally sourced materials as a

more cost-effective, sustainable solution. At the mine in Brugspruit, for example, residues from a nearby concrete plant will be used. Here, the researchers are testing the effectiveness of these materials to remove metals and neutralize the acidic mine water. Such local solutions also offer opportunities for the population in the mining areas, who can then take over the maintenance, which would be a source of income for them.

The researchers are also developing strategies for reusing the purified water, for example, for irrigation purposes in agriculture or for planting suitable vegetation on reclaimed spoil heaps, depending on the given location. These plants can serve as food or are used for biomass production, absorb pollutants from the environment, provide protection from soil erosion, improve biodiversity, and fulfil other important ecological functions. Such recultivation measures could create additional income opportunities for the local population.

The researchers in the WaMiSAR project are also developing a digital tool to evaluate the use of mine water from an ecological, social, and economic perspective, enabling decisions to be made on whether mine water reuse is a viable option for a given region. Here, a variety of criteria are factored into the calculations, e.g., treatment costs, water prices, and the regulatory context.

Networking and sharing

By the end of the project, the goal is to have developed an expandable toolbox for sustainable and climate-adapted water management in mining. The project findings and technologies will benefit local communities, political decision-makers, experts from the mining industry, environmental engineers, governments, and mining companies. An important multiplier for the exchange of knowledge and experience is the Mine Water Network (MiWaNet), which brings together relevant players from the fields of administration, research, mining, environmental consulting and technology from various countries. This ensures that the project results are effectively disseminated and used in the long term—not only in Namibia and South Africa, but worldwide, including Germany.

Funding Measure
Water Security in Africa (WASA)

Project Title
Sustainable and Climate Adapted Water Management in Mining in the Southern African Region (WaMiSAR)

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Contact in Germany
Prof. Dr. Stefan Norra
Universität Potsdam
Institut für Umweltwissenschaften und Geographie
14476 Potsdam
Email: norra@uni-potsdam.de

Project Partners
Aquantec GmbH, Karlsruhe/Bonn
Delta h GmbH, Witten
DVGW-Technologiezentrum Wasser, Karlsruhe
Karlsruher Institut für Technologie (KIT), Karlsruhe
Hydroisotop GmbH, Schweitenkirchen
IREM gGmbH, Witten
Sensatec GmbH, Kiel
Technische Hochschule Lübeck, Lübeck
Desert Research Foundation of Namibia, Windhoek, Namibia
Namibia University of Science and Technology, Windhoek, Namibia
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Federal Ministry of Education and Research

WASA Water Security in Africa

WaReNam – Multi-Scale Water Reuse Strategy for Namibia: Technology, Governance and Capacity Development

Water Security in Africa (WASA)

Namibia is one of the most arid countries in Southern Africa and is struggling with severe water shortages. To help solve this problem, the WaReNam cooperation project brings together African and German partners to create the basis for a national water reuse strategy. The goal is to recycle over one third of Namibia's municipal wastewater as a means of securing additional resources for the country's water supply. To implement the strategy, the project partners will be focusing on modern technologies, improved governance structures, and local capacity building.

Cooperation and partnership are key

Water scarcity is a major problem in Namibia, exacerbated by the impacts of climate change, high population growth, and outdated infrastructure. Water reuse is a promising strategy that can help reduce dependence on surface water sources. Namibia is one of the few countries in the Global South that already has decades of experience in this area. The Goreangab Water Reclamation Plant in the capital Windhoek, for example, is the first in the world to directly recover drinking water from treated municipal wastewater.

Such systems are limited to larger cities, however. And a national strategy for the nationwide implementation of water reuse does not yet exist. For wastewater to be recycled safely and effectively throughout the country, a clear legal and political framework is required, as are technical expertise and financial resources, all of which are currently lacking. Namibia urgently needs affordable, easy-to-implement, and environmentally sound solutions that can be adapted to local conditions in order to supply hygienically safe water that still contains important nutrients.

The WaReNam cooperation project is developing a three-pronged national water reuse strategy that uses new technologies, adapts governance structures, and builds local expertise. To ensure successful implementation, the project will have broad political support from the outset. The key actor here is the Namibian Ministry of Agriculture, Water and Land Reform. In what is known as a "living lab" approach, the strategic elements are not only developed in theory, but also tested and adapted directly in the field in collaboration with local partners from the research community, politics, and practice.

Laying the foundation for Namibia's water future

The strategy aims to reuse around 37 percent of municipal wastewater. The first key component of the three-pronged strategy will see the researchers developing and testing various technologies in pilot projects that are tailored to two areas of application.

First, in order to purify complex wastewater containing different contaminants for reuse in industry, the project participants are testing the use of membrane technologies such as ultrafiltration and reverse osmosis in the port city of Walvis Bay. The aim here is to achieve consistently high water quality despite fluctuations in wastewater quality.

Sewage pond in Oshakati: A typical method used in many communities in Namibia. The ponds are often too small, meaning they frequently overflow during the rainy season.

The researchers are also developing a dedicated filter system for agricultural use that purifies the wastewater, making it hygienically safe for plant irrigation, while retaining important nutrients such as nitrogen and phosphorus. To do so, the wastewater is first passed through filters that remove organic substances and pollutants. Ultraviolet disinfection is then applied to the water to kill or inactivate bacteria and viruses.

The second central component of the water reuse strategy centers on the establishment of effective administrative structures and processes to support implementation. A National Implementation Committee (NIC) is being created for this purpose. The multilevel committee involves all relevant stakeholders – from the government and local authorities to scientists. The aim is to promote cooperation across different sectors and administrative levels.

The third component – capacity development – aims to foster local expertise and skills, both of which are key to successful long-term strategy implementation. To help familiarize employees in waterworks and wastewater treatment plants with the new technologies, for example, they will take part in relevant training courses. Similarly, management staff with official bodies and government agencies will undergo training in decision-making processes and risk management. A central body will be set up to support local authorities in the maintenance and operation of the new water treatment plants. New training programs are also being developed in collaboration with universities to ensure that the workforce has the necessary skills and training.

From Namibia to the rest of the world

By developing a solid, well-defined strategy for water reuse, the WaReNam project is helping to make Namibia's water supply more secure. In addition, the approaches developed could serve as a model for other countries facing similar challenges. In this way, the project also contributes to the United Nations Sustainable Development Goals for water and sanitation.

Funding Measure
Water Security in Africa (WASA)

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Multi-Scale Water Reuse Strategy for Namibia: Technology, Governance and Capacity Development (WaReNam)

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Contact in Germany
Dr.-Ing. Martin Zimmermann
ISOE – Institut für sozial-ökologische Forschung GmbH
60486 Frankfurt am Main
Email: martin.zimmermann@isoe.de

Project Partners
Technische Universität Darmstadt, Institut IWAR, Fachgebiet Wasser und Umweltbiotechnologie, Darmstadt
Emschergenossenschaft, Essen
FUCHS Enprotec GmbH, Mayen
MANN + HUMMEL Water & Fluid Solutions GmbH, Wiesbaden
Ministry of Agriculture, Water and Land Reform, Windhuk, Namibia
Namibian University of Science and Technology, Windhuk, Namibia
University of Namibia, Windhuk, Namibia

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Water Security in Africa

WaRisCo – Water Risks and Resilience in Urban-Rural Areas in Southern Africa – Co-Production of Hydro-Climate Services for an Adaptive and Sustainable Disaster Risk Management

Water Security in Africa (WASA)

Southern Africa is one of the regions hit particularly hard by climate change. According to forecasts, the already very dry and arid region will see even more extreme weather conditions in the future. The WaRisCo cooperation project is investigating two of the biggest climate-related risks for South Africa: the risk of a prolonged drought in the province of Gauteng and flooding in the coastal region around Durban. In order to improve drought and flood risk forecasting in endangered areas, the project participants from Germany and Africa are developing a novel and comprehensive hydrological modeling system. The aim is not only to understand the frequency and intensity of these events, but also to assess their impact on water, energy, and food supply, and to derive sustainable risk reduction strategies.

Precise forecasting is of the essence

Gauteng in the northeast of South Africa, which includes the conurbations of Johannesburg and Pretoria, is the most populous province in South Africa and the economic center of the country. The water supply in this region is largely dependent on the Vaal River system which, however, is repeatedly affected by prolonged periods of drought. Global warming is increasing the risk of a "Day Zero" drought in the region. Day Zero refers to the point at which a region's water reservoirs are depleted to such an extent that there is virtually no water supply for the population or for industry. Such an extreme case almost occurred in South Africa once before in 2015/2016 following several years of drought.

On the other hand, the province of KwaZulu-Natal, which includes the port city of Durban in the east of South Africa, is at high risk of flooding. The rivers that flow through the coastal plain are highly sensitive to extreme rainfall, which is particularly common in years when the weather is affected by La Niña. This phenomenon causes the surface of the Pacific to cool down to an unusually low temperature in the central and eastern parts, resulting in heavy rainfall. In 2022, this led to one of the worst flood disasters in South Africa's history. Climate change could lead to even worse and unprecedented flooding in KwaZulu-Natal.

In the WaRisCo project, a team of researchers from Germany and South Africa is investigating these two disaster scenarios with a view to developing strategies for risk reduction and climate change adaptation. The forecasts for the drought and flood risks will be provided by a new type of hydrological model system co-developed by the project participants.

The Vaal is one of the rivers that supply the largest irrigation system in South Africa.

Developing solutions together

The new model system uses current, ultra-high resolution regional climate projection data, at the same time

factoring in potential land use and land cover changes in a particular region, for example due to deforestation or urbanization. The system is the first of its kind to calculate how global warming and landscape changes could affect the water supply in the Vaal and KwaZulu-Natal river basins.

Using the models and the data obtained from them, government bodies and other decision-makers can plan dedicated safeguards against droughts and floods. In collaboration with national and local authorities such as the Department of Water and Sanitation, the Disaster Management Centre of the City of Johannesburg, and the South African Cities Network, for example, disaster prevention plans are being drawn up for the high-risk regions examined. The involvement of relevant stakeholders is intended to ensure that the solutions are tailored to local needs.

To make scientific data and information easily accessible for decision-makers, a user-friendly web platform is being developed that will serve as a one-stop portal for the planning and communication of climate adaptation measures. Training programs for early-career researchers, decision-makers, and government officials build local capacity to sustain the project work and ensure that the measures have a sustainable impact. The WaRisCo participants are also developing a concept to facilitate the transfer of the project results to other regions in South Africa and beyond that face similar risks.

Helping to achieve global water security

WaRisCo, which is co-financed by the South African Water Research Commission, will promote intensive North-South cooperation between South Africa and Germany in the field of climate and water modeling. This will benefit numerous sectors, including industry, agriculture, and water resource management. By developing transferable models and strategies, the project is making an important contribution to water security not only in South Africa, but also at a global level.

Funding Measure
Water Security in Africa (WASA)

Project Title
Water Risks and Resilience in Urban-Rural Areas in Southern Africa – Co-Production of Hydro-Climate Services for an Adaptive and Sustainable Disaster Risk Management (WaRisCo)

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Contact in Germany
Dr. Sophie Biskop
Friedrich-Schiller-Universität Jena
07743 Jena
Email: sophie.biskop@uni-jena.de

Project Partners
Helmholtz-Zentrum Hereon GmbH, Hamburg
Martin-Luther-Universität Halle-Wittenberg, Halle
SYDRO Consult GmbH, Darmstadt
Agricultural Research Council, Pretoria, South Africa
Motlole and Associates, Pretoria, South Africa
University of the Witwatersrand, Johannesburg, South Africa

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