US and SA to Collaborate on Groundwater

United States ambassador to South Africa Dr Jendayi Frazer and Water Research Commission (WRC) chief executive officer Dr Rifka Kfir signing the Memorandum of Understanding between the United States Geological Survey and the WRC.

Groundwater research in South Africa received a boost in March when a Memorandum of Understanding (MoU) was signed between the Water Research Commission (WRC) and the United States Geological Survey (USGS).

The signing took place at the 2005 Biennial Groundwater Conference. The MoU aims to foster a suitable environment for the exchange of scientific and technical knowledge and the augmentation of scientific and technical capabilities of both organisations with respect to the earth sciences.

The USGS, which was established in 1879, is a government agency aimed at providing geologic, biologic, topographic and hydrologic information that contributes to the wise management of the United States' resources and promotes the health, safety and well-being of the public. South African counterpart the WRC aims to be the dynamic hub for water-centred knowledge, innovation and intellectual capital in the country. The organisation provides leadership for research and development through the support of knowledge creation, transfer and application. It also engages stakeholders in solving water-related problems.

"Groundwater cuts across all the key strategic areas of the WRC, from managing ecosystems to controlling pollution from industry and mining and basic water supply," commented WRC chief executive officer Dr Rifka Kfir. "For this reason, this MoU serves as a strategic step in the greater understanding and improved management of the country's underground water resources."

New Science Plan to Monitor Earth Intelligently

The CSIR Satellite Applications Centre (SAC) is working on a science plan for the development of an adaptable sensor network that can re-configure itself to answer user-defined queries about the state of the environment.

"A revolutionary new concept in earth observation will allow the animation and analysis of the behaviour of real world objects instead of just mapping their spatial distribution," explains Andrew Terhorst, Earth Observation manager at the CSIR. "This new breed of instrument, called a sensor web, will transform the way we explore, monitor and control the environment. It will have an impact on many areas, including disaster management, transportation planning, agriculture ecology, security and defence."

The sensor web is an observation system that provides a comprehensive, continuous monitoring presence of the earth, from which one can determine drivers of change. By combining information about large spatial areas, the sensor web gets an environmental awareness and can literally becoming a thinking presence within the environment.

A sensor web can be seen as one huge instrument whose surveying area can be expanded by using multiple sensors. Just as the connections between neurons in the brain give rise to intelligent behaviour, the sensor web measurements are shared, and interpreted, as they pass among its many pods.

A sensor web can, for example, be used to monitor the climate and concentrations of nutrients for agricultural purposes, to track flows of toxins in groundwater, to monitor traffic congestions or environmental conditions in an office building.

Water by Numbers

* **500 mm** – The average annual rainfall in South Africa.
* **860 mm** – The world average rainfall.
* **50 billion m³** – The average water that South African rivers receive a year.
* **34,2%** - The average level of the City of Cape Town's supply dams in February.
* **6 billion m³** – The water estimated to be available from South Africa's aquifers.
* **23** – The number of major dams (with a full supply capacity of over 2 000 million m^3) in South Africa.
* **13%** - The contribution of groundwater to bulk water supply in South Africa.
* **8** – The number of states sharing the Zambezi basin. They are Angola, Botswana, Namibia, Malawi, Zambia, Zimbabwe, Tanzania and Mozambique.
* **55%** - The percentage of Africa's population that has access to improved sanitation facilities.
* **16 000** – The number of people that die in South Africa every year from diarrhoeal diseases.
* **1/3** – The number of men and women in sub-Saharan Africa that are severely undernourished.
* **171 m** – The height of the Cahora Bassa Dam, on the Zambezi River, in Mozambique, the largest dam in Africa by height, according to the World Commission on Dams.
* **3,3 million ha** – The land under irrigation in Africa's most irrigated country, Egypt.
* **6 km** – The average distance that women in Africa and Asia walk to collect water.
* **10 ℓ** – The amount of water that the average person in the developing world uses a day.
* **10 million** – The number of viruses that one gram of faeces contains.
* **1,5 billion** – The average number of people in the world suffering from parasitic worm infections stemming from human excreta and solid waste in the environment.
* **95%** - The percentage of municipalities in South Africa applying the Free Basic Water policy, according to Department of Water Affairs & Forestry director-general Mike Muller.

More Groundwater Control Needed

Minister of Water Affairs & Forestry Buyelwa Sonjica at the 2005 Biennial Groundwater Conference.

Much work needs to be done to ensure the proper regulation, monitoring, and control of South Africa's groundwater resources.

So said Minister of Water Affairs & Forestry Buyelwa Sonjica. She was addressing delegates at the 2005 Biennial Groundwater Conference in Pretoria in March.

Until the promulgation of the National Water Act in 1998, groundwater was privately owned by the owners of the land under which the water was found. It is only after the new Act came into being that groundwater, as all water resources in South Africa, came to reside in the custody of the State.

Since then underground water resources have gained in significance, especially under government's basic water supply programmes. It is estimated that about two thirds of South Africa's rural population depends on groundwater for drinking purposes.

However, while groundwater resources have much potential they are delicate systems that are easily overexploited, noted Sonjica. She urged the industry to ensure that all research and development of the country's underground water resources should be undertaken with the sustainability of the resource in mind.

"In the immediate past we have not always been successful in overcoming our inertia to put a stop to inadvertent over pumping and stopping the deliberate over exploitation of underground water for personal gain," said Sonjica. "That is due to a complex legal problem, insufficient personnel, and a lack of will to protect our water resource,"

Sonjica pointed to the over pumping of fresh water from boreholes on Robben Island. This has resulted in the ingress of sea water into the aquifer, rending the water from the borehole unfit for use.

"One hopes that in the near future sufficient precipitation will recharge the aquifer forcing the sea water out again. In the meantime every drop of water is either delivered by tank ship from Cape Town or is supplied from an on-site desalination plant that is costly to run."

A similar incident occurred in the Northern Cape when electric pumps replaced diesel-powered pumps allowing the operators to 'switch on and forget' about the water supply.

DWAF's Groundwater Assessment Continues

The second phase of the Department of Water Affairs & Forestry's (DWAF's) Groundwater Resource Assessment programme is underway.

According to Dr Jan Girman of DWAF, the programme aims to deliver relevant information on groundwater resources in support of integrated water resource management. It comprises 11 projects, of which the first five have already started.

Phase II follows on Phase I which was completed in 2003. A national hydrogeological mapping programme, it culminated in the production of 21 map sheets of the Hydrogeological Map of South Africa.

"The project will take the national mapping programme to the next level, in other words, to quantify the groundwater resources," explains Dr Girman. Work is being carried out by a consortium comprising SRK Consulting, GEOSS, Water Systems Management and CSIR. The first five projects to be undertaken include determining the methodology for groundwater quantification; producing a groundwater planning potential map; calculating groundwater recharge and groundwater/surface water interaction; and the classification of aquifers and water use.

Water on the Web

http://igrac.nitg.tno.nl
The International Groundwater Resources Assessment Centre (IGRAC), an initiative of UNESCO and WMO, was launched in 1999. It is aimed at benefiting the entire international groundwater community with services on a free-of-charge basis. The centre is hosted at the Netherlands Institute of Applied Geoscience at Utrecht, in the Netherlands. One of the centre's main activities is the development of a global groundwater information system. The system is envisaged as an interactive and transparent portal for groundwater-related information and knowledge.

www.newscientist.com
This is the online version of the well read international *New Scientist* magazine. You have to be a subscriber to gain access to the online versions of the articles that appear in print. However, the magazine runs a free online news service featuring fascinating articles on science and technology issues. Themes are wonderfully varied, from the Mesopotamian marshlands of southern Iraq to the possibility of water on Mars.

www.scirus.com
Scirus is a science-specific search engine on the Internet. It searches more than 167 million science-specific Web pages. The website is great for use by scientists. As explained on the site: "we filter out non-scientific sites. So if you, for example, search for 'Dolly' the site will find the cloned sheep rather than Dolly Parton." A search for water + science + Africa brought back a staggering 2 386 results.

SA Welcomes Kyoto Protocol

South Africa has welcomed the coming into force of the Kyoto Protocol as government expressed growing concern about the effects of global climate change on the country.

It is reported that predictive modelling shows that over the next few decades, apart from moderate rises in global temperatures, there is likely to be a significant increase in the number of extreme weather events experienced by countries such as South Africa – including droughts, floods, increased incidents of malaria cases, and changes in rainfall patterns, resulting in reduced rainfall, especially in the western parts of the country. According to Minister of Environmental Affairs & Tourism Marthinus van Schalkwyk, these effects will impact negatively on South Africa's agricultural resources and biodiversity, especially in vulnerable regions such as the Cape Floral Kingdom, which is unique to the country.

According to data published by the World Meteorological Organisation in December last year, 2004 was the fourth-hottest year on record, surpassed only by 2002, 2003 and above all 1998. The year 2004 was reportedly 0,44°C hotter than the mean global temperature recorded between 1961 and 1980.

Government has expressed its concern over the potential effect of climate change on the country's biodiversity and agricultural resources

Water Also a Challenge for Developed World

While the world's eyes have been focused on developing countries and the challenges they face in increasing the percentage of the population with access to safe water and sanitation, the problems developed nations have to deal with have received less attention.

The developed world will have to spend millions to replace ageing infrastructure and keep up with tightening standards.

So said former Severn Trent Water director for asset management John Banyard. He was speaking in South Africa at the UK Institution of Civil Engineers' Fifth Brunel International Lecture.

Banyard pointed out that developed countries, such as the United Stated, the UK, and France, have their own challenges in terms of the United Nations Millennium Development Goals on water and sanitation. "Many of the developed nations are now struggling to balance the competing demands of sustainability with pleas from environmentalists for ever higher standards. At the same time, the infrastructure assets on which their societies depend are reaching the end of their useful lives."

The standard of treatment achieved in the developed world is extremely high, with requirements to meet demanding standards set by the European Union (EU) or the American Environmental Protection Agency. Additionally, current legislation such as the EU Water Framework Directive will ensure that enhanced standards continue to be provided over the next 15 years.

However, within developed countries the wishes of environmentalists to reverse centuries of environmental pollution are likely to carry a high price. To this has to be added the cost of simply maintaining the standard of infrastructure that society in the developed world enjoys today. Because all infrastructure has a finite life, it appears that over the next 20 to 50 years there will have to be a significant increase in spending on replacement of existing infrastructure compared to the level that is required today.

For example, a recent report by the Environmental Protection Agency in the USA put the price of renovating the country's water and wastewater infrastructure at US$1 trillion.

"It is interesting to speculate whether or not politicians or the public will accept this increased spend on water against the competing demands of transport, energy, education and the health service, or whether there will have to be a balance drawn between these demands and the aspirations for even higher environmental and medical standards. The one thing that is probably certain is that the public will not readily accept a reduction in the standard of water services that they currently receive, yet even this, without further environmental improvements, will probably cost more to deliver in the future than would be recovered by the charges levied today."

Developing countries will have to keep these challenges in mind as they work towards building up their water and sanitation infrastructure.

www.worldwater.org

The World's Water is a site dedicated to providing up-to-date water information, date and Web connections to organisations, institutions and individuals working on a range of global freshwater problems and solutions. There are four main sections: *Water Data* is devoted to tables, figures, and maps on the state of the world's water; *The Books* is about the *World's Water* series published by the Pacific Institute for Studies in Development, Environment, and Security of the US; *Water Links* provides links to other water websites; and *Water Conflict Chronology* track and categorises events related to water and conflict. The last link is an interesting one. Updated regularly it includes information on water conflicts from historic times till present under several categories. These include control of water resources where water supplies or access to water is at the root of tensions; where water is used as a military weapon; where water is used as a political tool; where water resources are the targets of terrorism; where water resources are military targets; and conflict related to development of water resources.

Africans to Look at Themselves to Develop

The Water Research Commission, in its capacity as a hub for water-centred knowledge, took part in the Knowledge Management Africa conference, held in Johannesburg in March.

The conference, which attracted about 500 delegates from all over the continent, was sponsored by the Development Bank of Southern Africa (DBSA). Themed "Knowledge to Address Africa's Development Challenges", the conference was aimed at providing a platform for knowledge dissemination and exchange among African stakeholders, including researchers, donors, academics, sector professionals, private sector and not-for-profit organisations.

Several focus areas were touched upon, including governance (accountability and public participation); service delivery (water and energy); knowledge systems (technology and indigenous knowledge systems); and agriculture (food security).

Perhaps the strongest message emanating from the conference was that Africa should stop looking at the First World for answers to its development challenges, but rather look towards its own expertise and indigenous knowledge to find solutions. The importance of good governance as the key to Africa's success was also pressed upon.

Delivery the keynote address South African deputy president Jacob Zuma said: "When Africa gained its independence from colonial powers after decades of struggle, the instruments of control by the colonising power had been entrenched. A particular culture of public service and governance, which did not put the interest of the indigenous people first, had taken root, which many countries still have to address today."

"The challenge now is how do we work together as all sectors to reverse the socio-economic challenges facing the continent, and to entrench a culture of democracy, good governance and peace," he continued. "It is the responsibility of every sector within the broader African society in the continent to work towards the regeneration of Africa and the reversal of stereotypes."

Dr Christopher Mlosy of the Manufacturing and Materials Technology Manufacturing Policy Unit of CSIR pointed out that the indigenous knowledge gathered over thousands of years by the people of Africa should not be underestimated. Not all indigenous knowledge needs to be replaced by modern science. Rather scientists needed to confirm indigenous knowledge and promote knowledge interaction.

According to Mlosy, Africa's biggest challenge is independence. "When we talk about development in Africa we always expect assistance from America and Europe. We should face the fact that these countries are not going to develop Africa. Rather we should look at coming up with solutions ourselves."

He said: "knowledge management must become a priority for governments in Africa and public policy should be geared towards encouraging knowledge production. At the same time, the utilisation of indigenous knowledge and systems in poverty alleviation and resource management in Africa is of practical importance."

The importance of sharing knowledge in the sustainable development and management of Africa's water resources was also reiterated at the conference. Despite its general abundance of water (Africa has about 5 400 billion m^3/y of water resources) the continent has the lowest water supply and sanitation coverage in the world. Very little of the continent's water resources are being exploited at present, only about 150 billion m^3/y of water is withdrawn for domestic, agricultural and industrial purposes at present.

Prof Ola Busari, water resource specialist at the DBSA.

Prof Ola Busari, water resource specialist at the DBSA, pointed out that national water resource management institutional frameworks in many African states remained weak, indicative of the poor and undemocratic governance that persisted in many of these countries.

Even more challenging was the fact that Africa had 60 international basins (basins shared between more than one country) making it difficult not to turn water into a political issue. "Negotiations around the sharing of water resources can take a long time, leading to delays in the development of these water resources," said Busari.

However, despite these challenges there have been positive movements towards improved water resources management, he noted. These included the establishment of the Water Task Force and the African Ministerial Initiative for Water, Sanitation and Hygiene under the African Ministerial Council on Water.

www.wrc.org.za

The official website of the Water Research Commission (WRC), this website is crammed with the latest news from the WRC, upcoming events (both locally and abroad), as well as a host of links to other interesting water websites. Clicking the *Publications* link allows the browser to sift through the latest reports and publications available from the organisation.

www.wsp.org

The Water and Sanitation Programme is an international partnership to help the poor gain sustained access to improved water supply and sanitation services. WSP receives support from public, private and non-governmental agencies in the water sector (15 are listed on the website, including the World Bank). The website includes information about the programme's projects in developing countries. It also features an interesting 'country at a glance' link, which information on the social and economic state of the country, structure of the economy and trade, among others.