

THE WATER WHEEL

ISSN 0258-2244

March/April 2007 Volume 6 No 2



Clean water through research





UNIVERSITY OF PRETORIA, DEPARTMENT OF CHEMICAL ENGINEERING:
WATER UTILISATION DIVISION
2007 SHORT COURSES

LECTURERS:

Prof. C.F. Schutte, Prof. E.M.N. Chirwa, Prof. J.J. Schoeman (Invited lecturers from industry)

ENQUIRIES:

Prof. C.F. Schutte Telephone: (012) 420 - 3571 E-mail: frik.schutte@up.ac.za

REGISTRATION:

Leona Barnard Telephone: (012) 420 - 3842 E-mail: leona.ce@up.ac.za

**OPERATION OF WATER AND
WASTEWATER TREATMENT PLANTS**

Course dates: 28 May - 1 June 2007

The course is aimed at scientists and technologists involved in the operation of water and wastewater treatment plants and aims to equip them to:

- understand the functioning, operation and application of water and wastewater treatment processes
- take informed decisions about treatment processes
- optimise the operation and control of water and wastewater treatment plants

Course fees:

R5 750 per person.
(For three or more participants from the same company, the fee is reduced to R5 300 per person.)

MEMBRANE PROCESSES

Course date: 18 - 20 Jul 2007

The course is aimed at scientists and technologists involved in the operation of membrane processes and aims to equip them to:

- understand the functioning, operation and application of membrane processes
- evaluate pretreatment requirements and brine disposal

Course fees:

R3 750 per person. (For 3 or more participants from the same company, the fee is reduced to R3 300 per person)

**INDUSTRIAL WASTE
MANAGEMENT**

Course date: 10 - 12 September 2007

The course is aimed at scientists and technologists involved in waste management and aims to equip them to:

- evaluate technical and legal aspects of waste handling and disposal
- take informed decisions about waste handling and disposal

Course fees:

R3 750 per person. (For three or more participants from the same company, the fee is reduced to R3 300 per person)

**WATER QUALITY MANAGEMENT
AND EFFLUENT TREATMENT**

Course dates: 29 October - 2 November 2007

The course is aimed at scientists and technologists involved in water quality management and aims to equip them to:

- evaluate technical aspects of effluent treatment and disposal
- take informed decisions about effluent control and catchment management

Course fees:

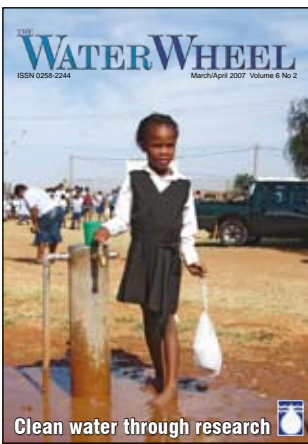
R5 750 per person.
(For three or more participants from the same company, the fee is reduced to R5 300 per person.)

For more detailed information please go to:
<http://www.up.ac.za/academic/water/>



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Cover: Membrane research has brought clean water to 800 children. See page 14.

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THE WATER WHEEL is a two-monthly magazine on water and water research published by the South African Water Research Commission (WRC), a statutory organisation established in 1971 by Act of Parliament. Subscription is free. Material in this publication does not necessarily reflect the considered opinions of the members of the WRC, and may be copied with acknowledgement of source.

Editorial offices:

Water Research Commission, Private Bag X03, Gezina, 0031, Republic of South Africa.
Tel (012) 330-9031. Fax (012) 331-2565.

WRC Internet address: <http://www.wrc.org.za>

Editor: Lani van Vuuren, E-mail: laniv@wrc.org.za; **Editorial Secretary:** Rina Human, E-mail: rinah@wrc.org.za;

Layout: Drinie van Rensburg, E-mail: drinie@wrc.org.za



Dinié van Rensburg

Worldwide waterbird count on

More than 15 000 voluntary expert observers in more than 100 countries around the world are currently participating in the International Waterbird Census.

The census, which has been running since 1967, is coordinated by Wetlands International, a non-governmental organisation. The count is the source of information about the global status of waterbirds and possible changes in populations.

Most observers are members of voluntary networks, with professional coordination at the national level. Altogether they

spend about 50 000 hours on this fieldwork. Wetlands International organises a standard method for the count, which makes it easy to compare yearly census data. Each year, between 30 million and 40 million waterbirds are counted on every continent except Antarctica.

It is reported that waterbirds are good indicators for assessing the status of wetlands globally, thus regularly tracking waterbird populations helps to identify priorities for the conservation of wetland sites at the local, national and international level.

International symposium heads to SA

Gauteng's Emperors Palace will be playing host to the next UNESCO Hydrology for the Environment, Life & Policy (HELP) symposium on 4-9 November.

Led by the International Hydrological Programme, HELP is creating a new approach to integrated catchment management through the creation of a framework for water law and policy experts, water resource managers and water scientists to work together on water-related problems. The programme has a global network of 67 basins, including two in South Africa (the Olifants and Thukhela basins).

The Help Southern Symposium 2007 is entitled *Local Solutions to Global Water Problems – Lessons from the South*. The symposium is aimed at bridging the gap between science and policy towards sustainable development at local, national and international levels.

For more information, contact Taryn van Rooyen at Tel: (011) 463-5085; Fax: (011) 463-3265; or E-mail: conference@soafrica.com

NW water crisis averted

The Central District Municipality in the North West has embarked on a project to install new water pipes in Puaneng village in an effort to ensure efficient water supply.

Director of the provincial project management unit, George Ramagaga, said the multi-million Rand project to supply clean water to more than 10 000 homes, is a permanent solution to the water shortage crisis in the area. Historically, the community has had to rely on water from boreholes and a local stream.

"The community has never had any formal water infrastructure," noted Ramagaga. "In some instances, members of the community use donkey carts to fetch water from the adjacent villages." More than 28 water pipes will be connected to a stream as a source of water supply for the entire village.

SA wants expats back for a while

The South African government plans to attract expatriate academics to share their skills in short exchange programmes and research projects as an alternative to moving back to the country, according to news agency BuaNews.

"We need to look at repatriation in a flexible and pragmatic way. Repatriation does not only have to take the form of people coming back to live for good," reported Minister of Education Naledi Pandor. According to the Minister, intellectual capacity was something that could be exchanged from anywhere.

Government, she explained, would continue to look at different ways to attract South Africans back to the country, even if it was just for short periods. To this end, government is looking at developing a mechanism to keep contact with skilled professionals from South Africa working abroad so that they could still contribute in the form of ideas and knowledge.

Engineering has been identified as a skill of prime importance for government in achieving its targeted 6% annual economic growth. For their part, higher education institutions have agreed to help increase the number of engineering graduates by an extra 1 000 a year.

In addition, government intends to recruit 1 500 engineers, 1 000 educational professionals, 3 500 information technology specialists, 5 450 health and medical specialists and 1 500 agricultural science professionals. "If we need to import skills to this country, then we must," noted Pandor.

Framework approved to fast-track delivery

Cabinet has approved a framework to fast-track and align infrastructure delivery. According to government spokesperson Themba Maseko, the framework aligns infrastructure delivery cycles with the medium-term expenditure framework budget cycle to improve planning and implementation. The infrastructure delivery cycle will be amended to include an infrastructure programme management plan, and an infrastructure programme implementation plan, which will be mandatory for all departments.



Best practice approaches will be adopted to include budget cycles that commit funds for the duration of the project without leading to so-called roll-overs. In addition, the framework will require the appointment of appropriately skilled built environment professionals across all relevant departments, provinces and local government.

New hygiene course for rural kids

Lenehan Consulting, with support from the Water Research Commission, has developed a new child-centred course for teachers to promote basic health and hygiene awareness in rural communities.

Children, especially those living in rural areas, remain most susceptible to health and hygiene challenges. Water supply and sanitation infrastructure can go a long way in improving this situation, but it is not enough. Community health and hygiene can only improve significantly through health and hygiene awareness education.

Children are good health messengers, yet their role in community health and hygiene promotion remains under-exploited. While many innovative approaches targeting school children exist, most have been designed for urban school environments.

The new health and hygiene awareness programme is based on the lesson plan format and is ready for use by rural school educators. It comprises ten lesson plans and is designed for learners aged six to eight years. Resources to support the lessons were chosen that are typically available in rural schools or relatively easy to substitute, acquire or replicate (e.g. paper, pencils, crayons, and plastic bottles).

To order the report, which includes the lesson plans, (WRC Report No 1400/1/07) contact Publications at Tel: (012) 330-0340 or e-mail: orders@wrc.org.za

Groundwater Papers Sought

The Geological Society of South Africa has called for papers for its upcoming Groundwater Conference to take place in Bloemfontein, from 8 to 10 October.

The theme of the conference is 'An Africa Where Groundwater is Valued and Sustainably Managed by Empowered Stakeholders'. Themes to be addressed include sustainable groundwater management; the impacts of mining activities on groundwater resources; the role of groundwater in integrated water resource management; aquifer characterisation; groundwater contamination, vulnerability and remediation; and groundwater governance.

Abstracts must be submitted before 30 March.

For more information, contact the Conference Secretariat at Tel/Fax: (028) 316-2905; E-mail: kruger@kurger-associates.com; or Visit: www.gwd.org.za

Buckets will be eradicated by end-2007

Finance Minister Trevor Manuel has reported that the Municipal Infrastructure Grant will receive R400-million to eradicate the bucket system across the country.

During his Budget Speech in Parliament, he said that R1,4-billion would be spent on bulk water and sanitation infrastructure, and R590-million on the delivery of water and electricity to schools and clinics.

He reiterated government's confidence that the bucket toilet system will finally be eradicated by the end of this year. Earlier, Health Minister Dr Manto Tshabalala-Msimang said the government approved sanitation acceleration strategy, Operation Gijima, had delivered some positive results. The programme is aimed at accelerating the delivery of sanitation in rural areas, while simultaneously building skills and creating jobs.

"The backlog at the inception of the programme in February 2005 was 252 254 units and the delivery against this backlog was at 110 648 units by the end of November 2006," reported Dr Tshabalala-Msimang. The remaining backlog, she added, was 141 606 units. The provinces with the highest backlogs are Free State (95 254), Eastern Cape (16 630) and North West (22 209).



THE WATER WHEEL



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Tel: +27 (0) 12 330-0340
Fax: +27 (0) 12 331-2565
E-mail: laniv@wrc.org.za / www.wrc.org.za
Physical address: Marumati Building, C/o Frederika & 18th Ave, Rietfontein, Pretoria
Postal address: Private Bag X03, Gezina, 0031

R800-m for sinkhole-affected Khutsong

The Merafong Local Municipality, in the North West, has secured R800-million to help resettle Khutsong residents after sinkholes were found in their area.

Government news agency BuaNews reports that the area was declared unsuitable for human habitation following the formation of sinkholes and unpredictable ground movement. The funds will be used to help relocate 18 000 households to land between Carltonville and Welverden.

An additional R1,4-billion is needed for the entire resettlement programme which includes the construction of formal housing, providing community facilities, and assisting the local business sector, among others. The dolomite sinkholes are not a newly discovered development in the area. In 1997, a survey commissioned by the municipality found that 90% of Khutsong fell within extremely high risk zones for dolomitic sinkholes which made it unsuitable for human settlement. Apart from damage to homes and businesses, the sinkhole formation also affected the Carltonville water reservoir last year.

Upcoming environmental water conference

The Department of Water Affairs & Forestry and the Water Research Commission are organising an international Conference on Environmental Water Allocation to be held in Port Elizabeth from 1 to 5 December.

The conference is aimed at promoting sustainable use of rivers, wetlands, estuaries and groundwater. Topics to be covered include integrating surface and groundwater; integrating water quality and quantity; eco-status assessments; government awareness, policy and decision making; operational issues; and hydro-politics, among others.

The organisers have called for papers. The abstracts should be submitted before 30 September.

For more information, contact the Secretariat at Tel: (012) 667-3681; Fax: (012) 667-3680; or e-mail: confplan@iafrica.com



Water on the Web

<http://environment.newscientist.com>

This is scientific magazine, *New Scientist's* newly-launched environmental news website. The website contains news, comments, blogs, podcasts, special reports and interactive graphics on internationally relevant environmental issues such as climate change, biodiversity, pollution and sustainability.

www.undp-saci.co.za

This is the website of the Southern African Capacity Initiative, a framework promoting responses to a number of critical human capacity areas. SACI supports countries in southern Africa to design and implement a set of additional actions and strategies which address the complex human capacity challenges in a systematic and integrated manner.

www.waterencyclopedia.com

This is a useful water website containing articles on everything from acid mine drainage, to dams and desert hydrology to water wars and water quality.

www.watgovernance.org

The United National Development Programme Water Governance Facility works with the governance of all aspects of water challenges. It promotes improved water governance reform and implementation.

www.worldwaterday.org

'Coping with Water Scarcity' is the theme for World Water Day 2007, which is celebrated each year on 22 March. The theme highlights the significance of cooperation and importance of an integrated approach to water

resource management at international, national and local levels.

http://ec.europa.eu/research/water-initiative/index_en.html

This is the website of the scientific research dimension of the European Union's Water Initiative.

www.icold-cigb.org

The International Commission on Large Dams (ICOLD) is a non-governmental International Organisation, which provides a forum for the exchange of knowledge and experience in dam engineering. The website contains a vast amount of information on dam engineering and includes the useful list of ICOLD publications on issues related to dams.

UN pits trees against global warming

In an effort to mitigate global warming, the United Nations Environment Programme (UNEP) has stepped up its campaign to plant a billion trees around the world.

Under the Plant for the Planet: Billion Trees campaign, individuals, children, youth and community groups, schools, non-governmental organisations, business and industry, farmers, local authorities, and national governments are urged to plant trees as a small but practical step to combat what UNEP says is probably the key challenge of the twenty-first century. At the time of writing, 157 million tree planting pledges had been received.

Rehabilitating tens of millions of hectares of degraded land and reforesting the Earth is necessary to restore the productivity of soil and water resources, reports UNEP in a statement. "Expanding tree cover will mitigate the build-up of atmospheric carbon dioxide, a global warming greenhouse gas."

Pledges can be entered on the website www.unep.org/billiontreecampaign. Each pledge can be anything from a single tree to ten million trees.



More to rain than meets the eye

US researchers have dispelled a 50-year-old misconception about how rain-splash transport works.

A single drop is harmless, but when billions of raindrops fall on to bare soil they strike like billions of tiny hammers, dislodging soil which is carried away by surface runoff. Rain-splash has played a significant role over time in sculpting the features of the mountains and cliffs of the world, particularly those in arid and semi-arid regions.

Researchers from Vanderbilt and Arizona State University used a high-speed camera to analyse the interaction between individual raindrops and soil particles. The high-speed camera revealed that when small drops fell on to coarse sand, they hit without a splash and disappeared with scarcely a trace.

However, when a large drop falls on to fine sand, it flattens out and pushes a ridge of grains ahead of it. At about the same time that it blasts the sand grains into the air, the drop begins to contract, pulled back by its own surface tension, leaving behind a small impact crater.

The difference in the impact of the different size raindrops did not come as a surprise. However, when the researchers started tilting the target to see what happens on sloping surfaces, they discovered something they did not expect.

For more than 50 years, scientists have known that soil particles detached by rain splashes move down slope further that they move sideways or upslope. Confirming this, the experiment found that more grains are

Water Diary

WATER QUALITY APRIL 16-18

Nepid Consultants is offering a training course on SASS 5, a rapid method for water quality assessment. The course will be held at Sabie, Mpumalanga. *Enquiries: Dr Rob Palmer, Tel: (013) 751-1533; Visit: www.nepid.co.za*

WATER LAW APRIL 20-21

The International Environmental Law Research Centre is hosting a workshop on Legal Aspects of Water Sector Reforms in Geneva, Switzerland. *Enquiries: E-mail: water@ielrc.org; Visit: www.ielrc.org/water*

WATER AWARENESS APRIL 23-27

Johannesburg Water is hosting its annual Water Festival at Mary Fitzgerald Square and Newtown Park, in Newtown. *Enquiries: Web: www.johannesburgwater.co.za*

SYSTEMS ANALYSIS MAY 7-9

The Seventh International IWA Symposium on Systems Analysis & Integrated Assessment will take place in Washington, in the US. *Enquiries: E-mail: watermatex2007@modelEAU.org or Visit: www.watermatex2007.org*

WATER MANAGEMENT MAY 13-16

The International Conference on Water Management and Technology Applications in Developing Countries will be held as in Malaysia under the auspices of the

International Water Association's Specialist Group for Developing Countries. *Enquiries: Conference Secretariat: the Malaysian Water Association; Tel: +603-6201-2250; Fax: +603-6201-5801; E-mail: arasi@malaysianwater.org.my; Visit: www.malaysianwater.org.my*

WATER ENGINEERING MAY 14-17

The International Council for Research and Innovation in Building and Construction (CIB) is hosting its World Building Congress in Cape Town. The theme is 'Construction for Development'. *Enquiries: Carla de Jager, SAICE, Tel: (011) 805-5947; Fax: (011) 805-5971; E-mail: cdejager@saice.org.za; Web: www.cib2007.com*

ejected in the down-slope direction than in other directions, and that they are ejected at higher velocities. This is particularly important because splash erosion does the most damage on sloping surfaces.

From this study the researchers produced a theoretical model for the way in which the momentum carried by raindrops is transferred to the sand grains that are blasted away from the impact site. When the model is used with new sources of information such as Doppler radar, which can provide data on average raindrop size and velocity in actual rainstorms, it could provide more reliable estimates of the amount of splash erosion taking place in different environments.

"The more we understand the basic physics of the splash erosion process, the better we can become at controlling it, especially in the farmer's field," said David Furbish, Professor of Earth and Environmental Sciences at Vanderbilt, who directed the study.

Cholera challenge for southern Africa

Several southern Africa countries are battling renewed cholera outbreaks that have been blamed on sewage contamination in Angola.

SciDev.Net reports that apart from Angola, which is said to be the epicentre of the latest outbreak, other countries affected include Namibia, Democratic Republic of Congo, Mozambique, Zambia, and Zimbabwe.

The outbreak has been put down to the overflow of sewage-contaminated water into the Ruacana River from Angola following

floods in January. The war-ravaged country's crowded slums lack adequate water supplies and sanitation, which facilitates infection. At least 44 000 people have already reportedly been infected.

More dams planned for Zambezi

Mozambique has several new dams in the pipeline to avoid repeats of the flooding of the Zambezi River that has devastated the country in recent weeks, SciDev.Net reports. The first dam to be constructed will be the Mpanda Nkhuwa Dam, located 70 km downstream from the Cahora Bassa Dam.

The initiative is expected to control the flow of floodwaters that are discharged from the Cahora Bassa Dam during the rainy season.

A loan for the construction of the dam, which will cost an estimated US\$2.3-billion, has reportedly already been secured from China's Exim Bank.

Treating malaria

A compound derived from tree bark has potential as a preventative treatment for malaria, scientists in Madagascar have found. Scientists isolated a new molecule, tazopsine, from bark collected in Madagascar's eastern rain forest. They found that N-cyclopentyl-tazopsine, a less-toxic compound derived from the molecule, was effective against early, liver-stage malaria parasites in animal tests.

new approaches for collaboration between stakeholders in the North and South. *Enquiries: Dr Nlombi Kibi, Institute of the Environment, University of Ottawa, Canada, Tel: +1-613-5625800 or +1-613-5907128; E-mail: nkibi@uottawa.ca*

MINE-WATER MAY 27-31

The International Mine Water Association's Symposium 2007 will take place in Cagliari, Italy. *Visit: www.unica.it/geochim/imwa07/index.htm*

ENVIRONMENTAL PROTECTION MAY 15-19

The World Environmental & Water Resources Congress will be held in Tampa, Florida, in the US. *Enquiries: Visit: www.asce.org/conferences/ewri2007*

NORTH-SOUTH COLLABORATION MAY 24-25

An international conference entitled 'Collaborating in Africa: New Approaches in the Water Sector' will be held in Quebec, Canada. The conference aims to promote

Water by numbers

- **11 000 £** – The volume of water it takes to produce one hamburger.
- **178 million k£** – The water consumed every year in the Tshwane municipal area.
- **800 000 m³** – The volume of seawater China is expected to desalinate per day by 2010, according to the government's latest five-year plan.
- **1 billion** – The estimated number of people who rely on fish as their main or sole source of protein.
- **33 billion** – The litres saved in Soweto to date through Operation Gcin'amanzi, Johannesburg Water's multimillion Rand project aimed at replacing leaking water pipes and ageing infrastructure.
- **15 hours** – The average amount of time women spend collecting water per week, according to a United Nations survey undertaken in 177 countries. The time wasted on collecting water from distant points has incapacitated women's efforts to engage in more relevant activities, including child care and productive work.
- **1.3 million ha** – The land under irrigation in South Africa.
- **300 £** – The volume of water the average North American consumes every day. The average Africa, in comparison, lives on less than 20 £ per day.
- **287** – The estimated number of small-holder irrigation schemes in South Africa.
- **50%** – The percentage of Iraq's fabled marshlands of Mesopotamia which have regained their 1970s extent, thanks to a multimillion US Dollar programme managed by the UN Environment Programme. Once totaling almost 9 000 km², the marshlands dwindled to just 760 km² during Saddam Hussein's reign.
- **830 million** – The estimated number of malnourished people in the world, mostly small farmers, herders, and farm labourers.
- **17%** – The increase in households in Gauteng from 2002 to 2005. In 2005, there were 2,983 million households in the province.
- **70%** – The percentage of wetlands along the Australian Great Barrier Reef coast that have been lost, threatening water quality of one of the world's greatest tourist attractions.

Botswana contract for water firm



VWS Envig Botswana has been awarded a R16-million contract from the Botswana Department of Water Affairs to supply a turnkey water treatment plant for the softening of borehole water.

The new plant, which will have a design capacity of 13 200 Mℓ/day, will be constructed at a site about 100 km northwest of Gaborone where borehole water is collected in an existing concrete storage tank before being pumped to the Thebephatshwa Defence Force Base, Molepole and Thamga villages.

VWS Envig Botswana MD Peter Healy reports that the water coming out of the borehole is hard and contains dissolved salts. "The hardness of the water causes scaling of pipes, geysers and household appliances such as washing machines. This means that more electricity is required to heat water and more detergents and cleaning products are needed

for the washing process to be effective."

Healy explains how the new plant will work: "The Multiflo is a high-efficiency clarifier that uses lamella plates and lime softening. Lime is injected into the water before the clarification process. Coagulant is then pumped into the water, and sludge is settled out. The sludge is concentrated into a thickener, pumped into a solar drying dam, and then taken to a landfill behind the plant. The clarifier water separated from the sludge is chlorinated and then directed into the supply pumps."

Design of the plant as well as the landfill, an earth-lined enclosure, is subject to an environmental impact assessment, which should be completed this month. If the results are acceptable, construction of the plant will start soon after. It will take about ten months to complete.

Clamp-on meters available

With no pipe cutting required, clamp-on meters save on installation costs and plant downtime, according to supplier Flowmetrix SA.

The company distributes Eesiflo's range of clamp-on meters, which include portable

meters and field-mounted flow transmitters. The Eesiflo range is feature rich, including multi-channel measurement, data loggers, thickness gauges, analogue and digital outputs, high-temperature transducers up to 400°C, gas flow and hazardous areas.

Elandsjagt WTW revitalised

The new infrastructure at the Elandsjagt Water Treatment Works should be commissioned this year, reports consulting engineering firm Ninham Shand.

The works treats water from the Impofu Dam, from where it is piped 100 km to supply Port Elizabeth and various towns along the way. The main process units include chemical dosing facilities, a bank of 16 floc blanket clarifiers (FBCs), 12 rapid gravity sand filters, and disinfection and stabilisation facilities.

It is reported that when it was commissioned in 1984, the treatment works was designed to treat a flow of 105 Mℓ/day, but since then it has not been possible to pass the full flow through the FBCs without compromising treatment efficiency. Following a detailed investigation of the challenges at the works, including various plant trials and laboratory tests, Ninham Shand recommended modifications to the FBCs. These have had a profound effect, the company reports, increasing achievable flow from as low as 35 Mℓ/day, to over 70 Mℓ/day.

It was also found that the achievable surface loading rate of the FBCs was about two thirds of the design rate. As a result, it was decided to construct a 35 Mℓ/day horizontal flow flocculation and sedimentation facility to operate in parallel with the FBCs. The FBCs, which are not well suited to fluctuating flows, will then be used to treat that base demand flow, while the new horizontal flow system will deal with the peak demands and enable the full design flow through the treatment works.

Several other improvements have also been undertaken during the upgrading process, including replacement of sludge pumps, refurbishment of various valves, and installation of an additional variable speed drive controlled 850 kW raw water pump, to be located in the 70 m-deep abstraction tower in the dam.

Is Climate Prediction Model Flawed?

The following was written by Dr GF Midgley and Prof LG Underhill in response to the article by Prof WRJ Alexander on his multi-year climate prediction model, which appeared in the January/February 2007 edition of the Water Wheel.

- The article by Prof Alexander makes five main points, as follows:
- 1) There is a 21-year periodicity evident in a multi-year "rainfall cycle" in South Africa.
 - 2) Based on this, it is possible to project rainfall and/or river flow changes by interpolation within this cycle (and an attempt at "verification" is presented).
 - 3) The 21-year cycle implies that "current simulation models" of water resources should be rejected (although no "current simulation models" are referenced by the author).
 - 4) Global climate model projections for South Africa are incorrect because they do not account for the 21-year cycle.
 - 5) Climate change will not cause any negative impacts in South Africa – and more specifically, that there is no evidence that Kokerboom (*Aloe dichotoma*) populations are subject to early impacts of climate change (as one example).

THE 21-YEAR PERIODICITY

Alexander cited his 2004 article (Alexander 2004), published in *Water SA*, that identified a statistically significant (at the 5% level) 21-year periodicity between rainfall, measured as Vaal Dam water inflow data, and the sunspot cycle. This paper forms the basis for much of the material that Alexander has circulated in many forms over the past few years to challenge the consensus opinion on climate change and water resources, and therefore deserves a degree of scrutiny.

We have reanalyzed key data sets presented in this paper, and find that the analysis is inappropriate and flawed for a number of reasons. Firstly, Alexander derived a correlation between two smoothed data sets to show the apparent influence of sunspots on rainfall, which is questionable statistical practice. Secondly, this analysis used the 5% level as statistically significant in literally hundreds

of tests, implying a likely positive result for every twenty statistical tests conducted, by chance alone.

Thirdly, the paper made the following statement in its "Methods" section: "Mathematical/statistical analyses were deliberately avoided as these are hypothesis-testing procedures where the problem was not in testing the hypotheses but in identifying them. Consequently graphical procedures were used. These are far more effective in this situation." Roughly translated – this means the author abandoned formal statistics where it was convenient to do so and simply eye-balled the data. Our formal re-analysis of the key data set presented, using appropriate statistical approaches, directly refutes the results reported by Alexander (2004) – we find no link between sunspots and inflow to the Vaal Dam. We aim to publish this result fully in due course.

Our analysis collapses virtually the entire edifice of Alexander's (2004) arguments,

but one important point remains – Alexander (2004) suggested that rainfall increased in South Africa during the 20th century, and concluded from this that climate change would be beneficial for the country. We wish to point out that this increasing trend in rainfall was to a substantial degree due to the fact that the rainfall time series analysed in Alexander (2004) began in 1921, at the beginning of a deep drought that lasted more than a decade. A simple recovery of rainfall to normal levels and above over the next few decades would have yielded the observed increase in rainfall – yet this evidence of natural rainfall variability (expected in a drought-prone region) appears to have eluded Alexander.

We would also point out that projections of rainfall change in summer rainfall regions "downscaled" from global climate models (Hewitson and Crane 2006) indicate that some increases in rainfall are projected for parts of the summer rainfall region of South Africa under global warming

Climate prediction 27



Locally-Developed Climate Model Verified

A South African-based climate prediction model which can be applied for multi-year regional and river-flow analyses and predictions has now been tested and verified, writes developer Will Alexander, Professor Emeritus at the Department of Civil and Biosystems Engineering at the University of Pretoria.

In particular, it is believed that the model can be used with greater assurance than current methods for multi-year simulations required for water resource development and management. In November 2005, during the first present drought, the first of four flood alerts were issued based on the model. Details of action for local authorities to limit the potential loss of life in informal settlements were included.

Three months later large regions of the African subcontinent were

water and grasses that at any time in human memory. Floods occurred in many rivers from Angola in the north through to the coastal rivers of the southern Cape. Dams filled over most of the region. The loss of life was minimal thanks to the emergency services in the areas.

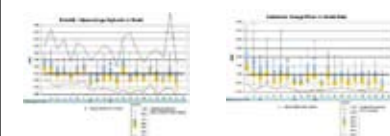
The threatened succulent (*Quiver tree*) and fynbos species are now in a healthy condition throughout the region. This is in contrast to claims that global warming would result in threats to the region's water supplies, the destruction of these valuable plants, and large areas of southern Africa becoming a desert within the next 50 years.

VERIFICATION OF THE MODEL

The prediction model is based on the statistically significant (and therefore predictable) 21-year periodicity in South African hydro-meteorological data. Two figures generated by Alyn van der Merwe illustrate the application of the model following the first complete hydrological year after its publication.

The Water Wheel January/February 2007

Climate prediction 28



The next ten years will be critical for water resource development and operation. This has nothing to do with global warming.

Figure 1 shows the annual rainfall for the Highveld region where the interest is in the availability of water for cooking at the coal-fired power stations. Figure 2 shows the annual river flow in the Orange River where the interest is in hydropower generation at the Gariep and Van der Kloof dams.

The figures show box and whisker probability plots derived directly from recorded data within the regions of interest. The outer thin lines show the observed maximum and minimum values. The upper values are off the sheet in the Gariep Dam figure. Current simulation models used for water resource analysis assume that all the boxes are in the same vertical position, i.e. there is no year-to-year variability in the probability distributions.

This regards the fundamental view of natural and inter-annual climate change scenarios that solar activity is not a cause of climatic variations. From this it was erroneously maintained that all multi-year changes are the result of the discharge of undesirable greenhouse gases into the atmosphere from industrial and other activities.

Note the increase in rainfall relative to the mean values during the four years in Figure 1. This is contrary to predictions of climate change scenarios in which it was maintained that global warming would result in a decrease in rainfall within this region.

Also note that the observed annual rainfall and river flow during the past years were nowhere near the historical maxima and minima. This is contrary to claims in the climate change literature that global warming will result in an intensification of the hydrological cycle with increases in the magnitude of floods and droughts.

Most importantly, refer to Figure 2 and note that, with the sole exception of year 13 (2007/08), the mean values of the predictions for the next ten years are all less than the long-term mean annual runoff (MAR). The predictions for the present hydrological year in both regions are below average rainfall and river flow.

The Water Wheel January/February 2007

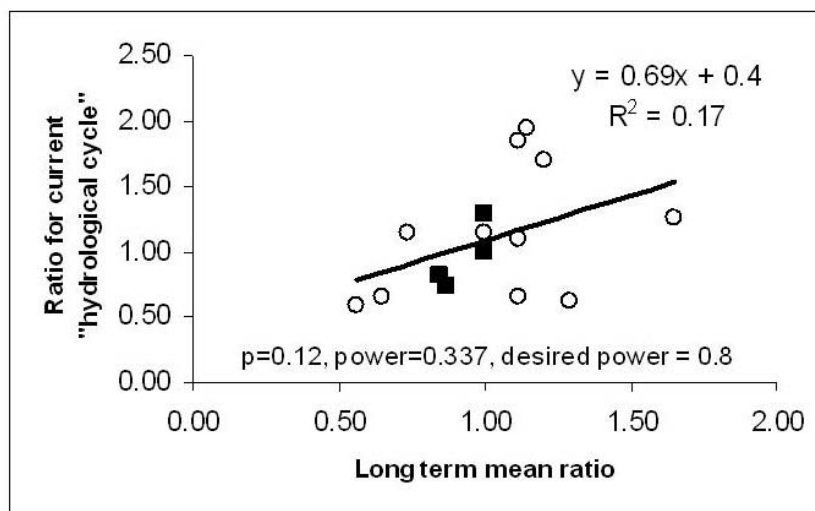


Figure 1: Regression of combined data for observed rainfall for the Highveld Region (squares) and river flow data for the Orange River (open circles) presented in Alexander (2007), expressed as a ratio relative to the long term mean, against the matching long term means for "hydrological years" of the "hydrological cycle" of 21-year periodicity identified by Alexander (2004). Ratio data were digitized from Figures 1 and 2 of Alexander (2007). The regression is far from statistical significance ($p > 0.1$), showing that the observed data cannot be used to verify the Alexander (2004) "multi-year model" – especially because the power of the test is low due to the small sample size.

scenarios, although rainfall intensity may increase in concert with dry spell duration. The use of simple mean annual rainfall measures is inadequate to formulate policy responses, and we thus question Alexander's simplistic conclusions.

Our analysis, together with several other statements in Alexander (2004), suggest that this paper should not have passed a scientific peer review process.

QUESTIONING ALEXANDER (2007) AND THE VERIFICATION OF THE "ALEXANDER MODEL"

An analysis of the two graphs presented in Alexander (2007) show that these data can in no way be taken as verification of the Alexander (2004) "multi-year model". A simple regression analysis shows a non-significant relationship ($p > 0.1$) between the yearly means plotted and the observed data (see Figure 1, although with such a small data set the power of the test is below a desirable level, additionally undermining its use for "verification". Furthermore, both the observed ratio data and the means plotted show a normal distribution around a mean

of ~ 1 – i.e. they are normally distributed variables with no discernible correlation whatsoever between them, and thus each is indistinguishable from a random sample from a normal distribution. We find it extraordinary that this set of graphs should have been invoked to "verify" the model, as nothing could be statistically further from the truth.

It was also stated that "The next climate reversal from drought to flood conditions based on the analysis of historical data is only expected to occur in 2016. This confirms the linkage with the double sunspot cycle." We ask how a projection such as stated in the first sentence above can be taken to confirm a relationship that has been proposed using the same data set?

REJECTING "CURRENT SIMULATION MODELS"

Alexander (2007) criticised "current simulation models used for water resource analyses [that] assume that all the boxes [i.e. means and variance measures in Figures 1 and 2 of Alexander (2007)] are in the same vertical position, i.e. there is no year-to-year variability in the probability distributions." From

point 2) above, this assumption by "current simulation models" appears to be correct at least for the means. In other words, the ratio of rainfall for particular years of the "hydrological cycle" relative to the long term mean are merely normally distributed about a mean of 1. The fact that "current simulation models" are not referenced by Alexander (2007) and remain incognito makes more detailed response impossible.

Criticising current global climate models Alexander (2007) stated that current lack of dune erosion in the Kalahari, verdant growth of desert vegetation (and fynbos vegetation, incidentally, for which no evidence was given), and recent rainfall events "disprove" the projections of current global climate models, such as used by the IPCC (2001). This charge is simply absurd, as climate projections and their impacts are generally made for the latter half of the 21st century, and observations of 2006 events can in no way provide a test of these.

ALOE DICHOTOMA (KOKERBOOM) POPULATIONS SHOW NO SIGN OF CLIMATE-INDUCED STRESS

Alexander (2007) apparently cited a single lengthy motor-car trip to the Orange River and southern Namibia reportedly covering two degrees of latitude (details available on request, in which he appears to have underestimated the latitudinal range he covered). His casual observations and photographs of a few populations, at most, appear to be the evidence that these populations no signs of climate impacts. This is, to put it mildly, a premature and unjustified conclusion. Kokerbooms have a latitudinal range of > 12 degrees (see Figure 2), being found in tens of populations from Nieuwoudtville in the south to the Brandberg massif, farther north than Windhoek, in Namibia. Alexander (2007) had simply not done the botanical and ecological fieldwork necessary to make this statement.

Data collected by the South African National Biodiversity Institute, now in revision for an international scientific journal following their presentation at both national and international conferences, show clearly from sampling of hundreds of individual plants across all

size classes, that northern populations are in decline, as would be expected according to early climate change impacts, while many central and most southern populations (i.e. possibly including some of those observed by Alexander) are stable or even thriving as climate warms and becomes more suitable to their physiology. Matched photographs of Kokerboom populations taken decades apart also confirm declines in key regions.

CONCLUSION

We suggest here that the Alexander (2004) “multi-year model” of rainfall in South Africa is without basis in fact, that the paper in which it was originally published appears to be scientifically flawed, and therefore that the conclusions inferred from it are not supported. Furthermore, the data and statements presented in Alexander (2007) can in no way be interpreted as a verification of this “multi-year model”, nor as criticism of climate change projections. While we are strong proponents of scientific debate and skepticism, bias and self-delusion are not a good basis for progress. The famous American physicist Richard Feynman summed this up when he stated “the easiest person to fool is yourself”. This is the reason the practice of statistical analysis has evolved to remove subjectivity as far as possible, and peer review is widely applied to ensure that basic principles of scientific enquiry are adhered to.

We are perplexed and concerned that the premiere mouthpieces of the Water Research Commission have published these and other apparently scientifically indefensible articles on this topic by the same author, apparently without the due review process (though we make the latter statement with caution, and would withdraw it without hesitation in the face of evidence of appropriate scientific review).

We note that the results presented in Alexander (2004) have been the basis for a sustained level of criticism by this author against climate change response policy in South Africa, and indeed more widely, and therefore that this and related work deserves a careful re-analysis using appropriate

Aloe dichotoma study sites

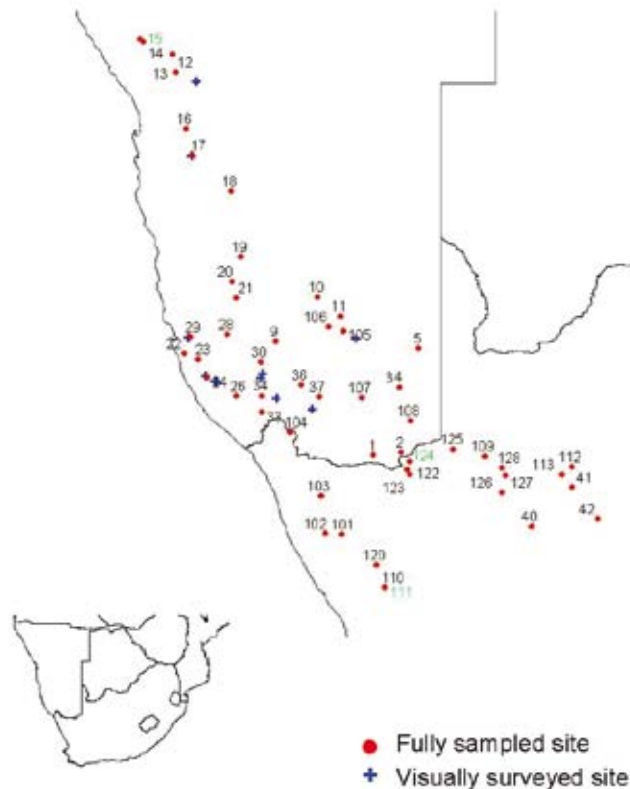



Figure 2: *Aloe dichotoma* populations throughout the known range of the species sampled by SANBI staff to assess population viability and adult plant mortality. This study confirmed for the first time, using genetic studies, that Kokerbooms growing at altitude on the Brandberg (site 15) and on other remote sites are in fact of this species, a necessary precursor to publishing this work.

statistical methods, and retraction if it is confirmed to be incorrect.

- Dr Midgley is the chief specialist scientist: Global Change and Biodiversity Programme at the SA National Biodiversity Institute, and Prof Underhill is the director: Avian Demography Unit at the Department of Statistical Science, University of Cape Town.
- Acknowledgements: Prof Bruce Hewitson provided useful comments on an earlier draft.

REFERENCES CITED

- Alexander WRJ (2004) Development of a multi-year climate prediction model. *Water SA* 31(2): 209-217.
- Alexander WRJ (2007) Locally-developed climate model verified. *Water Wheel* Jan/Feb 2007: 27-29.
- Hewitson BC & Crane RG (2006) Consensus between GCM climate change projections with empirical downscaling: precipitation downscaling over South Africa. *International Journal of Climatology* 26:1315-1337.
- IPCC (2001) Climate change 2001: The scientific basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). Houghton JT, Ding Y, Griggs DJ, Noguer M, van der Linden PJ, Dai X, Maskell K and Johnson CA (eds.) Cambridge University Press, Cambridge a.o., 881. 



Research Brings Clean Water to Rural School

Excessive nitrate and salt levels in groundwater remains one of the main reasons for many resources to be declared unfit for drinking. Unfortunately for many rural communities in South Africa, this is the only source of drinking water available. Lani van Vuuren reports.

Madibogo village is located about 90 km from Mafikeng in the Ditsobotla district of the former Bophuthatswana. The area has a total population of 23 000, who are all dependent on groundwater for their water supply. The water is drawn from several boreholes and fed to a number of reservoirs from where it gravity feeds about 86 communal standpipes. The water is generally not treated prior to distribution, although chlorine is sometimes added to the reservoir water.

In the 1990s, the Department of Water Affairs & Forestry expressed concern over the high levels of nitrate in some water resources in the North West province. As a result, the Water Research Commission (WRC) funded a research project, executed by the North West University (NWU), to survey the extent of nitrogenous pollution of groundwater in the province.

HIGH NITRATE LEVELS

This study confirmed high nitrate levels in the groundwater of some areas, including Madibogo. Nitrate levels up to 23 mg/l were found (the maximum allowed limit in South Africa as set by the South African Bureau of Standards is 10 mg/l). In addition, high levels of calcium, magnesium and phosphates were present in the water. High fluoride levels, which can cause skeletal and dental fluorosis, were also detected in some of the boreholes.

Why are excessive nitrate levels dangerous to human health? When bottle-fed infants digest water containing too much nitrate, this nitrate, when converted to nitrite in the infant's body, interferes with the oxygen carrying capacity of the child's blood (it replaces the oxygen in the red blood cells).

Children with methaemoglobinaemia, as it is known, will show signs of blueness around the mouth, hands and feet, hence the common term 'blue baby syndrome'. These children may also have trouble breathing as well as vomiting and diarrhoea. Expectant mothers are also at risk as spontaneous miscarriage or still birth may occur when too much nitrate is ingested.

Due to the high salt concentrations in their drinking water, the people of Madibogo also experience discolouration of their hair, and skin irritations. Long-term exposure also puts them at risk for kidney and liver ailments as well as increases their risk for cancer. Simply put, the water tastes bad.

It is unclear what exactly causes these high salt levels in the groundwater in the area. It has been

suggested that it may have accumulated naturally, however, other factors, such as livestock sharing the same water resources, and the siting of pit latrines near boreholes cannot be ruled out.

TESTING POSSIBLE TREATMENT

The WRC funded a follow-up study to investigate the applicability of membrane technology (specifically nano-filtration and reverse osmosis) for the treatment of groundwater with high nitrate and salt levels in such a rural area. A 10 000 ℓ/day test unit was set up at Madibogo Bathlaping Primary School.

Dr Mbhuti Hlophe of NWU explained that a cross-flow modular reactor was selected. The cross-flow unit connects to two tanks, one holding the feedwater and the other holding the product water. Raw water is fed through the treatment unit and forced through the membrane. Clean water goes through the membrane, while the pollutants are left behind. The clean water is then stored in a tank for use.

“We managed to bring the nitrate levels down from over 20 ppm to less than 10 ppm as well as removing other pollutants, making the water safe to drink,” said Dr Hlophe. Local people have also been trained in the monitoring, operation and maintenance of the plant.

At an information day held at the school in March, school principal JPT Phologane expressed his delight with the water treatment plant. “Prior to the establishment of the plant, the children had to rely on the salty groundwater. There is a big difference between the untreated water and the treated water, not only in taste, but in the general health of the 800 learners and teachers using the water. We have also instilled in our children the value of this water and the importance of cherishing it rather than just letting it go to waste.”



An untreated water source situated outside school grounds.



The learners of Madibogo Bathlaping Primary School now have ready access to clean water.



The 10 000 ℓ membrane plant erected at Madibogo Bathlaping Primary School to test the applicability of this technology for rural applications.

The social aspects regarding the treatment plant, as well as the use and storage of water in the area, were not neglected during the research project. The attitudes and perceptions of the consumers that use the water were investigated, and based on that a general water education programme was developed, implemented and evaluated to improve health and hygiene in Madibogo. This was executed by the NWU’s Department of Consumer Science.

ADVANTAGES OF RURAL USE

The research project is on the verge of being completed after which the final results will be published. It is believed, however, that the applicability of membrane technology in this case has already been clearly demonstrated.

This kind of water treatment has many advantages, for example, the plants are generally compact making them easier to transport, while membranes can be used to treat virtually any kind of water. In addition, chemicals are only needed when cleaning the membranes.

Dr Gerhard Offringa, WRC Head: Water and Health added that, unlike other technologies that can treat water with high salt contents, such as ion exchange and biological treatment, membranes are generally considered more user-friendly. This is mainly because of the lesser amount of operator input required, making this type of technology more suitable in rural applications.

“Membranes are no longer the ‘alternative’ treatment technology it was thought to be in the past,” noted Dr Offringa. “Its merits and applicability have been well demonstrated in South Africa. We believe membranes can make a valuable contribution towards ensuring that all our communities have access to safe, potable water.”

Bad Tasting Groundwater Tackled



The same handpump as the one in the picture on p 17, following the installation of an iron filter. It is now in constant use.

Groundwater rich in iron poses a serious challenge in many parts of the world, especially in rural areas where communities often have to depend on this water as the only safe supply. A recently completed project in Zambia investigated possible solutions in this regard. By Max Karen and Jim Anscombe.

Iron is an essential element in human nutrition and, depending on factors such as age, sex and physiological status, the daily requirement for iron ranges from 10 to 50 mg/day. According to the World Health Organisation, iron concentrations of 1 to 3 mg/l can be acceptable for people drinking anaerobic groundwater.

However, these high levels of iron can cause discolouration of the water, and can impart an unpleasant taste as well as cause stains on food and laundry. This results in people returning to unprotected sources, which increases the risk for waterborne diseases, such as cholera and diarrhoea.

The issue of high levels of iron found

in groundwater resources in parts of North Western Zambia was highlighted during the North Western Province Rural Water Supply Project. An initial hydrogeological survey indicated that large numbers of boreholes contained high levels of iron.

Within the project area levels of iron above 1 mg/l were found to cause

discolouration. At levels of iron above 2 mg/l many boreholes were found to have been abandoned by the local communities and health centres where they were constructed as a means of safe water supply.

Two solutions were put forward. The first was to carry out a study of existing iron filtration methods around the world. The results of this study were used to design a filter specifically for the project area. This filter was then installed and assessed in terms of its ability to reduce iron and performance in terms of ease of operation and maintenance.

“At levels of iron above 2 mg/l many boreholes were found to have been abandoned by the local communities.”

The iron levels from the inlet to the filter were monitored regularly using portable iron photometers. The levels were further quantified during a trace element sampling programme carried out in order to identify if there were any other potentially toxic elements contained in the groundwater. The results were analysed at the British Geological Survey laboratories at Wallingford, in the UK. All tests indicated that the filter removed iron to well below acceptable limits.

The second solution was geophysical. During the in-house geophysical

Table 1:

Borehole name	Iron filter	Fe (mg/l)
Mafuliwanjamba RHC	Inlet	6.910
Mafuliwanjamba RHC	Outlet	0.212
Chilemba BS1	Inlet	10.600
Chilemba BS1	Outlet	0.235
Kivuku	Inlet	4.410
Kivuku	Outlet	0.013

This reliable hand-pump, situated next to a healthcare centre in North Western Zambia, was hardly used despite its good yield due to the large concentrations of iron in the water.



siting programme, boreholes with high iron levels were surveyed using resistivity sounding. A preliminary assessment of the results indicated that there is a link between boreholes with high levels of iron, and conductive layers of below 40 Ωm, below 30 m depth. This was interpreted in the geological context of an association with clay.

The project has now moved to full scale. The boreholes with high iron content are dealt with as follows. If the iron levels are above 1 mg/l a second borehole is drilled. If iron levels are also high in the second borehole, the borehole with the lowest iron concentration is selected and an iron filter installed.

The filtration system is being modified so that it can be incorporated into the

civil works that will be constructed next to each new borehole. The crucial issue, however, is the sustainability of the filter. Based on monitoring data and the fact that the communities themselves were put in charge of the maintenance of the handpumps it is believed that this problem can be solved.

About 350 boreholes will be drilled in North West Zambia, and it is anticipated that about 10% of these boreholes will have levels of iron above acceptable limits. It is anticipated that the installation of the filtration system will go a long way in overcoming this challenge.

- This article first appeared in the March 2007 edition of *Forum for Groundwater*. To download a copy go to <http://burden.wwgw.org> or www.waternet.co.za/groundwater



Busting Hunger Through Research

A new approach to smallholder farmer training, developed with support from the Water Research Commission (WRC), has helped thousands of rural people to break the hunger cycle. Lani van Vuuren reports.

Statistics show that 2,3 million households in South Africa are not able to meet their daily food requirements. In addition, about half of the country's population lives on R20 or less a day. "We do not realise the extent to which people in South Africa are going hungry," says Marna de Lange, who was part of the WRC project team.

She was speaking at a recent workshop to introduce the new approach to other countries within the Southern African Developing Community. The workshop was organised jointly by WRC, the Department of Agriculture and Southern African Regional Irrigation Association.

De Lange went on to explain that chronic hunger and malnutrition has far reaching effects. "When a child is malnourished, especially during the pre-school phase, it is not only his height and weight that are affected. It does irreversible damage to his intellectual development. Add to this increased potential for infection and you end up with an adult that

will have lower earnings during his lifetime than someone who is not malnourished. Chances are then that these people's children will also be malnourished, and so the cycle is perpetuated."

"Unfortunately, so much of the knowledge generated by scientific research ends up sitting on a dusty shelf, never reaching those who so desperately need it."

Many farmer training programmes have been developed over the years to address this situation. Yet little progress has been shown to date. This is because available training has almost exclusively been scaled-down versions of high-cost, high-risk commercial production practices, which are especially inappropriate to food insecure households. In the far-flung areas in Limpopo where the training was piloted, the majority of the farmers were found to have only basic

levels of education (Grade One to Three). Many of them were illiterate, and elderly, making the current methods of training unsuitable.

In addition, much of the training required trainees to be away from their homes for extended periods of time. This is impossible for many, especially the women responsible for food insecure households.

Tshinakao Havhi, a pensioner living in Beaconsfield, in Limpopo, knows what it feels like to be constantly hungry. To feed her family she tends a one-hectare plot of maize. Despite her hard work she used to get only five to seven bags of maize per bed, scarcely enough to feed her family or earn an income.

However, after received training under the new 'development through needs-based approach' she improved her yield to ten to fifteen bags per bed. She is now feeding her family regularly while the sale of additional maize provides her with valuable income. In fact, she has

been able to pay the tuition fees of her two sons, one of whom attended the University of Venda. They are now both employed.

Havhi is but one of thousands of poverty stricken dry-land and irrigation farmers that can testify to the success of the new approach to farmer training. The concept was pioneered by late independent consultant Johann Adendorff, who applied it to train about 7 000 farmers in Phokoane in the Nebo district of Limpopo, as part of a government initiative to revitalise smallholder irrigation schemes in the area.

This was followed up by WRC's action research project, which was aimed at transferring skills to especially resource poor farmers, youth and women's groups. The training includes enhancing skills in agricultural production, water use and management, business and entrepreneurship. Several trainers received tuition in the new approach, and the methods applied have now been captured in a formal set of training materials.

The training is undertaken at the farmers' fields where they are comfortable, and in their own language. Prior to the start of training, the trainer gets to know the farmers and their circumstances, their challenges and their expectations so as to better assist them. Local stories and folklore, rather than textbooks are used to convey the message, and practical demonstrations abound. Humour is added to the message. "If a story is funny people are bound to remember it," explained De Lange.

The training also makes use of local 'tools' at hand. For example, as the farmers do not have rulers to measure the distance between maize plants, or how deep they are planting the seeds, other forms of measurement are used, such as fingers and arms. The top of a cooldrink

bottle has become a favourite measurement for the application of fertilizer.

Commenting on WRC's reasoning behind funding this initiative, research manager Dr Andrew Sanewe explains that the organisation has placed greater emphasis on the transfer of knowledge in the last few years. "Unfortunately, so much of the knowledge generated by scientific research ends up sitting on a dusty shelf, never reaching those who so desperately need it. With this project we have created that vital link between scientific knowledge and the end-user, the farmer."

Training material in the new approach has now been created for facilitators. A roll-out process has started to take the approach beyond the Limpopo province, where it all started, to other regions across the country.

The new approach is not only aimed at transferring technical agricultural knowledge, but equally so on human development. "It must be recognised that many of these people have been left alone to struggle for many years. They feel that they have failed, and are therefore despondent, and have feelings of low self worth," reports project team member Marius Botha. "Many of these people have been farming for

MOSADI MEALIE PORRIDGE

How do illiterate people understand and memorise a concept when they cannot take notes during class or read a handbook? One way of conveying an important message is to create a visual in someone's mind. This mental picture becomes even stronger if that person can connect an emotion to it.

To help smallholder farmers understand the needs of a maize plant, they are introduced to Mosadi (Mrs) Mealie Porridge. Just like a human lady needs groceries and water to feed her family, the mealie mosadi needs fertilizer and water to feed her family (the cobs).

The tassel is the kitchen where all the groceries and water are brought to by the roots. It is here where the mosadi prepares the meals for her family. The cobs, in turn, will feed the farmer and her family. Just as in case with humans, the maize plant requires the right amount of food and water – too much causes problems, as does too little.

The leaves are the lungs of the lady, which allow her to breathe. Her land is her house. She does not live in the bush and just like human ladies, she does not like living in a dirty house where diseases can breed. This brings the message across that farmers have to regularly hoe their fields. Also, Mosadi Mealie Porridge needs to keep the tsotsis (weeds and livestock) out that make trouble and steal her food and water.

The mosadi cannot live on meat alone; her family needs other types of food. This teaches farmers to look for the main ingredients in fertilizer, namely phosphate, nitrogen and potassium. To help them remember these ingredients P is equated with porridge, N with nama (meat), and K with kool (cabbage).



In the past many training programmes have been scaled-down versions of high-cost, high-risk commercial production practices, which have proved unsuitable for smallholder farmers with limited access to education and resources.



self worth undergo the training and emerge as leaders who willingly share their newly-gained knowledge with others for the upliftment of the entire community," notes Botha. "People now have more respect in their families, and have improved their livelihoods."

The WRC has launched a follow-up project to develop similar training material for the farming of other crops, including fruit and vegetables.

To order the training material (WRC Report No TT 254/1/05), contact Publications at Tel: (012) 330-0340 or E-mail: orders@wrc.org.za 

years, but might have lost faith in their own abilities. Through this approach, we not only teach them new skills, but also to be proud and self confident."

The project team has witnessed some far reaching changes during follow-up visits to areas where training has been offered. For example, young boys, who never showed an interest in farming, taking up the hoe following the success of their mothers and grandmothers. "We have seen farmers with little

AIKONA TO ICONS

Marius Botha explains why extra care has to be taken when preparing training material for smallholder farmers:



"When we first developed our training manual we included icons, such as a light bulb, to illustrate an important piece of information. The farmers did not understand this iconography, thinking that this meant that the training was only for 'rich' people who could afford electricity. They, therefore, rejected the training. This taught us a valuable lesson not to over-estimate the knowledge of symbols or concepts, and to rather keep things simple."

SOUTHERN AFRICAN REGIONAL IRRIGATION ASSOCIATION WORKSHOP

Representatives from 11 southern African countries and several agricultural colleges in South Africa spent a day learning about irrigation management, based on research and on-farm trials with the wetting front detector.

The main aim of the wetting front detector project is to make the concepts behind irrigation scheduling accessible to a wider audience than is currently the case. This starts by building a picture of irrigation that make intuitive sense to farmers, i.e. the depth water penetrates to following rain or irrigation. The device is also simple to understand – convergence of infiltrating soil water in a funnel to activate a mechanical float.

The links are built between soil water deficit, and the way wetting fronts move through the soil. This is first demonstrated by 'irrigating' three sponges, representing the top soil, sub soil and the soil below the root zone. Irrigation can be improved by knowing when the wetting front has passed each of the depths.

The benefits and limitations of



Dr Richard Stirzaker of CSIRO (middle) demonstrates the wetting front detector technique

the wetting approach are then discussed, as well as how to bridge the gap between scientific information and the actual practice of irrigation by farmers.

Delegates conducted experiments to test the depth of wetting front penetration as a function of initial water content using sand-filled perspex tubes placed on top of the detector. The water was coloured so that the existing soil water could be distinguished from 'new' irrigation water.

- Submitted by Dr Richard Stirzaker of CSIRO.

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SAACE Aims for Quality over Cost

Consulting engineering firms and their clients should be placing greater emphasis on the provision of quality service, rather than focusing on price, maintains newly-elected president of the South African Association of Consulting Engineers (SAACE), Cecil Rose.

Economic conditions in the past led to the service provided by consulting engineers being downgraded to that of a commodity and priced in terms of time. The notion has been one of selling or buying time rather than expertise." Rose told the media that SAACE aimed to assist member firms to change their mindset from the "survival mode" of the past and rather to improve the quality and professionalism of their service so that clients would recognise the value provided by them and, therefore, be more amenable to paying for that value.

SUSTAINABLE BUSINESS CULTURE

Instilling a sustainable business culture in its members is an area of focus for SAACE this year. "The

consulting engineering sector is an essential component of the construction sector which, in turn, is essential to the development of our country and the delivery of infrastructure to our communities," said Rose. "In the present economic environment it is necessary to adjust the business culture from one of survival through the difficult times in the past to one of expansion and development for the future."

Another main focus area for the association this year is the new procurement system which government has implemented through the Construction Industry Development Board. One advantage of the system is that of uniformity, and Rose believes having a single procurement system for all organs of State

will lead to greater predictability, fairness and efficiency. "The new procurement system is based on competitive bidding, and is a radical change from the past. For it to be successful and to avoid undesirable delays to delivery, it will require a major education process to bring it into the market."

GROWING SKILLS AND CAPACITY

The intensification of government spending on building new infrastructure over the next three years while maintaining existing services is set to place even more demands on the consulting engineering sector. In light of this, building capacity and skills remains a significant challenge for engineering firms.

Evidence of this is that in SAACE's most recent bi-annual management survey (January to June 2006), over 90% of firms reported an intention to recruit more engineers. Nearly as many intended recruiting more technologists. A worrying trend, however, was that 95% of these firms reported difficulty in such recruitment activities. To alleviate this, member firms committed nearly R40-million to bursaries for this period. "This represents a doubling in constant value terms of the past two years," noted Rose.

A further reflection of the need to build capacity and skills is the expenditure which consulting engineering firms are committing to training their existing staff. In addition to the Skills Development Levy of 1% of payroll which all employers have to pay, the SAACE survey indicated that a further 1,5% of payroll is expended on the direct costs of training of staff. With member firms' payroll currently in excess of R3,5-billion a year, this represents a spend of over R55-million a year.

The same survey indicated that present staff levels and the utilisation of those resources are both at the highest levels that have been recorded since SAACE started recording these particular indices eight years ago. Staff levels are now at 11 400, and their utilisation is at over 95%. "This indicates a severe shortage of capacity and skills and is an unsustainable situation," reported Rose.

"While the association acknowledges that these shortages have to be addressed rapidly, it is of the view that the only sustainable approach is to devote even more effort to upskilling present staff; promoting engineering and the industry to young people; encouraging the return of skilled employees who have left the country; and bringing back older, retired engineers to assist with capacity building and mentoring within firms and client bodies."

ASSISTING GOVERNMENT

SAACE has joined hands with other engineering associations and government to assist in capacity building efforts. One example is the partnership with government under leadership of the Department of Provincial and Local Government (DPLG) to place experienced engineers into selected underperforming local authorities. Engineers have already been deployed to five municipalities, although as many as 80 have been identified by DPLG. The intention is that the experienced engineer supports the existing officials and councillors, providing capacity and transfer skills through mentoring.

"We do not believe that the answer to the skills shortage lies in the recruitment of foreign engineers who have different levels of training and come from different environments with different practices and standards," said Rose. "We believe we have the human capital available in our country, and must allow them to derive the benefit of the increased job opportunities that are developing."


SAACE has also been called to assist in dispersing R650-million in disaster relief made available to parts of the Eastern Cape and Western Cape following devastating floods last

year. Discussions are currently being held with different stakeholders, and SAACE member firms are expected to be recruited to act as project managers.

ETHICS AND PROFESSIONALISM

Maintaining standards of ethics, quality and professionalism among the consulting engineering sector remains one of SAACE's focus areas. Its Code of Conduct is reviewed regularly to ensure that it remains relevant and reflects present ethical standards. The Code places obligations on SAACE members in relation to the conduct of their businesses.

"The association will intensify its efforts to promote and encourage a high standard of professionalism in the conduct of our members' businesses," reported Rose. It provides toolkits such as Advisory Notes, Client Briefs and other supporting documentation to achieve these objectives. It has also included aspects of professional conduct in its Continuing Professional Development (CPD) programme for 2007.

With regards to transformation, SAACE continues to subscribe to the Construction Charter while its formal launch is awaiting finalisation of the Broad-based black economic empowerment Codes of Good Conduct by government. "The Charter provides a consistent and clear means of measuring an entity's achievements with regards to a broad spectrum of measurable empowerment criteria and allows established entities to achieve meaningful transformation despite the severe shortage of black engineers, technologists and technicians. Application of the Charter by clients will go a long way to rooting out the scourge of fronting which has been encouraged by the narrow approach of many client body's procurement policies," said Rose. 



New SAACE president Cecil Rose.



Tenth Anniversary of River Health Programme

A report celebrating the first decade of the implementation of the eminent River Health Programme (RHP) is now available. Liesl Hill and Lani van Vuuren report.

The RHP was initiated 13 years ago as a response to the need for more detailed information on the state of South Africa's aquatic ecosystems, at a time when the Department of Water Affairs & Forestry's (DWAF) management focus was broadening from end-of-pipe monitoring to an integrated water resource management approach. The programme uses several ecologically-based approaches and methods, some uniquely South African, to determine the state of river ecosystems.

The overall purpose of the programme, supported by partners such as the Water Research Commission and CSIR, is to provide information on the ecological state of river ecosystems in South Africa to support the management of these rivers. About 13 river systems from the Crocodile River system to Cape Town's rivers have been assessed to date.

The latest report, *Achievements of the River Health Programme 1994-2004*, reflects on the first ten years of the programme's existence, from the initial planning phase to its implementation. The report provides an overview of the achievements, challenges and lessons learnt during this period. Moreover, it provides a synthesis of the ecological health and condition of many rivers in South Africa that were assessed as part of the RHP's State-of-Rivers reporting.

In view of present signs that globally, inland water resources are under immense pressure due to population growth and increased water resource demands, the value of biological monitoring, and hence the RHP in South Africa, cannot be over-emphasised. During the past ten years the RHP has brought the importance of aquatic ecosystems to the attention of stakeholders through awareness creation and capacity.

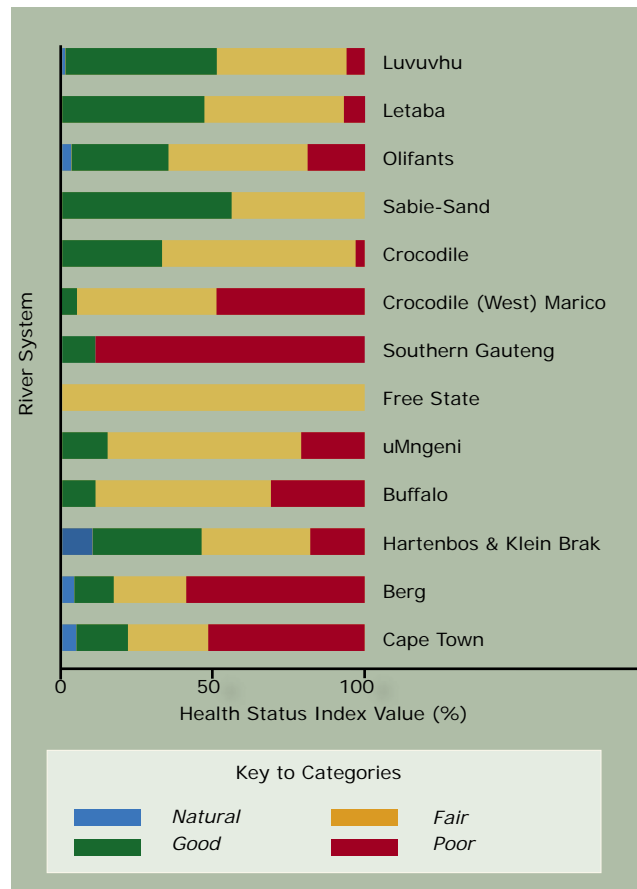
The report importantly points out that DWAF is not solely responsible

for safeguarding South Africa's rivers. Other government departments, provincial and local authorities, industries, agricultural organisations, rural communities and even individual landowners all have a share in ensuring the protection of the country's aquatic resources.

The river health assessments have shown that some of the pressures on the country's river systems are specific to a region, while others occur throughout South Africa. These pressures include urbanisation, overexploitation and modification of rivers and streams, increased demand on sewage treatment works, water supplies and solid wastes, as well as illegal dumping of solid waste, among others.

As the report concludes, aquatic ecosystems, such as rivers and wetlands, provides immeasurable benefits, either directly in the form of water or indirectly in the maintenance of vast ecosystems that underpin our survival. Despite this, we are changing these water resources so dramatically that the health of many rivers and wetlands is precarious.

- To download the report go to www.csir.co.za/rhp/state_of_rivers.html or contact Joyce Maluleka at Tel: (012) 808-9500 or e-mail: malulekaj@dwaf.gov.za



The ecological status of all river systems assessed by the River Health Programme to date.





SAICE president for 2006, Sam Amod, and his wife Lekha, with president for 2007, Neil Macleod and his wife Glenda.

People More Valuable than Technology – SAICE President

Newly inaugurated president of the South African Institution of Civil Engineering (SAICE), Neil Macleod, has urged professional engineers to engage more closely with the communities they work in so as to ensure a better understanding and value of the profession. Lani van Vuuren reports.

Other than doctors, lawyers and accountants, who deal directly with clients, engineering professionals' work is done in a less direct way, with only the products of their work being evident and not their role. "This lack of a direct link between the work of a civil engineer and his 'products' is a limiting factor in building the status of the civil engineering professional," noted Macleod during his inaugural address.

To compound the problem, the work of civil engineering professionals is generally well publicised in the case of failures. The general public takes for granted the fact that water comes out of their taps at a relatively constant pressure and is able to be drunk directly from the tap. Toilets are flushed with no thought for the processes

needed to transport this waste and treat and dispose of it safely. "As engineers we tend to assume that the public knows how these things work, and does not need to have them explained," said Macleod.

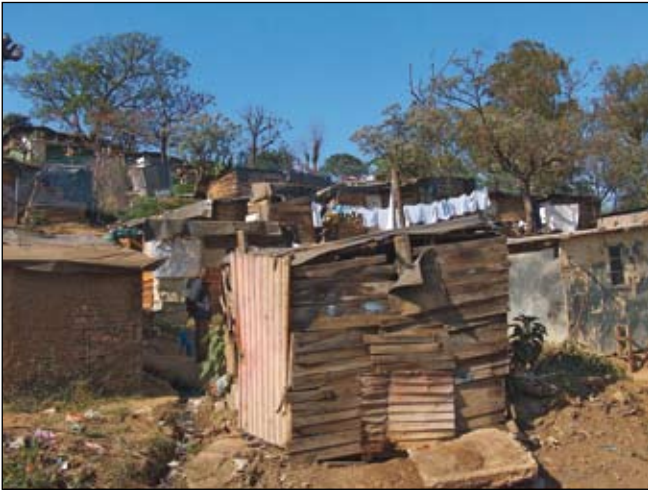
"There is a clear need for SAICE to communicate more clearly the role that civil engineers play in society and the fact that engineering is not 'obvious' or 'easy' and requires years of training and experience for one to become proficient," he continued.

"There is also a need to ensure that the quality of civil engineering work is of the highest quality and integrity and that this work is undertaken by competent persons."

According to Macleod, this improved communication would result in more

students choosing civil engineering as a career, as well as lead to a better understanding of the value of the civil engineering profession to society. Quoting his father, Don Macleod, who was president of SAICE in 1987, he said: "We should never see the fruits of technology as being of greater importance than people. Our respect for the dignity and immeasurable value of the human being should always be upheld."

All indications are that the civil engineering sector stands at the beginning of a period of significant increase in activity which will be equal to, or even exceed, the level of investment in civil engineering projects last seen in the late 1970s and early 1980s. Cabinet has recognised that, for economic growth to achieve levels



SAICE president Neil Macleod has urged civil engineers to engage more with the communities they serve.

needed to halve the levels of poverty and unemployment, the growth rate as measured by the increase in gross domestic product needs to be increased. In addition, the need to invest in new infrastructure and to adequately maintain existing infrastructure is emphasised in the Accelerated and Shared Growth Initiative in South Africa strategy document.

“We should never see the fruits of technology as being of greater importance than people. Our respect for the dignity and immeasurable value of the human being should always be upheld.”

Municipalities have the constitutional obligation to ensure the provision of infrastructure services to their communities. However, as Macleod pointed out, to meet community expectations in this regard was proving to be fraught with difficulties. “The shortage of engineering staff is a limitation on the sector’s ability to deliver. There are also valid concerns about the market’s ability to meet the demand for material resources

– plant and equipment, reinforcing and structural steel, cement, piping, electrical equipment and timber – at affordable prices.”

Contrary to belief, funding is not a constraint to growth at present, but rather the ability to access the funding that is available and spend it efficiently and effectively on projects that are socially, environmentally and financially sustainable. This is influenced by, among others, the shortage of engineering staff in the municipal sector, coupled with the small number of graduates that are being trained and mentored in municipalities.

“Our profession stands at the threshold of a period of unprecedented opportunity in South Africa, and we have the ability to meet the technical challenges that will be presented,” said Macleod. “However, we need to make a concerted effort to move closer to the general public so that the role of the civil engineering professional is valued and understood. To do so will require us all to relate to people with the same passion as we relate to technology.” 

MORE ABOUT NEIL MACLEOD



Born and educated in Durban, Neil graduated in 1972 with a B.Sc in Civil Engineering. He obtained an MBA in 1999 and is currently completing his PhD on the sustainable provision of water services to poor communities.

He has 30 years’ experience in the water and sanitation sector, and has since 1992 been the head of Water and Sanitation at the eThekweni Municipality where he manages an organisation with over 2 500 staff members and an annual turnover in excess of R2-billion providing services to the Durban metropolitan region.

His fields of expertise include water supply (conservation, demand management, treatment and distribution), sanitation, sewage collection and treatment as well as solid waste management, tariff design, and public/private partnerships.

Neil serves on the boards of the Municipal Infrastructure Investment Unit, and Johannesburg Water. He also chairs Building Partners for Development in Water and Sanitation.

Table showing grant funding to municipalities

YEAR	05/06	06/07	07/08	08/09
MIG (capital) funding	5,44 bn	6,26 bn	7,14 bn	8,05 bn
ES (operating) funding	17,16 bn	18,05 bn	20,08 bn	22,77 bn

Saving SA from Alien Invasion

The future of South Africa's natural resources is threatened by the invasion of aliens. No, not little green space men, but rather species from other parts of the world that are taking over our ecosystems, using up the country's scarce water resources.

Invasive alien plants constitute one of the greatest single threats to conservation in South Africa. Some of these invaders arrived by accident, however, the majority were introduced deliberately by people who thought it a good idea at the time. Many alien species were imported for commercial reasons (such as forestry) or as ornamental garden plants.

Today, there are more than 700 alien plant species in southern Africa, originating from places such as Asia, South America and Australia. About 10% of these are considered invasive plants. This is because of their aggressive qualities, and their capacity to invade natural habitats and overwhelm some, or even all of the indigenous vegetation.

Invasive plants have specific traits that make them especially good competitors. Sometimes it can be as simple as having the ability to grow and reproduce more rapidly than native species. Other plants can directly or indirectly prevent other plants from growing nearby. Local herbivores might also find these alien plants inedible.

Invasive alien plants come in many shapes and sizes. They may be trees,



Cape fynbos is severely threatened by alien species such as Australian acacias, which were originally introduced into the country for timber, bark products, and to stabilise sand dunes.

shrubs, small herbaceous plants or waterweeds. These plants have been declared undesirable and may not

be grown on any public or private property. What they have in common is the ability to spread and reproduce rapidly and to resist all but the most determined attempts to control them.

Invasive alien plant species found in South Africa include chromolaena, lantana, pereskia, American bramble, sesbania, syringa, bugweed, prickly pear, and water hyacinth. These plants have already taken over more than 10 million hectares of South Africa.

Why do we need to worry about invasive alien plants? Of most concern in South Africa is the fact that most of these species consume vast amounts of water. Experts maintain that more than 7% of all water runoff is lost to alien plants. That's some 3,3 billion cubic metres of water (equivalent to the mean annual runoff of the Vaal River).

WHAT CAN YOU DO?

- ◆ Plant indigenous plant species (nurseries can help you identify which species are local).
- ◆ Familiarise yourself with the pervasive alien plants plaguing your area and learn how to identify them.
- ◆ Don't bring foreign plants into the country.
- ◆ Join a volunteer clearing group, and adopt a piece of land to keep it clear from alien plants.
- ◆ Encourage your municipality, school, church and others to work with the Working for Water programme.



Courtesy of SA Tourism

Many rivers and dams are clogged with exotic water lettuce, water hyacinth, Kariba weed or parrot's feather.

WORDS

Alien: This refers to a species which does not occur naturally in an area (in other words, it is not indigenous), but has been introduced by people. Also referred to as 'exotic' species.

Biodiversity: Biodiversity refers to the variability of all living organisms – including animal and plant species – of the genes of all these organisms, and of the terrestrial, aquatic and marine ecosystems of which they are part. Biodiversity makes up the structure of the ecosystems and habitats that support essential living resources, including wildlife, fisheries and forests.

Indigenous: An indigenous plant or animal is one which occurs naturally in the place in which it is currently found.

Invader: A few alien species reproduce and spread, unassisted by man, into areas where they are not wanted. For a species to become an invader it has to a) arrive, b) survive and c) thrive.

In addition, invasive alien plants can cause flooding and erosion, which destroys riverbanks and leads to the siltation of dams and estuaries, and consequent poorer water quality. These species can also fuel wild

fires, making fire management difficult.

To combat this invasion, the government, under the leadership of the Department of Water Affairs & Forestry, established Working for Water. The organisation employs especially underprivileged people to literally hack and cut their way through alien plants. Since its inception, Working for Water has invested more than R25-billion to clear invasive alien vegetation and establish programmes in more than 300 areas. At the same time it has created thousands of jobs. About 52% of the people employed by Working for Water are women, mostly single moms.

WEBSITES

- www.dwaf.gov.za/wfw
- www.sanbi.org.za
- http://en.wikipedia.org/wiki/Alien_%28biology%29

The first Jacaranda tree was imported to Pretoria from Brazil in 1888. Today some 70 000 of the trees grace parks, gardens and streets.



Working for Water was established 11 years ago to help clear South Africa of invasive alien plants while creating much needed employment.



SA Hosts International Algae Workshop

The Water Research Commission, a Global Water Research Coalition partner, hosted a workshop for the preparation of an internationally-relevant manual on cyanobacteria and cyanobacterial toxins.

The workshop, held in Somerset West, was attended by working group members from South Africa, the UK, the US, Germany and Australia. It is reported that the group used as a basis for their deliberations the national manuals prepared by

Australia (SA Water), South Africa (WRC) and the documents and software prepared by European TOXIC & PEPCY programmes. An electronic format, six chapter, multi-layered product is now scheduled for publication by end-2007.



Left: The working group.

Below: Dr Gesche Gruetzmacher from UBA, in Germany, also attended.



Right: The workshop was not all hard work.

Above: The workshop offered plenty of opportunity to network.





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