

THE WATER WHEEL

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WATER INNOVATIONS



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Cover: Intensive studies of the Waterberg's rivers by members of the CSIR Natural Resources & the Environment have revealed compelling reasons why these aquatic ecosystems should be protected against pending industrial development. See the article on page 8.
(Cover photography courtesy CSIR)





The global hunger crisis – Water as a route to nutritional security

According to the official statistics of the United Nations Food and Agriculture Organisation (FAO), in 2011-13, there were 842 million people defined as chronically undernourished in the world.

Chronic hunger is defined as 'not getting enough food to lead active and healthy lives'. This is one in eight people in the world. Of this, 826.3 million are in the developing world while only 15.7 million reside in OECD countries.

According to FOA DG, Jose Graziano da Silva, this was a vast improvement on the 1990 figures when more than a billion people worldwide were deemed to be chronically hungry. This progress is significant especially given that there has been an exponential growth in population in that period.

The largest gains though have been in East Asia, South East Asia and Latin America where we have witnessed a 17% decrease in the total number of undernourished people from 995.5 million in 1990-92 to 826.6 million in 2011-13. In 2013, it was estimated that only 50 out of nearly 190 countries had already achieved the Millennium Development Goal of halving the number of hungry in the world.

The central message is that nutritional security remains unachieved for 12.5% of human beings today, and most of these people are in the developing

world. The secondary message is that great strides have been made in recent times, strides that demonstrate that we have some of the core elements of solutions that may eventually lead to universal nutritional security.

This nutritional security defined by 'access to food' is the end point of a complex web of factors and interdependencies as illustrated in Figure 1.

The complexity of the resource factors (water, energy, land and finance) are exacerbated by the behaviour of the markets. This is compounded exponentially by consumer behaviour. It is estimated that as much as a third of all food produced is dumped as waste.

This amounts to approximately 1.1 billion tons.

The WRC and its partners have been pursuing a research and development programme to directly address various parts of this puzzle with encouraging contributions. These include landmark work in the irrigation domain. Smart solutions with high impact include the water administration system or WAS, which is now being rolled out under the auspices of the Strategic Water Partnership Network (SWPN). Further beacons include creative combined water and power off-grid solutions (using rain water harvesting and bio-digesting pastoral waste) such as the Green Village project in Okhombe, KwaZulu-Natal.

More recent work is geared toward direct empowerment of poorer communities who have the tradition of growing and/or harvesting indigenous crops. While these crops have been proven to be more resilient in harsher conditions, there has been a debate as to whether there was a nutritional sacrifice associated with this choice. Recent WRC projects have demonstrated that the nutritional content of traditional crops, including African leafy vegetables, is high and, in some cases, higher than commercial crops. In addition, the water budgets of these crops remain positive with lower than average water use and the advantage of being primarily rainfed.

The additional boons include the possibility of developing whole new market mechanisms for indigenous crops. This may mean that economic access may be improved as indigenous crops are shielded from the commodity trading mechanisms which are the current key price drivers and in many instances, together with the sophisticated distribution chains, the mainstay reason for food price inflation.

While water wise indigenous crops will not in the short term offer the solution to bring 850 million people out of chronic hunger, it certainly holds promise for several million people, particularly

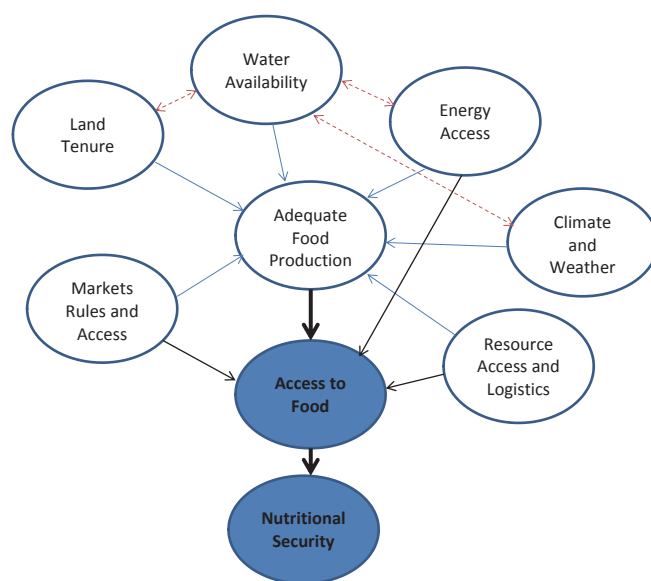


Figure 1. An illustration of the complexity of the interdependent relationships between resource availability and the market that eventually determines nutritional security.

in Sub-Saharan Africa to not only ensure an end to hunger, but also offers the possibility of sustainable livelihood to very small scale, largely subsistence farmers and their communities.

Recently published WRC reports related to food security

- Water use and nutrient content of crop and animal food products for improved household food security (**Report No. TT 537/12**)
- Nutritional status of South Africans: Links to agriculture and water (**Report No. 362/P/08**)
- Agricultural water use in homestead gardening systems (**Report No. TT 430/09 and TT 431/09**)
- Water use and drought tolerance of selected traditional crops (**Report No. 1771/1/13**)
- Nutritional value and water use of African leafy vegetables for improved livelihoods (**Report No. TT 535/12 and TT 536/12** (production guidelines))



River biomonitoring tool scoops international award

GroundTruth (a specialist consulting company) and the Wildlife and Environment Society of South Africa (WESSA) have jointly received a RCE Recognition Award for an 'Outstanding Flagship Project' on behalf of the KwaZulu-Natal Regional Centre of Expertise (RCE).

This award recognises the achievements of the Stream Assessment Scoring System (miniSASS), and it was received by Tich Pesanayi from WESSA REEP (Southern African Development Community Regional Environmental Education Programme) at a high-profile event held at the United Nations University as part of the 8th Global RCEs Conference on Education for Sustainable Development. The conference was held in Kenya late last year.

The citation on the award



acknowledges 'River health monitoring and public mobilisation using the miniSASS community river health monitoring tool'. The citation further notes the project's 'contribution to the development of an innovative platform for citizens to measure and express

their concerns around water quality and service delivery'.

The miniSASS biomonitoring project is now implemented on a Google Earth platform, which makes all of the results visible in the public domain. The research of miniSASS is supported by the Water Research Commission (WRC).

The international award from the United Nations is the second award that miniSASS has received in the last few months, following the recognition received from WRC in the form of a 'Community Empowerment Award'.

To learn more about the miniSASS project, including how to sample the health of a river, submit river health data and gain access to a host of supporting resource materials, visit: www.minisass.org

Water Diary

Water innovation May 25-29 Nelspruit

The Water Institute of Southern Africa Biennial Conference & Exhibition will be held in Nelspruit. *Enquiries: Jaco Seaman; Tel: (011) 805-3537; Fax: (011) 315-1258; Email: events@wisa.org.za; Visit: www.wisa.org.za*

Water resource management June 11-12 Bloemfontein

The Second African Water Symposium titled 'Planning for the future' will be held in conjunction with the 6th Orange River Basin Symposium at the University of the Free State. *For enquiries Tel: (051) 401-2863; Fax: (051) 401-2629; Email: info@african-watersymposium.co.za or Visit: www.africanwatersymposium.co.za*

Drinking water reticulation June 17-20

The Department of Civil Engineering, Stellenbosch University, is presenting a block course on water services planning. The focus is on water reticulation network planning and modelling, including pipes, pumps, reservoirs and valves. One session also addresses O&M. An optional 4th day (20 June) involves a hands-on modelling experience and is available to those who attend the 3 day course. The course is co-ordinated by Prof HE Jacobs, with experts from industry, other universities and local authorities contributing expertise. Presentation and all course material is in English. An iPad Mini is up for grabs in our hydraulic network modelling competition, open to course delegates only. *Enquiries: Rene Burger, Tel: (021) 808 2100, Email: burger@sun.ac.za or visit www.civeng.sun.ac.za.*

Aquatic science June 22-26 Thaba 'Nchu

The 2014 conference of the Southern African Society of Aquatic Scientists will

be held in Thaba Nchu, Free State. *Enquiries: Petrie Vogel; Tel: (012) 346-0687; Fax: (012) 346-2929; Email: petrie@savetcon.co.za; or Visit: www.savetcon.co.za to register.*

Sediment water science July 15-18

The International Association for sediment water science (IASWS) brings together and fosters collaborative research and dialogue between earth scientists, biologists, chemists and environmental engineers whose interests pertain to sediment-water interactions in all aquatic systems. Conference themes include the impact of sediments on ecosystem functioning and human health; multiple stressors; scale-dependent connectivity in aquatic systems; technical and methodological advances in sediment-water science; and physical and biochemical processes in sediment systems. *Enquiries: Prof Kate Rowntree; Email: k.rowntree@ru.ac.za or visit: www.iasws2014.co.za for more information.*

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Please assist us to improve the *Water Wheel*. Complete this survey and stand a chance to win **one of 3 FREE registrations** to the WISA Biennial Conference & Exhibition, 25-29 May 2014. The prize is worth R6800¹. Entries close 20 March 2014.

You may fax (086 649 8600), email (laniv@wrc.org.za) or mail (Private Bag X03, Gezina, 0031) your entry to us. Entries must be marked for the attention of the Editor

PLEASE MARK THE ANSWER THAT APPLIES TO YOU WITH AN **X**:

- IF YOUR ANSWER IS NOT LISTED, MARK 'OTHER' AND WRITE THE ANSWER IN 'SPECIFY'.
- PLEASE GIVE MORE DETAIL WHERE ASKED TO DO SO.

1 Who reads the *Water Wheel* that you receive in the mail?

Only me	Me and other people (PLEASE SPECIFY WHO THESE OTHER PEOPLE ARE.)
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IF MORE THAN ONE ADULT (18+) READS THIS *WATER WHEEL*, PLEASE COPY THE QUESTIONNAIRE AND FILL IN SEPARATELY FOR EACH READER.

2 What do you do with the *Water Wheel* once you have read it or paged through it?

Throw away	Keep For how long?	Give it away To whom?	Other (PLEASE SPECIFY)
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3 Which of the following uses of the Water Kidz section applies to you? (YOU MAY GIVE MORE THAN ONE ANSWER.)

The children use it for their schoolwork	The children read it because the information is interesting	I use it for teaching material	It is not read or used	Other (PLEASE SPECIFY)
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4 What did you read in this issue of the *Water Wheel*?

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5 What do you usually read in the *Water Wheel*? (YOU MAY GIVE MORE THAN ONE ANSWER)

Upfront	New WRC report	Feature articles	Water Kidz	Last word	Other (SPECIFY)
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6 What is the **main** reason why you read the *Water Wheel*? (ONE ANSWER ONLY)

It is interesting	I use it in my work How do you use it?	I use it for my research	Other (PLEASE SPECIFY)
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¹ Should you win and have already paid for the conference registration, Water Wheel will refund you.

7 Is there any specific topic(s) that you would like the *Water Wheel* to cover?

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8 How would you rate the *Water Wheel* on the following quality aspects? PLEASE MARK WITH AN **X** FOR EACH ASPECT.

Objective	Very	Reasonably	Not
Useful	Very	Reasonably	Not
Factually correct	Very	Reasonably	Not
Clear and easy to understand	Very	Reasonably	Not
Visually attractive	Very	Reasonably	Not

9 Will any of the following extras for the feature articles be useful to you? (YOU MAY GIVE MORE THAN ONE ANSWER.)

A list of references	A source where I can get more detail	A summary	No, the articles are sufficient as they are.
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10 Which of the following links that appear in in the *Water Wheel* have you accessed? (YOU MAY GIVE MORE THAN ONE ANSWER.)

Web links	QR codes	Links to Youtube	None of these
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11 Are you aware that you can search and download the *Water Wheel* on the Water Research Commission's website?

Yes	No
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12 Have you ever searched for a specific topic or topics in:

a Hard copies of the *Water Wheel*?

Yes	no
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b Online copies of the *Water Wheel*?

Yes	no
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c If 'Yes' for a **and** b above, what search method do you prefer?

Hard copy	Online copy
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13 Do you read any other water-related magazines?

Yes (PLEASE SPECIFY WHICH ONES.)	No
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14 How do you prefer to receive the *Water Wheel*?

Hard copy in the mail	Download from WRC website	I no longer wish to receive the <i>Water Wheel</i>
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Thank you! We appreciate your time.



CSIR Natural Resources and the Environment researcher, Arno de Klerk, is looking into the possible degree of risk for a variety of potential impacts on the water quality and aquatic ecosystems of the Mokolo River, as part of his PhD studies.

Research builds body of knowledge to protect WATERBERG RIVERS

While a growing number of developers are staking a claim in the coal-rich Waterberg, researchers are building a body of knowledge to ensure the sustainable development of this Limpopo region's unique aquatic ecological infrastructure. Article by Lani van Vuuren.

Coal contributes 93% of the total electricity consumed in the country. Growing demand for electricity in South Africa has resulted in a massive electrification programme, with several new power stations being built or on the cards. In turn, this increases the demand for coal.

The Waterberg is considered the 'next frontier' in terms of coal-mining in South Africa, cited by many as the answer to much of the

country's future additional energy requirements. Home to what is believed to be the third-largest coal reserves in South Africa, the area is set to become a new powerhouse for coal-fuelled electricity production in the country – a far cry from the agriculture-dominated area it is today.

Development has been triggered by Eskom's new Medupi Power Station outside Lephalale. According to Eskom's website, the power station, which is currently under

construction, will be the 'fourth-largest coal plant in the Southern Hemisphere', and will be 'the biggest dry-cooled power station in the world'.

This has prompted various mining companies to start prospecting in the Waterberg region. Further expansion could see more new power stations being constructed and several more new coal mines being added to the region to supply the necessary coal for these large operations. This will undoubtedly lead to dramatic changes in the landscape.

WATER RESOURCES

All of these economic developments, with accompanied population growth and urbanisation (Lephalale, for example, is currently the fastest growing town in South Africa), are likely to have an effect on the Waterberg's water resources. Ironically, the Waterberg has not been blessed with an abundance of water and does, in fact, have a dry climate. Even before all the economic expansion in the area there was hardly any additional water left in the region to meet future demands.

This has prompted authorities to seek additional water in other catchments. To meet the future water demand in the Waterberg, the Department of Water Affairs (DWA) has embarked on the Mokolo Crocodile Water Augmentation Project, which entails the phased construction of two main bulk raw water transfer systems, as well as associated infrastructure to transfer water from the Crocodile (West) and Marico catchments to the Mokolo River catchment, the main catchment of the Waterberg. The first phase of this project is expected to be completed in 2015.

IMPACT ON RIVERS

The projected increase in water abstraction, coupled with a rise in pollution associated with mining,

power generation and related development, could have far reaching consequences for the Waterberg's rivers. The Waterberg hills form the headwaters of four main rivers, namely the Lephalale, Mokolo, Matlabas and Mogalakwena rivers. These rivers are also important tributaries of the internationally significant Limpopo River, which forms the border between South Africa and Botswana, between South Africa and Zimbabwe, while flowing downstream through Mozambique.

A few years ago, a team from the CSIR's Natural Resources & the Environment (NRE) started conducting a series of in-depth investigations into the state of the Waterberg's river systems. The studies have included numerous sampling trips to the region's main rivers over the years during different seasons, with a great deal of samples being collected across different tropic levels (benthic algae, phytoplankton, protozoans, macroinvertebrates and fish) from the rivers.

In addition, water quality analyses, isotope analyses of macroinvertebrates, as well as investigations into riparian vegetation have been

"These baseline ... will provide a useful benchmark against which possible future deterioration in the water quality and ecosystem health of these aquatic ecosystems can be assessed."

undertaken. Funding for the studies, which have stretched over several years, have been provided mainly by the CSIR, with additional funding from Eskom.

The ultimate objective of these studies has been to develop a set of ecological indicators that can be used to provide an accurate baseline estimate of the ecological status and integrity of the aquatic ecosystems in the important rivers draining the Waterberg, explains CSIR NRE researcher, Arno de Klerk. "The studies have provided us with a relatively good idea of the state of the Waterberg's rivers before additional industrial and mining developments. These baseline results are of immense significance, because these data will provide a useful benchmark against which possible future deterioration in the water quality and ecosystem health of these aquatic ecosystems can be assessed."

The Mokolo Dam, located on the river of the same name, is the largest impoundment in the catchment.



Courtesy CSIR

STATE OF THE WATERBERG'S RIVERS

Researchers have had to build good relationships with local stakeholders, such as farmers, to gain access to potentially useful monitoring sites. In addition to getting permission to enter private premises to gain access to the rivers they were studying, researchers have also had to dodge snakes, hippos and crocodiles.

Despite these challenges, their results have borne fruit, with investigations revealing that the Waterberg's main rivers are still in reasonably good condition as far as water quality and aquatic ecosystem health is concerned. In addition, researchers have also made some remarkable discoveries, which emphasise the need to preserve the generally good condition of the Waterberg rivers' waters.

One of these discoveries has been that of CSIR principal researcher, Dr Paul Oberholster, who found

“The Mokolo River faces the same types of risks from activities that exert progressively more serious adverse impacts on water quality and aquatic ecosystems in the upper Olifants River, including acid mine drainage, return flows from agriculture, and discharge of sewage effluent.”

Ophrydium versatile in the Lephala River. This was the first ever recording of this species of protozoa in an African river. *Ophrydium versatile* needs clean water and a high penetration of the sun to survive in the water. This protozoan has subsequently also been recorded in the Mokolo River.

Interesting biota have also been discovered in the Mokolo River. CSIR researcher, Leanie de Klerk, (with the assistance of Dr Anatoliy Levants of North West University) has found a filament-forming desmid (a type of green algae), *Micrasterias foliacea*, in the river. The only other known report of a filament forming *Micrasterias sp.* in Southern Africa is from a stream in Lesotho.

The NRE team has also reported the discovery of a fish, *Barbus spp.*, in the headwaters of the Mokolo and Lephala rivers, the identity of which still needed to be properly investigated at the time of writing.

CAUSE FOR CONCERN

Not all is well with the Waterberg's rivers, however. The CSIR team has expressed its concern for the region's largest river system, the Mokolo River, due not only to the variety of different land use activities adjacent to the river at present (such as agriculture and municipal sewage works), but also because this river is likely to be most

impacted by future development. The main impoundment on the river, the Mokolo Dam, is currently the sole surface water supply for the Lephala Municipality and for irrigation farmers, who use the vast majority of the river's water.

According to Arno, the team has already found elevated levels of oxidative stress within certain organisms tested at both agricultural and sand-mining impacted sites. “Our studies indicate that these organisms are showing signs of stress. We are now investigating it further by employing gene expression-based biomarkers to screen for the impact of pollution in the surface waters.”

In addition, researchers are looking into other potential water/sediment quality impacts, as well as impacts on the biological community structures of the algae, invertebrates and fish. “From our results to date it appears that the impact of nutrient enrichment is of specific concern [in the Mokolo River catchment].” Potential sources of nutrient enrichment are runoff from informal settlements, wastewater treatment works that are not functioning optimally, and agriculture.

Stakeholders (such as farmers) in the Lephala area have also expressed particular concern over sand mining activities reported in the Mokolo River. “As yet we don't know enough about the specific impacts that these activities have on the Mokolo River (and its associated biota), nor the residual impacts of these activities in the long term.”

Impacts on the Mokolo River are further exacerbated by relatively low water levels being experienced in the river over the past year.

MOKOLO RIVER STUDY

This research also forms part of Arno's PhD study, which is looking into the possible degree of risk for a variety of potential impacts on the water quality and aquatic ecosystems of the Mokolo River. This study will compare the results from

CSIR principal researcher, Dr Paul Oberholster, during a site visit to the Waterberg rivers.



Courtesy CSIR

the Mokolo River with similar data sets collected in the upper Olifants River (in Mpumalanga), which has been heavily impacted by a variety of activities (for more on the CSIR's research activities on this river, see *the Water Wheel* May/June 2013).

“At this time the Mokolo River faces the same types of risks from activities that exert progressively more serious adverse impacts on water quality and aquatic ecosystems in the upper Olifants River, including acid mine drainage, return flows from agriculture, and discharge of sewage effluent,” Arno explains.

To determine the existing levels of risk in the Mokolo River, Arno will determine several thresholds and compare them to those found in the upper Olifants River. He explains that, although aquatic ecosystems are affected by many variables, such a system is usually driven by a few key controlling variables (e.g. metals from mining activities). Associated with these key variables are threshold concentrations.

Dr Oberholster explains: “If an aquatic ecosystem consistently moves beyond a critical threshold (e.g. above a certain maximum concentration of metals) it may start to behave in a different way, often with unforeseen or undesirable consequences. These may include toxic cyanobacterial blooms, massive fish mortalities and/or high levels of microbial flora.”

The outcomes of this study will be used to detect existing processes of change in the aquatic ecosystems and estimate the likely future changes that increased mining, human population growth and water transfers will cause. “These results will provide the basis for management guidelines designed to inform and direct management actions aimed at ensuring the long-term sustainable use of aquatic ecosystems,” notes Arno. “Ultimately, with this study we hope to aid in the planning, prioritisation, management and remediation of freshwater ecosystems in the Waterberg area in



Courtesy CSIR

Sand mining is one of the anthropogenic activities placing increasing strain on the Waterberg rivers' ecological infrastructure.

the face of major future energy, coal and associated developments.”

WAY FORWARD

Results of the CSIR studies have been shared extensively with stakeholders in the Waterberg. The work has been received extremely positively to date, reports Arno, as not only water quantity but also water quality is a huge concern for many residents in the area.

The research conducted on the rivers of the Waterberg provide a

strong scientific basis on which all future decisions regarding development of the area should be based, maintain the researchers. The Waterberg is an important region for South Africa, not only because of its coal but also because of its biodiversity, relative water scarcity and ecological infrastructure. “It is therefore crucial that an integrated approach be followed using thresholds of potential concern to ensure that the rivers of the Waterberg continue to flow in as natural a state as possible for generations to come.” □

Currently the only power station in the Waterberg area, Matimba is soon to be joined by Medupi, which will be the largest dry-cooled power station in the world.



Courtesy CSIR



Lam van Vuuren

MADIBENG: The place of 'water'

Deputy Chairperson of the South African Human Rights Commission (SAHRC), Pregs Govender, shares her thoughts on recent water-related protests, which started with the death of four people in Brits.

Hartbeespoort, Rooikoppies, Vaalkop and Klipvoor Dams are located in the Madibeng Municipality. Four dams...that should be more than enough water for everyone, to drink, wash and wallow in on scorching summer days in the North West Province. The world's third-largest chrome producer and the richest Platinum Group Metals Reserve are in Madibeng. During apartheid and democracy the wealthy owners of the mines, tourist companies, agribusiness and other large industries did not experience water shortages or water cuts. Yet communities who are Black and poor, living next to the dams complained to the SAHRC that they went without water for days, weeks and months.

In this area, as in most parts of the world, the wealthiest pay less per kilolitre of water than households do. They have seldom been held to account for significant wastage; for cleaning up their pollution of groundwater with dangerous chemicals or the theft that some commit. In the suburbs, the manicured lawns are well watered and swimming pools are the norm. They enjoy the full meaning of Madibeng. Here there is abundant water.

In sharp contrast, those who are Black and poor face a daily struggle to uphold basic human dignity. There are endless queues for water. Children miss school because they have to carry containers that weigh more than their body weight. Illness and death from preventable water-borne disease is not uncommon. Women's and girls' time and safety is particularly compromised in a country with high levels of gender-based violence.

The indivisibility and interdependence of all rights is particularly reflected in the impact of the lack of water and sanitation on health. The UN Secretary General, Ban Ki Moon, estimates that health budgets would be almost halved if these rights were addressed.

The poor parts of this province are rooted in apartheid's notorious homeland, Bophuthutswana. White mines and farms sent Black workers who were too old, sick or injured 'home' to die here. Apartheid criteria for Black lackeys appointed to rule were greed, corruptibility and brutality. The job was to protect white apartheid privilege by ruthlessly suppressing

opposition. Apartheid's violence was institutionalised in brutal and dehumanising poverty and inequality that devalued human life.

Our democratic Constitution upholds the value of every human being, enshrining the right to dignity as our birth right, linking it to socio-economic rights like water and civil-political rights like peaceful protest. South Africa's wealth of natural and mineral resources should have enabled clean drinking water for all. No one should have had to resort to protest.

In the second week of January this year, after several significant periods without water, people protested in Mothutlung, Madibeng. They were shot at by the police, many of whom live in the same areas, struggling with the same frustrations for survival. The death toll is four. The Independent Policy Investigate Directorate launched an investigation, which the SAHRC hopes will act powerfully to ensure that those responsible are brought to book. Police leadership is ultimately responsible for individual police action in such situations. From Marikana to Madibeng, the 'shoot to kill' statements underline a militarised police force that resuscitates apartheid-era policing in place of the democratic vision of service. At the Farlam Commission on Marikana, the SAHRC expert police witness, Gary White (MBE), shared his 30 years of police leadership experience in Northern Ireland. This included violent protests in which protestors carried lethal weapons. Not once did he order the use of live ammunition. In stark contrast, South African police have used live ammunition in Ficksberg, Marikana and Madibeng, despite official records and independent studies confirming that most South African protestors are peaceful and unarmed.

The SAHRC finding on Andries Tatane, recommended that police be properly trained to manage large protests so the right to life is protected. The Commission maintains that if the police deployed to Madibeng had been properly equipped and trained, this tragedy would have been avoided.

The allegations of corruption related to tenders need to be urgently dealt with through the criminal justice system and the Public Protector. Those entrusted with

the public purse cannot be involved with companies which tender for water tanks and other state services. Those companies who use massive resources to corrupt those in government should also be apprehended. Many are sceptical that this will happen, pointing to the huge numbers of poor people who go to jail and stay there, while few of wealthy criminals seem to be convicted and serve out their sentences.

Since 2009, the SAHRC has been systematically addressing complaints about the right to water and sanitation. In the run-up to the last local government election, the SAHRC investigated and made findings firstly in Makhaza, against the Democratic Alliance-led City of Cape Town, in the Western Cape, and then against the African National Congress-led Moqhaka Municipality, in the Free State, that had both built toilets in open public spaces without enclosing them.

The Commission ruled that both municipalities had to urgently enclose these toilets in a manner that upheld dignity, privacy and clean environment. The subsequent High Court case in the Western Cape noted that 'the SAHRC investigated the complaint that led to considerable public interest and media reports' and affirmed the SAHRC finding, which the City initially disputed.

In addition to ensuring local government accountability, the Commission required a systemic response from national Government. In the SAHRC 2010 finding against the City, the Department of Human Settlements together with the Department of Water Affairs had to 'intervene' to ensure the eradication of the bucket system across South Africa. This should lead to the 'phasing out of communal toilets'. In 2011, the Minister established the Sanitation Task Team headed by Winnie Madikizela Mandela, which reached many of the same conclusions as the SAHRC hearings.

The SAHRC's 2011 Moqhaka finding ruled that the Presidency's Department for Performance, Monitoring and Evaluation (DPME) had to compile a report on the 'quality of sanitation services provided by local government across the country'. To compile its 2012 report to the Commission, the DPME brought together

relevant departments, including Cooperative Governance and Traditional Affairs (COGTA), Human Settlements, Water and Environmental Affairs and Finance. Inter-governmental co-operation and collaboration together with meaningful engagement with communities are critical parts of the solution.

In 2012, the SAHRC organised hearings in every province across South Africa in areas that the DPME report identified as being amongst the poorest. In packed halls members of communities from across each province presented the reality that they live with daily. Many spoke of poor quality water and sanitation services and often about the complete lack of basic services. Many participants spoke in despair and frustration about all the legal avenues they used to try to get redress.

The SAHRC invited local, provincial and national government representatives including the DPME to the hearings to respond to community's concerns and questions with clear plans and time-frames. Tragically, in the North West province and other areas of South Africa, the problems remain, as evidenced by the recent protests and killings. Last year, the SAHRC ruled against the Madibeng Municipality, along with several others. Our press release reiterated the SAHRC call for government to go beyond reacting only when communities protest to proactively ensuring that poor communities immediately access clean drinking water linked to sustainable long-term solutions.

The National Water Act enables the Minister of Water & Environmental Affairs to intervene where there are clear water emergencies at a local level. Madibeng and similar municipalities in previous homelands and informal settlements demands that the Minister use the Act's powers. Government needs to ensure proper capacity is built at every level, in all the necessary areas of competence and crucial vacant posts need to be filled. Local Government needs to have the capacity to build the necessary infrastructure, operationalise and maintain it so water flows to people's taps. Government's Indigent policy is aimed at free water and other basic services for people who are poor. However, it is not national uniform policy and many complain that it



SAHRC Vice Chair, Pregs Govender

is implemented in a way that undermines their dignity. The result is the poor end up paying more per kilolitre than wealthy corporations.

The structural, systemic problem of inequality and poverty that is still defined by apartheid spatial geography calls for an urgent evaluation of policy and governance. The DPME report notes that 'key water services sector weaknesses and challenges has been attributed to a lack of adequate funding and poor revenue collection leading to financial instability; a lack of technical, management and business skills...political interference and corruption...unclear municipal powers and functions...'

This affects not just one right...many people who are poor are denied many fundamental human rights. This crisis can only be solved by true co-operative governance. The President, his Cabinet and all spheres of Government, beyond political party affiliation, must ensure that South Africa is governed in a way that upholds the rights of all.

* SAHRC Deputy Chair, Pregs Govender, led the Commission's water and sanitation hearings across the country in 2013 as part of the Commission's wider investigation into South Africa's water and sanitation challenges. At the time of writing, the report had been finalised and SAHRC was preparing to present the report to Parliament and government departments. □



Dr. Jine van Rensburg

Is government's biofuel strategy waterproof? WRC study investigates

While the use of biofuels have been put forward as a viable alternative to the world's dependence on conventional oil, concerns over the impact of these fuel alternatives on South Africa's scarce water resources have prompted the Water Research Commission (WRC) to launch a series of investigations in this regard. Article by Petro Kotzé.

Globally, as the demand for energy is growing, so is the support for renewable energy and cleaner energy sources. As a result, the production of fuels from alternative sources has been a priority for many countries, particularly in Europe and America. The production of ethanol and diesel from vegetable biomass and oil (i.e. biofuels) has been promoted as one of the environmentally friendly alternatives to oil-based fuels.

South Africa is also making strides into this sector, and our fledgling biofuels industry has recently made the news again after the Department of Energy published the long-awaited draft position paper on the pricing regulations and rules for administering biofuel prices for comment. This is the final step in

the process of getting the potentially R15 billion-a-year South African biofuels industry off the ground. It follows a pragmatic approach towards a goal of 2% biofuel penetration within five years, and the deadline for comment was set for 10 February.

Locally, our biofuels strategy, the National Biofuels Industrial Strategy, is driven predominantly by the need to address issues of poverty and economic development. The focus of the strategy is the promotion of farming in areas previously neglected by the apartheid system and areas that did not have market access for their produce.

Yet, there are a number of concerns regarding the development of our biofuels industry. One is the impact of biofuels production

on water resources, particularly since much of the country is water stressed, and there are already severe limitations on the availability of additional water for allocation to new uses. Irrigated agriculture already uses about 60% of the available surface water and groundwater resource, and irrigated cropping for biofuels will have to find its water from existing allocations, or compete for scarce new water sources.

The Department of Water Affairs (DWA) has noted that impacts on water quality (erosion and siltation, and fertiliser and pesticide runoff) are as important a concern as impacts on available volumes available to other users and the reserve, and that best practice management for both land and water will have to be applied to all biofuels cropping, both irrigated and dryland.

Consequently, the WRC launched a scoping study on the water use of crops and trees for biofuel production, which provided initial results on the water use and growing conditions of some biofuel crops. It also highlighted key gaps in available knowledge applicable to South Africa. After its completion, a follow-up study was launched to investigate the water use and optimal growing conditions for a comprehensive range of potential crops, particularly those that was identified as in need of further research in the scoping study. This project also involves detailed mapping of suitable production areas and the projected impact of biofuel production on water resources and food supply.

The six-year project, titled 'Water use of cropping systems adopted to bio-climatic regions in South Africa and suitable for biofuel production' (WRC project no. K5/1874), initiated and funded by the WRC, will be completed in 2015. The project is led by the Centre of Water Resources Research at the University of Kwa-Zulu-Natal (UKZN) with the CSIR and the University of Pretoria. While it has already yielded useful results, much of which will be used

as reference by the DWA, it has needed to adapt to the changing regulatory environment in which it is taking place.

THE SOUTH AFRICAN BIOFUELS INDUSTRY

On 7 December 2005, Cabinet approved the development of an industrial strategy targeted at creating jobs in the energy crops with the biofuels value chain.

Biofuels supply requires low-cost, high-yield and surplus agricultural production, generally not destined for food consumption, as well as government support, particularly when crude oil prices are low. South Africa has limited arable land, only 15% of the total land available and about 10% of this land is irrigated.

However, according to the National Biofuels Industrial Strategy, in most years South Africa has surplus crop production, which could generate sufficient ethanol to meet 5% of national petrol demand. In addition, there are 3 million ha of under-utilised, high potential land, mainly in the former homelands. Utilising 1 million ha of such land could produce biofuels representing about 5% of national diesel usage.

In South Africa, the main



Courtesy UKZN

Grain sorghum with bagged grain heads to prevent yield loss due to feeding birds.

motivation for the development of the biofuels industry is the upliftment of the agricultural sector through utilisation of this under-utilised agricultural land to produce products in excess food needs, and to promote sustainable development.

Because of this, the development of the industry based on imported feedstock has not been supported, and will only be considered in times of adverse agricultural production and when local producers cannot meet the investors demand.

An initial target of 4.5% penetration level of biofuels was proposed in the draft strategy document, later revised to adopt a short-term focus (5-year pilot) to achieve a 2% penetration level of biofuels in the national liquid fuel supply, or 400

Transplanting of sugarbeet seedlings in to the trial site at Ukulinga research farm.



Courtesy UKZN

According to the National Biofuels Industrial Strategy, in most years South Africa has surplus crop production, which could generate sufficient ethanol to meet 5% of national petrol demand.

million litres pa, from 2008 to 2013.

For bioethanol, sugar cane and sugar beet was recommended while sunflower, canola and soya beans were proposed for the production of biodiesel. The exclusion of other crops and plants such as maize was based on food security concerns, as it was deemed that further research was needed to test the usability of these in the country. Questions marks were raised around the use of Jatropha, again, due to concerns around the potential for invasion.

Regardless of the approval of the strategy, no single, large scale biofuels industry player has emerged, attributed to the fact that biofuel projects on their own is not financially attractive at the prevailing feedstock and crude oil / liquid fuels process. The DoE then started focusing on the refinement of the Biofuels Industrial Strategy.

The most recently published draft position paper on the pricing regulations and rules for administering biofuel prices for comment stipulates that all oil refineries will be required to blend 2% of locally produced bioethanol into their petrol from October 2015. The choice of crops has also changed slightly to sorghum and soybeans as the bio-ethanol and biodiesel feedstock respectively. These choices have in part been motivated by the hope that it will

revive the flagging sorghum farming industry, which has collapsed following the decline in popularity of sorghum beer.

A CLOSER LOOK AT THE SUGGESTED FEEDSTOCK'S WATER USE

The approach followed in the mentioned scoping study was to first identify all field and tree crops grown in South Africa as potential biofuel feedstock, both for bio-ethanol and biodiesel production, and then assessing their water use through literature review.

Twenty crops with the potential to be used for biofuel production in South Africa were identified, guided by the South African Biofuels Industrial Strategy. Canola, cassava, Jatropha, sweet sorghum, soya bean, sugar beet and sunflower were investigated in greater detail. Sugarcane was omitted from the subset because of having previously been studied in much greater detail.

Further investigation into the potential growing areas of the crops in question revealed that, based on climatological drivers only, canola, sugarbeet, Jatropha and possibly sweet sorghum, have the potential for their production areas to be expanded. The study further showed

that, under dryland conditions, only sweet sorghum and sugarcane may have the potential to use substantially more water than that of the natural vegetation, and this have the potential to be defined as Streamflow Reduction Activities (according to the National Water Act). As such, it would need a water use license to be cultivated and would put these crops in the same category as commercial forestry.

Uncertainty also remained around certain emerging crops (like sweet sorghum and sugarbeet) as potential biofuel production.

The main aim of the current study is to estimate the water use and fuel yield of selected biofuel feedstock in regions suitable for feedstock cultivation. This will allow the project team to rate the feedstock in terms of water efficiency. "Our initial focus was led by the Biofuels Industrial strategy," says principal investigator Richard Kunz.

He explains that they looked at potential and unknown feedstock such as sugarbeet after indications were that it could be grown in fairly large scale. Sweet sorghum, that showed huge potential was also investigated, he says. Currently in its fifth year, field trials have now been conducted on emerging crops such as sugarbeet, sweet sorghum, grain sorghum, Jatropha and Moringa.

Their experience has taught them that, in general, there are a lot of the problems with these so-called wonder crops like sweet sorghum and sugarbeet, notes Kunz. Sugarbeet is a particularly difficult crop to grow in South Africa and getting it to the state where it is ready for production requires some effort. Kunz says he would think that it was lifted off the list of feedstock for bioethanol in the draft position paper for economic reasons. Similarly, grain sorghum cannot be advised to emerging or inexperienced farmers because there are other problems such as massive bird damage.



Sweet sorghum growing in an irrigated plot at the Hatfield research farm.

Courtesy UKZN

Regarding the choice of sorghum and soybeans for the bio-ethanol and biodiesel feedstock respectively, it seems to be a good choice. However, the final say on this from the project team's side will have to wait until the project has been completed.

"We're still looking at the numbers but according to preliminary results grain sorghum appears to be some of the more water sufficient option. It's also the one feedstock that can be grown in rural areas," reports Kunz.

While grain sorghum was not originally included in the choices of feedstock under investigation by this project, they have had to adapt to new information and legislations as they went along, adds project leader, Prof Graham Jewitt (Umgeni Water Chair of Water Resources Management). They are harvesting their first crop soon, and results will be included in the final report.

The project is also collaborating with another WRC-funded research project, titled 'Validation of the forcing variables (evaporation and soil moisture in hydrometeorological models)' (WRC project no. K5/2066). This project has provided water use and yield information for soybean and maize.

IS THERE LIGHT AT THE END OF THE BIODIESEL TUNNEL?

"The industry is very complex," says Kunz. "Grain sorghum looks to be the correct way forward for ethanol production, but you can't exclude sugarcane. At the moment it looks like the proposed two plants that are in the pipeline will produce enough to provide the legal blending rate. But, if you aim higher you would need to get the sugarcane industry involved. Plus, the deadline is short, and by 2015 we might only be in a better place to provide sugar based ethanol rather than sorghum, he says. At the moment we do not have the efficiency to grow all of this.



Courtesy UKZN

Two mesh bags used to protect each sorghum grain head at Ukulinga. Unprotected heads were completely stripped of seed by feeding birds.

Otherwise, we might have to import feedstock."

Even though the project results will not be ready in time for the deadline for public comment on the draft position paper, when the biofuels industry does lift off, the results from this study will be very valuable in the long-term, says Prof Jewitt. The water use results will be beneficial to the DWA, as well as the water use efficiency results as this covers the aspect of "beneficial use" in the National Water Act, says Jewitt. In general, the water use efficiency results will be useful to all potential growers.

Yet, even if the biofuels industry never gets off the ground, the research results will still not be wasted because it can be used in the food production industries or by farmers, notes Prof Jewitt. "It has been a six-year project and that has given us time to establish decent

field trials and continue with them, which is invaluable."

Research topics on biofuels are evolving constantly and in future, Prof Jewitt says that topics will move towards the understanding of second generation feedstock. This involves understanding the potential impacts of second generation biofuel production systems, in which all crop cellulose material as well as woody vegetation would qualify for use as biofuel feedstock. An example includes using eucalyptus trees.

An implication is that perennial crops and natural vegetation could then become sources of cellulose for biofuel production. Should these sources include deep-rooted, evergreen crops which are able to transpire throughout the year, impacts on catchment water yields similar to this of commercial forests could be anticipated. □

Even if the biofuels industry never gets off the ground, the research results will still not be wasted because it can be used in the food production industries or by farmers.



Courtesy UKZN

In-field weighing of heads, stems and leaves of sweet sorghum plants.

Management, tenure issues threaten Limpopo smallholder irrigation schemes



While it is recognised that smallholder irrigation schemes can make a contribution towards alleviating household food insecurity and poverty levels in South Africa, examples of vibrant and successful schemes remain relatively few. In addition to the challenges of management and infrastructure maintenance smallholder irrigation plot holders are now also facing a new threat in the form of land grabs.
Article by Lani van Vuuren.

Lerato* is part of the 200 000 farmers and their families that make a living off the country's 300 or so smallholder irrigation schemes. Her family has worked the land at Dzindi Irrigation Scheme, in Limpopo's Vhembe district, since 1954, and while she does not own the land she does have permission to occupy and use it, according to the certificate in her possession.

So imagine her surprise when arriving at her plot one day to tend her maize, she found instead of

plants the foundations of a house. Even more surprising was that the new land 'owner' could show a deed of sale allegedly given to him by the local municipality. Lerato had just been the latest victim of a land grab – a new trend that is threatening the already precarious livelihood of plot holders at Dzindi Irrigation Scheme.

The issue of illegal occupation and urban encroachment is but one of the challenges standing in the way of smallholder irrigation

*Not her real name

scheme vitality uncovered during a recently published research study undertaken by the Department of Crop and Animal Sciences of the Tshwane University of Technology (TUT) and the Agricultural Engineering Institute of the Agricultural Research Council. Funding for the five-year study, which focused on mainly smallholder canal irrigation schemes in Vhembe was provided by the Water Research Commission (WRC).

According to the final report, *Improving plot holder livelihood and scheme productivity on smallholder canal irrigation schemes in the Vhembe District of Limpopo Province (Report No. TT 566/13)*, the root of the problem appears to be the trust tenure system, which prevails at most of the irrigation schemes in Vhembe. Trust tenure is regarded as the least secure of all systems applied to African land holding, the report points out.

OVERCOMING INSECURE TENURE

In a trust tenure system, land belongs to the state and land use rights are awarded and regulated

by the state. Originally (prior to 1994) these regulations were strictly enforced and managed all aspects of plot holders' lives, from the time they were allowed to be absent from the scheme, to what they planted and when, and that they had to provide labour to maintain the irrigation works infrastructure. Disobeying any part of the regulations meant immediate eviction.

Following South Africa's democratisation the trust tenure system prevailed at schemes at Dzindi, however enforcement of the terms and conditions for occupation were notably relaxed. While this has removed many of the anxieties plot holders had in the past about losing the user rights over their irrigation plots, it has inadvertently also contributed to the deterioration of conditions on the scheme.

In addition, plot holders have seemingly lost their exclusive rights to use the land surrounding the irrigation scheme. At Dzindi, commonage land has been excised for residential purposes, bringing residential developments onto the commonage of the scheme. Township areas are now extending into canal areas, and basic housing has

Plot holders have seemingly lost their exclusive rights to use the land surrounding the irrigation scheme.

been constructed on commonage land. This is rapidly reducing the size of the land resource.

It now appears that the municipality has even demarcated plot land for residential purposes. When plot holders turned to their local chief for support they found that he too was allegedly grabbing land belonging to the irrigator community. "The WRC study has found that various power groups, both traditional leadership and local government have been grabbing land from this smallholder community," reports Prof Wim van Averbek of TUT and WRC project leader. "It is a great shame. The victims of past land policies are becoming victims once more."

When Lerato confronted the municipality she was told that the person who had built his house on her plot was in possession of a legal document that entitled him to his stand, and that even if the matter went to court, she would never win the case. "Now that the house is

The main farming system on smallholder irrigation schemes involves the production of maize and vegetables, both of which could be used for own consumption or sales.



“It is a great shame. The victims of past land policies are becoming victims once more.”

almost ready, I have problems getting a tractor to enter what remains of my plot, because the house has closed off access. I now have to ask my neighbour for permission to have the tractor drive over his plot every time I want to plough some land.”

The conflict over land at Dzindi is not unique. Similar issues have been reported at Palmaryville, close to Thohoyandou. According to Prof van Averbeke, the issue of urban encroachment on irrigation land is bound to affect schemes that become part of peri-urban areas as a result of urban expansion. “In these circumstances, the value of land increases greatly, because people are looking for residential land. On the other hand, such locations are extremely favourable for farmers, because of the closeness of substantial markets for their produce.”

Indeed, the degree of commercialisation on smallholder irrigation schemes in Vhembe was found to be associated directly with the location of schemes in relation to local urban

centres. As distance between scheme and urban centre increased, farmers were less likely to produce for marketing purposes. “Smallholder schemes of about 50 plots of 1 to 2 ha located close to towns or cities generally have the best potential to generate livelihoods linked to food value chains, particularly those involving perishables and semi-perishables,” maintains Prof van Averbeke.

In Limpopo, registered smallholder irrigation schemes fall under the Department of Agriculture, the report points out. “This department represents the state, which is the owner of the land. It is therefore the mandate and duty of that department to protect the community of registered occupants against land grabs and other forms of interference by outsiders that infringe on the user rights of the legitimate occupants of this scheme. Without this protection, the land rights of the plot holder communities are very vulnerable.” Prof van Averbeke further points out

that zoning could go a long way to halt land grabs.

IMPROVING MANAGEMENT

Lack of effective management of smallholder irrigation schemes in Vhembe has not only led to illegal occupation of farm land. It has also had a marked effect on the productivity of schemes. “Scheme management, of which water distribution and routine maintenance of the system are central, depend on a rule system and collective action in adhering to that system,” explains Prof van Averbeke. Few of the schemes investigated by the research team had such a management system in place. On the schemes that did have a management system it was generally not enforced.

On schemes where little to no management takes place, infrastructure is allowed to deteriorate rapidly. In addition there is a lack of proper scheduling of irrigation, leading to



A street trader buying green maize at Dzindi canal scheme. Most marketing of farmers' produce are in the hands of street traders.

upstream farmers extracting more than their share of water, leaving too little for those farmers situated downstream of the irrigation canal.

At Dzindi the project team discovered large holes, cracks, misalignment and missing sections along the main canal, causing leakage. Aqueducts and sections of the canal that passed under bridges were of particular concern. Canal water was also lost due to the absence of or poor working order of the gates regulating the flow of water. Plots located at the tail end of the canal received too little water to enable effective short furrow irrigation.

It was further found that of the 48 smallholder irrigation schemes investigated only 27 had a water license issued by the Department of Water Affairs. Payment for water occurred at only 17 schemes, but water was paid for by the Limpopo Department of Agriculture, not the farmers themselves.

It is important that this be improved, the report points out. "Government support for refurbishment of degraded parts of the system could be made conditional to the revitalisation of the rule system and related collective action," notes Prof van Averbeke. "Government should also monitor the collective action, especially routine maintenance. The report presents a simple procedure based on visual observations that could be used to objectively monitor routine maintenance of canal systems by plot holder communities."

According to Dr Gerhard Backeberg, Executive Manager of Water Utilisation in Agriculture at the WRC, while the findings of the study were not necessarily surprising, the consequences of the underlying causes for underperformance are a major concern. "Management deficiencies and problems with tenure are interrelated and require decisive interventions. Tenure reform is essential to ensure tenure security at smallholder irrigation schemes, while priority attention should be given to improving the knowledge

WRC SMALLHOLDER IRRIGATION REPORTS

To order the main report related to this article, *Improving plot holder livelihood and scheme productivity on smallholder canal irrigation schemes in the Vhembe District of Limpopo Province* (Report No. TT 566/13) or related production reports: *Growing green maize on canal schemes in Vhembe: Production guidelines* (Report No. TT 567/13); *Production guidelines for small-scale broiler enterprise* (Report No. TT 568/13); and/or *Guidelines on management of working animals* (Report No. TT 569/13), contact Publications at tel: (012) 3300340; fax: (012) 3312565; Email: orders@wrc.org.za or download a copy at www.wrc.org.za



and skills of smallholder farmers. This will provide incentives for individual farmers and groups of farmers to better manage the plots and schemes to the best of their capabilities."

PRODUCTION GUIDELINES

The most common farming system found on the schemes investigated involved maize. As part of the WRC project a production guideline was produced for the growing of green maize aimed specifically at farmers on these schemes. For this part of the project Prof van Averbeke and his students spent much time in the field conducting experiments.

"The work on green maize was of particular interest to farmers. Farmers' days were held to demonstrate the objectives of the experiments as contained in the treatments, and to demonstrate and discuss the effects of particular treatments," Prof van Averbeke reports. In addition, a production guideline for small-scale broiler enterprise and guidelines on the management of working animals have also been produced.

WAY FORWARD

The report has highlighted important issues in the revitalisation of smallholder irrigation schemes, notes Dr Backeberg. He continues to say that this investment in human and social capital must receive priority attention, in contrast to the usual preference to invest in physical and natural capital, i.e. infrastructure on irrigation schemes. "This report directs attention to key issues of management and land tenure, which should be addressed as a matter of urgency. A long-term approach with a focus on investment in people is necessary rather than attending to short-term, quick-fix solutions. Of course, on some irrigation schemes refurbishment and upgrading of infrastructure is necessary, but this should not receive exclusive attention."

It is only through these long-term investments in people that we will see smallholder irrigation schemes reach their full potential and become the food baskets we hope they will be. □

ECOLOGICAL RESTORATION – Giving back to SA's watercourses

It's been almost 20 years since the Working for Water (WfW) programme was launched in 1995, shining a spotlight on the need to safeguard South Africa's scarce water resources by clearing invasive alien vegetation from mountain catchments and watercourses. In the intervening years, the riparian zones of hundreds of kilometres of streams and rivers have been cleared with WfW and other Expanded Public Works Programme (EPWP) funding, as well as by NGOs and private individuals. But how effective are such clearing programmes in achieving ecological restoration? Sue Matthews reports.



The denuded riparian zone of a tributary immediately after clearing a stand of black wattle. Apart from destroying natural riparian habitat, invasion by alien trees and their subsequent removal alters the banks and bed of watercourses, with a knock-on effect for aquatic life.

Sue Matthews

A number of studies have shown that removal of alien trees increases streamflow, but concern has long been expressed that indigenous riparian vegetation cannot simply 'self repair' when river banks are left in a denuded state after clearing. Indeed, an external evaluation of WfW conducted in 2003 noted: "The WfW Programme

has made no provision for routine project monitoring or evaluation in relation to ecological responses to alien clearing. Even research in this regard is scant. Currently performance is measured on alien-clearing efficiency (hectares cleared) rather than on degree of vegetation recovery. Without measuring the impacts of clearing, managers have no idea

whether they are using the optimal approach, degrading or improving ecological integrity."

WfW responded to this criticism, and in May 2004 provided funding for a three-year research project to assess ecosystem repair targets in alien-invaded riparian zones in the fynbos, grassland and savanna biomes, under the leadership of

Dr Patricia Holmes. At around the same time, the Water Research Commission (WRC) funded a project on riparian zone invasion in the south-western Cape, conducted by the University of Cape Town's Freshwater Research Unit. Similar projects focusing on restoration were carried out by staff and students at the DST-NRF Centre of Excellence for Invasion Biology at the University of Stellenbosch, the University of Witwatersrand's Restoration and Conservation Biology Group, and Rhodes University's Botany Department. WfW contributed funding to some of these studies.

This body of research was consolidated in a special issue of the *South African Journal of Botany*, published in July 2008, entitled 'Riparian vegetation management in landscapes invaded by alien plants: insights from South Africa'. The suite of papers concluded with a synthesis of the research findings, and guidelines for improved management of alien-invaded riparian zones.

It was recognised then that where dense stands of alien plants had excluded most indigenous vegetation, and the ecological condition of the surrounding catchment area had also been highly compromised, restoration of riparian vegetation with a similar structure and function to uninvaded sites would probably be untenable. In such cases, re-establishing a vegetation cover of non-invasive and preferably indigenous species that would be resilient to re-invasion and floods, and also provide some erosion control, was the best that could be hoped for.

In less-transformed catchments, it might be possible to restore riparian vegetation via recruitment from the soil seedbank – so-called 'passive' restoration – but a more 'active' approach involving seed-sowing and planting of seedlings and cuttings would facilitate vegetation recovery and inhibit re-invasion.

More recent research in the fynbos biome has largely supported these initial findings. Saskia Fourie

was awarded her PhD in 2012 by Rhodes University for her study in acacia-infested riparian zones in the Eastern Cape, which showed that active restoration resulted in significantly higher indigenous cover after seven months, compared to passive restoration or restoring with grass. The fell-and-burn alien-clearing treatment was found to hinder passive restoration, as the high temperatures reached under burning stacks killed a large proportion of indigenous seeds, especially in the upper layers of the soil. The alien acacia seeds were more resistant to fire, and germinated faster than any indigenous species. And while grass restoration helped suppress the regeneration of the alien acacia, it did the same to indigenous species.

Sheunesu Ruwanza also assessed the effectiveness of active and passive restoration as part of his PhD through the University of Stellenbosch, awarded in 2012. Working at sites along the Western Cape's Berg River that had been heavily invaded with eucalypts, he found that there was no recruitment of indigenous species at passive restoration sites, which were instead dominated by alien herbs and grasses. At active restoration sites, germination of sowed seeds was low, but the fell-and-burn treatment yielded better results than fell-and-remove. Nevertheless, few

indigenous seedlings survived the hot, dry conditions of their first summer, while cuttings failed to establish at all.

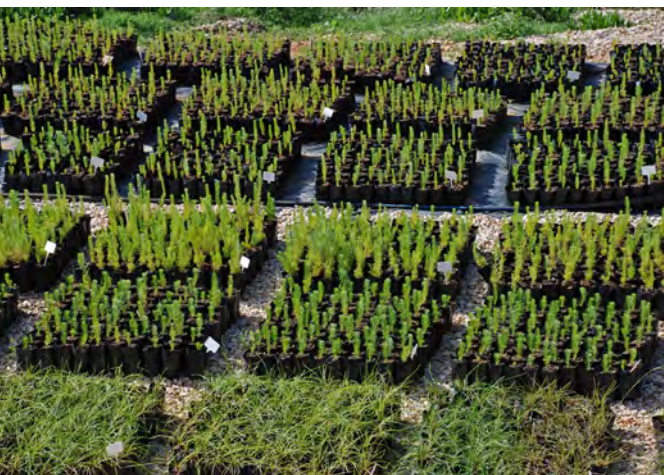
Secondary invasion by alien herbs and grasses after clearing can be attributed to nutrient enrichment of soils by previous invaders. Like many other legumes, acacias are nitrogen-fixing plants that increase levels of nitrate and nitrite in the soil, while eucalypt stands have an especially thick litter layer that releases nitrogen as it decays. Under normal circumstances these nutrients would be rapidly taken up by the alien trees, but clearing results in a sudden increase in litter and decrease in living vegetation. The resulting glut of nitrogen is thought to exclude indigenous fynbos species – adapted to nutrient-poor soils – and give alien species a competitive advantage.

A recent WRC research project by Jacobs et al., 'Identifying relationships between soil processes and biodiversity to improve restoration of riparian ecotones invaded by exotic acacias' (**Report No. 1927/1/13**), suggested that riparian soils do not accumulate nitrogen to the same extent as terrestrial soils because they are regularly flushed by floods. Nevertheless, soil nitrogen at study sites remained relatively high more than seven years after acacias had been removed.

Members of the Berg River riparian rehabilitation project team tend to young plants.



Dana Grobler



Sue Matthews

A nursery set up for a riparian restoration project in the Eastern Cape.

This clearly represents a challenge to riparian restoration, particularly since Working for Water policy for alien-clearing operations on private land has been to do follow-ups for only two years after the initial clearing, after which the landowner is expected to take responsibility for ongoing control.

“Ecological restoration is a long-term commitment”, says Prof Karen Esler of Stellenbosch University’s Department of Conservation Ecology and Entomology. “The success stories are where there’s been collective and focused attention – you need champions and dedicated groups of people that will keep on going back. Probably the way to go is to establish public-private partnerships where there are local interest groups that have a close connection to the area.”

This is the approach being taken for a riparian restoration initiative on the Berg River, driven by the provincial government’s Department of Environmental Affairs and Development Planning (DEADP). The project is a component of the Berg River Improvement Plan, drafted in response to concerns about the deteriorating condition of the river due to faecal and nutrient pollution from agricultural and urban sources.

Until recently, this stretch of the Berg River was lined with eucalypt and acacia trees. One of the aims of the provincial government’s riparian zone rehabilitation and management project is to raise awareness among farmers of the need for riparian buffers to reduce agricultural runoff.

A service provider, Blue Science, has been awarded a three-year contract to rehabilitate riparian areas that have been cleared of aliens by either Working for Water or Landcare. The aim is to demonstrate the benefit of re-establishing a buffer zone to improve water quality by absorption of run-off and reduction of erosion.

“So far we have five sites at Hermon, just downstream of Wellington, but with the next planting season this winter we are looking at identifying new sites in the Franschhoek and Paarl areas,” says Jason Mingo, Berg River Task Manager in DEADP’s pollution directorate. “Within the last year we have planted just over 22 000 plants comprising 24 species. The teams are watering these regularly, although in some cases farmers have agreed to install irrigation systems. The plants’ survivability in the first year will guide us in terms of which species

are more adapted to the very harsh and stark conditions that are created when you clear a section of bank of all alien vegetation.”

“The reason we’ve focussed on this stretch of the river is that it’s far removed from any natural sources that would allow for recolonisation by these types of fynbos species,” he explains. “We hope to re-establish pockets of natural vegetation that will over time reseed newly cleared areas on the river.”

“We’ve established an advisory committee to bring all the role-players and stakeholders that are involved in such activities together, to allow for effective planning and to understand who’s doing what where. The idea is to identify key partners, such as local conservancies and the Biodiversity and Wine Initiative, that can help raise awareness around the reason we need these riparian buffer zones to the relevant farmers and farm managers.”



“The sites we’re currently working on total only 2.2 km, which is a drop in the ocean in terms of the almost 300 km length of the entire system, but the vision of the Berg River Improvement Plan is to begin the process of introducing water stewardship among the various landowners, organisations and stakeholders along the river so it becomes not just a government initiative, but a partnership where we assist each other in rehabilitating the banks of the river.”

Prof Esler, who serves on the advisory committee, says: “The project is an important initiative because it’s bringing a whole range of different groups around the table for a common interest.” She adds that this is also the motivation for a proposal to establish a South African restoration network, which would improve communication between scientists, policy makers and practitioners, and help close the ‘knowing-doing’ gap.

She has recently been involved

in a WRC-funded research project, led by Dr Phumza Ntshotsho of the CSIR in Stellenbosch, to investigate the feasibility of establishing such a network – possibly a regional chapter of the international Society for Ecological Restoration. A workshop was held at the end of February to explore the idea. “My interest in the network is in focusing research attention and also allowing us to learn from each other, so it’s not just individuals doing research here, there and everywhere, but collective learning as well.”

A bibliometric analysis conducted as part of the project revealed that 141 of the 191 journal articles on restoration or rehabilitation in South Africa published since 1994 focused on terrestrial ecosystems, with only 19 and 14 articles reporting on riparian and aquatic studies respectively. About a third of the terrestrial studies related to mining, with invasive alien vegetation studies lagging well behind in second place.



DEADP/Western Cape government

The fynbos star-apple or bloubessie (Diospyros glabra) is one of the species being planted in cleared areas along the Berg River. It is hoped that such taller shrubs will ultimately shade out the grass and improve conditions for natural groundcovers and low-growing riparian species.

However, a recently completed WRC-funded research project by Blynnaut et al., which examined the costs and benefits of eight restoration projects countrywide and assessed the potential market for ecosystem goods and services associated with restoration, found that those yielding water services had a relatively high likelihood of success as well as high payoffs. In contrast, the one mining-related restoration effort studied was considered something of a ‘white elephant’, as significant resources have been committed to it with proportionally little reward and a low probability of success. (For more on this WRC project, see *The Water Wheel*, November/December 2013.)

“It’s obviously a big challenge to source funding for restoration projects, but we found that it is worth investing in those that are linked to some kind of water service, because South Africa is such a water-poor country,” says Prof Esler, a member of the project team.

“Around the world, ecological restoration is coming to the forefront now, because we’re realising that we’ve degraded the services that ecosystems supply to such an extent that there’s a feedback to our well-being. That’s not to say restoration is replacing conservation – conserving intact habitat has to happen in parallel, but it’s just simply not enough.” □



John Hishin/Game Plan Media



Courtesy of Adele Low

If it were not for the brave action of a group of miscellaneous men more than a century ago, Pretoria might not have the privilege of its Fountain water resources, still in use today. Article by Adele Louw.

Several interesting articles on the history of the Pretoria Fountains have recently appeared in *the Water Wheel*. Few people, however, know about an incident during which the future of these fountains were threatened and saved, in the nick of time, by a special commission whose findings led to significant changes in the approach to dolomitic groundwater and Water Law that ended up being applied for almost a century and which had a significant repercussions on mining in the Far West Rand.

On 16 January 1905 an Inter-Colonial Irrigation Commission was established by the then Governor of the Transvaal. The commission was led by a Judge of the Transvaal Supreme Court, JW Wessels. Other members of the Commission were WL Strange, the Director of Irrigation for the Transvaal, J Rissik, the former Surveyor-General to the South African Republic, JA Nesor, an Attorney-at-law and the Mayor of Klerksdorp, Capt. BHO Armstrong, RE Director of Relief Works ORC, ER Grobler, a landowner and farmer

who was also the former Vice-President of the Volksraad in the Orange Free State and CDH Braine, Executive Engineer of the Transvaal Irrigation Department, who was the Commission's Secretary.

The Commission was given various tasks, one of which was to look into the precautions necessary in dealing with subterranean water, especially water that flowed in areas situated in the dolomite formations. This task had been mooted as a priority to prevent, as far as possible, the diversion of such water from public streams and fountains to the detriment of the public and, to avoid raising concern, the target area was from the Bank spring to Gerhardminnebron.

This fear was not unfounded as the owners of land where there were underground channels feeding large springs could, at the time, consider the groundwater as 'private' and use their position to 'blackmail' downstream users. The Commission noted that Pretoria's water supply was at risk if "someone situated above the fountains (a) may open up the channels and reservoirs which supply the Aapies River springs with water, (b) and that by erecting suitable pumps they may so exhaust the supply as to deprive Pretoria and the riparian owners of water."

The Commission obtained full oral and written evidence and also visited areas where the impact of

their findings could lead to improved conditions. Various places, mostly in the Pretoria area and what is now the Far West Rand, were visited.

The Commission relied on the evidence of 40 witnesses to draw up their findings. It was noted that a large pumping station at Zuurbekom, where about two million gallons of water were pumped daily to supply Johannesburg with water, was the only example in South Africa, at the time, where the effect of pumping water from the dolomites could be seen on fountains and on neighbouring streams. The commissioners also found that this pumping station had most probably led to the drying up of the Klip River, and that the rapid dropping of the water at the Klip River's eye synchronised with the pumping at Zuurbekom.

LEGISLATION

At the time the Commission was appointed, legislation which dealt with subterranean water was based on Civil Law. The English Common Law was used, and adopted the same principles as the Civil Law. This law, when applied, meant that the owner of a piece of land was entitled to use everything found upon that land, everything about that land and everything beneath the land as far as he could reach it. Accordingly, an owner could also use all the water on the land, whether it was found above, or below ground, as long as it was not used in such a way that it became a nuisance to others.

If, however, the water flowed from a higher level over an individual's property in a well-defined

"Owners of land where there were underground channels feeding large springs could...use their position to 'blackmail' downstream users."

Left: The area near what is now known as Carletonville where the Wonderfontein Cave is situated.

Right: Water flowing from the Lower Fountain of Pretoria, with the historic pumphouse in the background. This dolomitic resource has faithfully supplied water to the centre of Pretoria for over 150 years.



Lani van Vuuren



Courtesy of the FWRDWA

The entrance to the Wonderfontein Cave, where the Commission did much of their investigations.

channel, and was of sufficient volume that it could be used by several land owners, then the land owner could only use it in such a way that he did not interfere with the use

of neighbours who were situated on a lower level. In this case, the landowner had no ownership of the water that flowed over his ground, although he had the right to take a part of it for his own use.

The Act differentiated between 'private' and 'public' water. The question of whether or not water in geologic dolomitic formations flowed in defined channels was thus the definitive factor in determining whether the upstream use of water was legal, or not.

Up to the time of the appointment of the Inter-Colonial Commission, no one was sure of the exact manner in which water flowed through the dolomites, or if the water flowed at all.

During their investigation, the Commissioners visited the Wonderfontein Valley between Bank Station and Frederikstad, inspecting the upper and lower Wonderfontein eyes and the springs at Turffontein and Gerhardminnebron. They also explored the Wonderfontein and Welverdiend caves, in which they

followed, for a considerable distance, substantial streams of water running through large caverns and passages.

In addition, the group considered the effect of pumping from dolomite and its probable consequences. They argued that, according to the evidence of technical witnesses, there is no limit to the amount of water that can be raised by pumps to the surface in a dolomitic area.

PUMPING AT ZUURBEKOM

During their visit to the Klip River, the members of the Commission found the practical consequences of the effect of heavy pumping on the dolomites. Large volume pumping commenced in 1892, before the Rand Water Board, established in 1904, was instructed by the Crown Agencies for the Colonies that sustainable water had to be delivered to Johannesburg and the townships, as well as the mining industries in the Rand area.

The Commission also found that there is a considerable difference between pumping from the dolomite formation and from formations where water permeates the mass and does not flow in channels. Where water is found in the latter state, uniformly distributed in the ground, pumping is not so rapid and exhausting a process as when water is pumped from the dolomites.

This meant that someone pumping water from the dolomites, or who dug a well in the correct place could stop the flow of an eye as well as the stream, or river being fed by it.

PRETORIA'S WATER SUPPLY UNDER THREAT

The appointment of the Inter-Colonial Commission was a direct response to the threat posed by those who sought to deplete the dolomites feeding the Fountains and hold Pretoria to ransom. In fact, Pretoria was totally dependent on the dolomitic water until the early 1930s when the city was connected to the



The Sammy Marks Fountain originally stood in Church Square serving dolomitic water to the town's residents.

“The appointment of the Inter-Colonial Commission was a direct response to the threat posed by those who sought to deplete the dolomites feeding the Fountains and hold Pretoria to ransom.”

Rand Water Board supply.

One of the witnesses interviewed by the Commission, a representative of the Transvaal Agricultural Union, Mr FT Nicholson, told the Commission that he believed that someone was making illegal use of the water and that he also believed that the water was being wasted. Nicholson even added that someone threatened in his presence to put down a bore-hole and take away the water supply of Pretoria.

The Commission then interviewed the alleged perpetrators, Stephanus Petrus Erasmus and his brother, Daniel Jacobus Elartus Erasmus, who respectively stayed on the farm *Rietvlei* and on the adjacent farm *Garstfontein*, situated just south-west of Pretoria. Another farm, owned by Erasmus (Sr), *Rietfontein*, contained the springs of the Pienaars River.

The Commission also spoke to the son of Stephanus Petrus Erasmus, Daniel Jacobus Elartus Erasmus (Jr). The hearing during which they were questioned took place in the Palace of Justice in Pretoria on 11 April, 1905.

Although the Erasmuses argued vehemently that the legislation regulating such water use should not be changed, the Commission decided that the water in the dolomites had to be protected and that no individuals should be allowed to endanger the water supply of towns by excessive pumping from the dolomites.

The Commission recommended that while it may be to the public's advantage to allow the owner to sell water to towns, or persons, or bodies requiring large supplies, legislative

sanction must first be obtained and that the Government should have the power of applying to the Court to prevent persons from pumping where this interferes with the water supply of a town, or populated area, whether the Government is a riparian owner, or not. In such a case, if the Court grants a perpetual interdict, the owner would be entitled to compensation on the basis of the advantage which was the actual use of the water.

The Commission, however, also recommended that farm owners must be allowed to freely pump subterranean water for their own use, whether for watering cattle, or irrigation and that mine owners should not be restricted from mining because simply by doing so, they may strike subterranean water.

Traffic in underground water should also be prohibited, thus land owners should not be allowed to sell, or barter underground water which he does not require for his own use.

Other recommendations were that:

- The Government should have large powers of expropriation where the pumping, or the deflection, of the underground water interferes with the water supply of a town, or populated area, subject to the general rule of adequate compensation;
- It is unnecessary to prove that water in the dolomite formation flows in channels;

- This be accepted as prima facie by the courts, and
- If the judge deems that the facts establish a connection between the pumping and the diminution of the water in a stream, he could prevent the pumping to the extent he thinks fit.

IMPACT ON LEGISLATION

As a result of this investigation, the Commission recommended that water contained in dolomitic geologic formations should be controlled by law. The first legislation which set out to control the use of dolomitic water was the Transvaal Act (Act 27 of 1908). According to Article 51 of this Act, “All subterranean water in the dolomite formation shall, until the contrary is proved, be presumed in Courts of Law and other places to flow in defined channels,” which by Roman and English Law considered such flows to be ‘public water’.

This Act led to the Irrigation and Conservation of Waters Act of 1912 (Act 8 of 1912), which stipulated that until proven otherwise, all subterranean water in dolomites must be deemed by the Courts to flow in ‘known and defined channels’ and that farm owners were not allowed, without sanction of Parliament, to sell, give, or dispose of underground water. □

The collection chamber protecting Pretoria's Lower Fountain.



Gerrit Burger

Collaborative conservation effort to save one of SA's smallest frogs

Several organisations and individuals across South Africa have joined forces in the fight for the survival of the small Pickersgill's Reed Frog. Article by Petro Kotzé.

Frogs always seem to get the short end of the fairy tale – being as they are depicted as the exact opposite of the handsome prince. Unfortunately, it also appears that the tale of many frog species are dangerously close to an unhappy ending.

Amphibians are the most threatened vertebrates on Earth,

with 32.5% of species currently Red Listed. Locally, the situation is not much different and, to a large extent, the survival of one specific amphibian is now dependent on people taking note of it, and even more so, planning future developments around its heartbreakingly small remaining habitat.

Luckily for this frog, reports Dr Jeanne Tarrant, Manager of the Endangered Wildlife Trust's Threatened Amphibian Programme, they are making good progress, and the private property owners on whose land the remaining habitats of the Pickersgill's Reed Frog occur are coming to the party.



A male Pickersgill's Reed Frog.

A UNIQUE AMPHIBIAN

The Critically Endangered Pickersgill's Reed Frog (*Hyperolius pickersgilli*) is a small hyperoliid frog (a group of sedge and bush frogs). First described in 1982, it is named after the herpetologist Martin Pickersgill, who discovered the species at Mount Edgecombe in 1978. The original specimen was found at Avoca in Durban. Due to extensive urban development and wetland drainage, these two historical sites no longer exist.

These tiny reed frogs only measure up to 29 mm, the maximum size for females. Males and juveniles are usually brown in colour, and are characterised by a dark-edged, light, torso-lateral band running from the snout to the hind quarters on each side. The underside is smooth and pale, while the inner thighs, toes and fingers lack pigmentation. The snout extends only just beyond the nostrils and is slightly pointed. The frog's call is a soft, insect-like chirp.

Pickersgill's Reed Frogs are described as habitat specialists that require perennial wetlands comprising dense reed beds in Coastal Bushveld-Grassveld at low altitudes. The

perfect habitat includes thick vegetation such as Snakeroot, from which males call, and taller broad-leaved vegetation, including the Common Reed, Bulrushes, and sedges on which the frogs lay their eggs.

The wetlands these frogs like to inhabit should not be burnt regularly in order for a layer of decaying vegetation to form over the water surface. They also require perennial standing water of between 20 and 60 cm deep. Outside the breeding season, these frogs can move up to 2 km from these sites for foraging.

The Pickersgill's Reed Frog is endemic to a narrow and extremely fragmented range within 16 km of the KwaZulu-Natal coastline. They are known to still occur in only 20 isolated sites between St Lucia in the north and Sezela in the south. The majority of these sites are located on privately or commercially-owned land, and many are experiencing ongoing decline in habitat quality.

Some sites even face the threat of complete elimination as a result of industrial development. Only two sites are placed within statutory protected areas; the Umlalazi Game Reserve and the iSimangaliso Wetland Park.

Without intervention there is a very real danger that this special amphibian will go extinct. As a result, the plight of the Pickersgill's Reed Frog has been taken up by the EWT's Threatened Amphibian Programme (TAP), which has highlighted this species as a priority species for conservation action.

*Dr Jeanne Tarrant,
Manager of the EWT's
Threatened Amphibian
Programme.*



EWT

MAKING A PLAN

The TAP Pickersgill's Reed Frog Recovery Project, in conjunction with several partners including Ezemvelo KZN Wildlife, entails a comprehensive plan with a variety of objectives.

Firstly, the team is developing a Biodiversity Management Plan for Species (BMP-S), potentially the first for an amphibian species in South Africa. A BMP is warranted because this species has been provisionally listed as a Threatened or Protected Species (TOPS) under the National Environmental Management Biodiversity Act in 2013.

The BMP for the Pickersgill's Reed Frog will guide management plans for its habitat to ensure the long-term survival of the species. This needs the input and support of all the stakeholders and property owners, of which there are at least 15 that are well-placed to influence the future of this species. Dr Tarrant reports that they have received positive support from these parties and, following a stakeholder meeting at the end of last year, this process is progressing.

While they still have to knuckle down site-specific stipulations, the main threats as well as the concurrent necessary mitigation action have been identified. According to Dr Tarrant, these include the maintenance of a terrestrial buffer zone with natural, indigenous vegetation

Mount Moreland, one of the few remaining sites where the Pickersgill's Reed Frog can still be found.



EWT

Top right:

Johannesburg Zoo is one of the organisations involved in establishing a captive breeding population of the Pickersgill's Reed Frog.

Bottom right:

Facilities such as these at the Johannesburg Zoo are used to breed a captive population of Pickersgill's Reed Frogs.



Petro Kotzé



surrounding the frogs' core habitats. It further includes the removal and management of alien invasive plants, and the prevention of siltation entering the wetlands that the frogs call home.

The EWT is also aiming to secure at least 30% of the total population of the Pickersgill's Reed Frog in the next three years through habitat management, stewardship and land acquisitions. Dr Tarrant notes that a good example of this is their dealings with the eThekweni Municipality to help them purchase a specific property from the land owner.

The team is also looking at establishing Biodiversity Stewardship Programmes, a key mechanism to secure priority biodiversity on land outside of state-owned protected areas where the landowner is willing to enter into

a voluntary conservation agreement. It is hoped that Mount Moreland, a small village on the North coast of KwaZulu-Natal, next door to the new King Shaka International Airport and Dube Tradeport, will be secured under such an agreement. A freehold property available to prospective investors and developers, it is also home to what is probably the biggest remaining population of Pickersgill's Reed Frogs outside a protected area, explains Tarrant.

They are also considering relocation and re-introductions where necessary. One of the precious few remaining populations, for example, is on the site of Transnet's proposed digout-port in Durban, set to be the biggest port in Africa on completion. Dr Tarrant says they are working with Transnet to secure this

population, and possibly relocate it to suitable habitat nearby.

While the current existing populations are being kept a close eye on, Dr Tarrant is also on the hunt for any potential new subpopulations. To do this, she has identified 80 wetlands that are suitable for this frog and has visited each to see if they are present. Her team is also engaging with the public, and follow up on any leads from people that think they might have found some of these frogs. Unfortunately, none of the leads have borne any fruit. Dr Tarrant is not deterred, saying that her feeling is that more populations "will be revealed over time."

Another option is the restoration of historical sites, and facilitating restoration with relevant partners where appropriate. Such an example is Simbithi, a 430 hectare eco-estate. Described as a "natural, coastal paradise with indigenous riverine vegetation, lush valley wetlands, undulating hills and distant, breath-taking vistas," the wetland habitat inside the development, but has been badly affected by sugarcane farming in the past, but is now returning to a state that is very suitable to the species. According to Dr Tarrant, the property owners here are excited about conserving the Pickersgill's Reed Frog, and are assisting with monitoring the populations on the estate.

GETTING A GRIP ON THE POPULATION

Another tier of the Pickersgill's Reed Frog Recovery Project is the development and implementation of a standardised, long-term monitoring protocol at priority sites, in order to ascertain population trends, threats to populations and responses of populations to management interventions.

The team has completed a proposed methodology and were able to implement trials at Mount Moreland throughout the last breeding season from October until mid-February. They are also testing the

methodology at Prospecton, the proposed Dig Out Port site, in order to estimate population size. Dr Tarrant says their attempts “have been very successful over the most recent breeding season” and they were able to learn new, interesting facts about this special creature.

Their methodology includes surveillance by listening for the frogs’ call to count them, and monitoring work. The team divides the wetland into transects through which they then move to complete their work. Except for a better idea of population sizes, they were also able to find out more about which temperature is ideal for the frogs, and how they react to rainfall.

While it sounds easy in theory, the reality is much different. “You are up to your armpits in mud and the reeds are cutting you to bits,” notes Dr Tarrant. “To find two or three frogs every hour or two is very good going.” Eventually, the plan is to train staff at these various sites to do the monitoring and take responsibility for collecting the data.

Now that the collecting season is over, the project is focusing on other aspects like the frogs’ genetics. The team is interested to find out how the frogs have been affected by the fragmentation of their habitat and the resulting isolation of populations. They also need to know what the impact will be on population genetics should they be relocated or reintroduced into the wild.

The frogs to be introduced into the wild will hail from the captive breeding programmes currently on the go in the Johannesburg and Pretoria zoos and, most recently, the uShaka Marine World.

The first collection of 30 adults by Johannesburg Zoo was done in 2012, says Dr Tarrant, and later, ten of these went to the National Zoological Gardens in Pretoria. The programme seems to be progressing well. “Last year we had quite good breeding success,” she says. The adding of uShaka to the mix is a wonderful and logical development, she says. In order for

successful breeding in Pretoria and Johannesburg, the breeding rooms have to be strictly regulated to maintain certain temperatures and climatic conditions. As uShaka is so close to the frogs’ home ground, creating the correct habitat should be somewhat easier.

While the breeding successes in captivity are great news, Dr Tarrant stresses that the ultimate goal is their reintroduction into the wild.

ARE THEY WINNING THE BATTLE?

Dr Tarrant is positive about the future of this species. One of the most important facets for their survival is to raise public awareness around the precarious position that the Pickersgill’s Reed Frog, and many other amphibian species are finding themselves in. And, this seems to be happening. Frogs don’t always have the best public perception, she says, but this is changing as people are learning more and getting more

excited about the prospect of becoming involved in their conservation.

“For example, frogging, where the public gets to participate in surveillance and monitoring work, is gaining popularity, and we are trying to spread the word and benefits of backyard-conservation,” she says. For frogs, this could be as easy as keeping a pond in your own yard.

The protection of this species is also increasingly getting a stronger legal foot to stand on. While the BMP-S is not legally binding, Dr Tarrant notes that once the Pickersgill’s Reed Frog is included in the revised TOPS list (NEMBA), habitat destruction of this endangered species will be prohibited. If the the necessary TOPS amendment is passed before mining licenses are approved that is set to take place on some of the frogs’ habitats, they will have an uphill battle to get permission to start this activity.

Concludes Dr Tarrant: “I would like to think that the frog crisis is one that we can still remedy.” □

While the breeding successes in captivity are great news, the ultimate goal is their reintroduction into the wild.

TAKE A LEAP FOR FROGS

The EWT Threatened Amphibian Programme (TAP) held an awareness day for South African frogs on Friday, 28 February. The Leap Day for Frogs is the one day of the year when ordinary South Africans can take a leap of actions and do something to appreciate and protect one of the most threatened groups of animals on Earth: Frogs. The EWT TAP also uses the day towards the protection and conservation of three of our most endangered frog species: the Amathole Toad, Pickersgill’s Reed Frog and Western Leopard Toad. For more information, and to learn how you can get involved, visit <http://www.leapdayforfrogs.org.za/>





Signing of the first Impilo Yabantu franchisee on the 30 January 2014. Pictured from left are Oliver Iwe, MD of Amanz' abantu Services (wholly owns the franchisor, Impilo Yabantu), Nocawe Lupuwana, the franchisee, and co-director, Otto Delihlazo.

Better sanitation services to schools, municipality, thanks to franchising

It will take unconventional thinking to solve South Africa's obstinate sanitation challenge. Thanks to the persistence of one engineer, a private sector partner and the Water Research Commission (WRC), an award-winning alternative solution to effective water and sanitation service delivery is now available. Article by Debbie Besseling.

When one considers the concept of franchising in South Africa, the first businesses that come to mind include those selling fast food and petrol. But, what about applying the franchising concept to water and sanitation? It can be done, says Dr Kevin Wall of the CSIR Built Environment, and he has proven it.

Dr Wall has explored the concept of water and sanitation services franchising with the WRC for a number of years, with one of the first reports published in 2005. This report, *Development of a framework for franchising in the water services sector in South Africa (Report No. KV 161/05)* identified the need for partnerships between public, private and civil institutions in order to achieve the objectives of water services delivery. At that time it was highlighted that a number of partnerships had been successfully implemented both internationally and in South Africa, however, they had been for larger scale contracts in which investment in new infrastructure had played a prominent role.

According to the report, franchising is "an alternate service delivery institutional concept that would be more suited for the on-going

operation and maintenance of water services systems, rather than investment for new infrastructure." The concept was recommended as it structures the operation, facilitates the setting up of the business, and provides the supporting structure thereafter.

This initial report investigated the concept of franchising, focusing on the legal, socio-economic and institutional context of the South African water services sector. It was highlighted that water services franchising had the potential to deliver water services as well as promote local economic development, small, medium and micro enterprises development and black economic empowerment. Overall, this first study of water services franchising partnerships indicated that there were opportunities in the water services delivery chain, and it was

recommended that these be further investigated.

Acting on these recommendations, the WRC funded follow-up studies. In 2010, Dr Wall, with private sector partner, Olive Ive of Amanz'abantu Service, published another series of reports, the main one titled: *Going with the franchising flow. An exploration of partnerships for the operation and maintenance of water services infrastructure (WRC Report No. TT 432/09).*

Dr Wall notes in this report: "How is it that one can go to some parts of our country and buy clean petrol and clean (if, arguably, unrepresentative of good dietary practice) hamburgers, but cannot get clean water from a tap or hygienic and environmentally acceptable sanitation? Especially when the oil from which the petrol is made has to be imported from very far away, whereas the 'raw material', so to speak, for the clean water can be sourced from relatively close by?"

In this study, Wall and Ive examined what made the fast food outlet, or petrol station work as well it does and what the operational principals are behind this. The authors also explored how these principles can be applied to providing acceptable sanitation and clean water.

Among others, the report discusses the WRC's research of a partnership concept, which made use of the principles of franchising, for improved water services infrastructure operation and maintenance. In this concept, ownership of the water services infrastructure remains with the public sector (e.g. the water service authority). "The principle of water services franchising partnerships is the creation of a pool of appropriate expertise upon which the local operators can draw," explains Dr Wall.

Several key success factors for franchised water services partnerships were identified. These include:

- Franchisor has an existing successful business to study, model and systematise

- Clear definition and understanding of the product, the customers and the market
- Simplicity and replicability through systems (i.e. personality cannot be replicated, but systems can)
- Local applicability of the concept. (Some concepts cannot be exported for a variety of reasons, including cultural reasons)
- Training (and retraining) schemes
- Franchisee understands franchising and his roles and functions, and can manage his expectations
- Franchisee has some commercial background or a culture of trading
- Franchisee puts some equity into the business
- Franchisor invests in the franchisee
- The franchisor/franchisee relationship is sustained for the planned franchise period
- The local community accepts the franchise concept and this particular franchise
- The local community accepts the particular person of the franchisee
- Continuous franchisor support of the franchisee: including redesign, market research and quality and performance audits

THE GENERIC PRINCIPLES OF FRANCHISING PARTNERSHIPS

- Franchises' success is based on replication of success, efficient logistics and a trained and capacitated workforce.
- Franchisee small businesses are relatively easy to establish.
- Franchising is robust, and able to ensure consistent quality products and services.
- Franchisees are obliged to adopt the tried and tested systems and procedures of the franchisor, and to accept the quality control of the franchisor – resulting in higher quality assurance and greater efficiencies.
- Franchises are able to innovate and develop constantly.

The concept of franchising in the water sector now well proven, it was time to pilot the concept. With additional funding from Irish Aid and in partnership with the Eastern Cape Department of Education, a three-year pilot project was rolled out in Butterworth, in the Eastern Cape. The project saw a number of emergent micro-entrepreneurs being trained and mentored, then taking up the routine servicing of water and sanitation facilities at 400 schools of the Butterworth Education District. The micro-entrepreneurs are franchisees in a social franchising partnership with Impilo Yabantu, a subsidiary of Amanz'abantu.



Drums, filled with sanitation waste from households in Dutywa, are loaded for safe disposal.

Trainee franchisees and their employees during the pilot in 2010.



The experiences of the project are captured in the latest franchising report of the WRC, *Social Franchising Partnerships for Operation and Maintenance of Water Services: Lessons and Experiences from an Eastern Cape Pilot (Report No. TT 564/13)*. According to Dr Wall, the report clearly illustrates the suitability of social franchising partnerships under these circumstances, and develops a model which can be used for rolling out similar services to the rest of the more than 4 000 rural schools across the Eastern Cape if not nationally.

In addition to the schools services, the pilot was extended to the pit-emptying of 400 household toilets for the Amathole District Municipality. This was also successfully completed.

An employee from Impilo Yabantu at work.



The report boasts some significant numbers. The learners at the 400 schools have benefited tremendously, especially the girl learners, who now have access to private, clean and hygienic toilets. According to Dr Wall, the sanitation improvements have seen an increase in attendance rates at schools which are being serviced.

Furthermore, six emergent franchisee micro-entrepreneurs have been established and supported. A training programme has also been developed, consisting of formal training, on-site mentoring, regular get-togethers, report backs and sharing of experience, and ad hoc training. Operational methodologies for school and household situations have been developed.

More than 20 sustainable jobs and more than 50 part-time informal employment opportunities have been created (mostly taken up by rural women). A public-private partnership, supporting job creation and the establishment and nurturing of emergent micro-entrepreneurs, has been created.

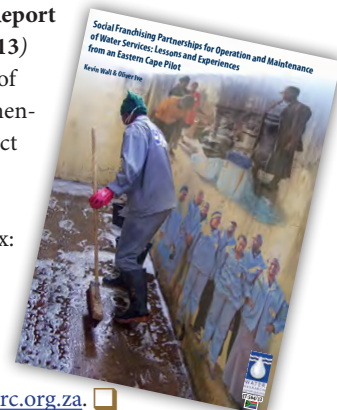
“The concept of social franchising partnerships for the operation and/or maintenance of water services infrastructure has been shown to work successfully in two different situations, i.e. routine servicing of schools sanitation facilities and

household facilities, both with VIP toilets,” notes Dr Wall.

Introducing franchising to the South African water and sanitation sector has not ended with the pilot project. In January, a significant milestone was reached when Impilo Yabantu (the franchisor) signed up its first franchisee, Nocawe Lupuwana, who will trade under her own dedicated franchise company, IY East London (Pty) Ltd, trading as Impilo Yabantu East London. According to Dr Wall, four other micro entrepreneurs who have been working with the franchisor since 2010 will be following shortly.

“This is a significant step in increasing the quality and reliability of our services, as well as improving our water and sanitation infrastructure,” reports Dr Wall. “The social franchising partnerships for water services infrastructure operation and maintenance concept addresses the requirements of many of South Africa’s national goals, including: job creation, transfer of workplace skills, micro-enterprise creation and nurturing, broad-based black economic empowerment, and most important of all service delivery, through operation and maintenance activities that increase the availability and utility of infrastructure, and the quality and reliability of services.”

- To order the report, *Social Franchising Partnerships for Operation and Maintenance of Water Services: Lessons and Experiences from an Eastern Cape Pilot (Report No. TT 564/13)* or any other of the reports mentioned, contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; Email: orders@wrc.org.za or Visit: www.wrc.org.za. □



Southern African Society of Aquatic Scientists – serving the region for 50 years

It has been 50 years since a small group of scientists passionate about South Africa's aquatic environment decided to come together to form the Southern African Society of Aquatic Scientists (SASAqS). Deidré West traces the history of this remarkable society of water experts.



Dr Helen Dallas and Prof Brian Allanson at the SASAqS conference in Arniston in 2013.



Prof Jenny Day with daughter, Belinda and granddaughter, Katherine, with Prof Day's gold medal awarded at the 2013 conference.

It was 5 July 1963 and members of the South African Association for the Advancement of Science (S²A³) were gathered in Pietermaritzburg for the association's symposium. On the agenda was a discussion on the biology of southern African rivers.

The small group of biologists gathered there made use of this opportunity to hold a meeting the night before, which was chaired by Prof Brian Allanson. They founded the Limnological Society of Southern Africa (LSSA) at a time when few were even aware there was such a word as 'limnology'. The original society had 74 ordinary members, seven student members and seven corporate members. The first committee consisted of Dr AD Harrison (president),

Prof BR Allanson (vice-president), RG Noble (secretary/editor), Dr SC Seagrief (treasurer) and RS Crass (committee member).

By 1964 the Society had 121 members and had applied for membership of SIL (*Societas Internationalis Limnologiae*). This too was the year in which their first annual general meeting was held in Kimberley, and it was agreed to produce a bibliography of limnological topics for Africa south of the Sahara. Originally Mark Chutter was the compiler but, as work piled up, he was joined by two more editor/compiler – Profs Allanson and Marjorie Scott. The 1964 (Kimberley) and 1965 (East London) conferences were joint meetings with S²A³, but in 1966 LSSA felt strong enough to organise a conference of

its own, which was held in Pietermaritzburg, the founding location.

In 1967 Pretoria was the venue for a joint meeting, again with S²A³, but this time including a special limnological symposium – *Effects of Land Usage on the Aquatic Environment*. The eminent British limnologist Dr EB Worthington chaired the 1968 meeting in Grahamstown, while 1969's meeting was one to remember as members of the Society travelled up to the new man-made reservoir on the Zambezi – Lake Kariba.

This trip was in accord with the title of the association 'Southern Africa' and was to become a habit! At the 1970 AGM in Stellenbosch it was decided to de-affiliate from S²A³ and Dr Harrison handed the presidency over to Prof Allanson. After the 1971

This small group [of biologists] founded the LSSA at a time when few were even aware there was such a word as 'limnology'.

Courtesy of SASAqS

AGM, once again in Pietermaritzburg, the Society's members visited Lake Malawi in 1972.

Dr Amy Jacot Guillarmond writes in an 1988 article in the *Journal of the Limnological Society of Southern Africa* how members "sampled the luscious local strawberries on Mount Zomba, the range of delicious freshwater fish, enjoyed the vistas of the huge and scenic lake, looked quizzically at David Eccles' submarine and sampled the cold canned beer available in every mud-walled thatched-roofed canteen throughout the country". Of course there were academic sessions too!

During the years that followed, AGMs were held in places such as Bloemfontein, Johannesburg and Durban, amongst others, before venturing in to Namibia for their

1986 meeting in Windhoek. It was in 1974 that Prof Bryan Davies met up with South African limnologists at the LSSA conference held in Bloemfontein, before moving from the University Eduardo Mondlane in Maputo, Mozambique to Rhodes University.

A significant event for limnology in Africa took place when the SIL Workshop on African limnology was held in Nairobi, Kenya, in 1979. Sadly, the organisers were under immense pressure from outside interests to prevent South African limnologists from participating, due to South Africa's political isolation.

Fortunately, the country had strong ties with the International Council of Scientific Unions (ICSU), which led to the organisers allowing a limited number (10-12) of South

African passport holders to participate in the conference. South African limnologists at that time were a determined bunch, however, and in the end about 45 members arrived at the conference, having travelled using a variety of foreign passports. South African limnologists and their counterparts worldwide formed strong ties of professional collaboration.

A testament to the scientific credibility that local aquatic science had achieved under the Cooperative Scientific Programmes is that the Southern Hemisphere Limnology Conference and workshop were held in Wilderness in 1984. Here limnologists from across the Southern Hemisphere were brought together for two weeks to discuss issues of mutual concern and interest. Prof Davies and Danny Walmsley edited its proceedings in a special issue of *Developments in Hydrobiology*.

During those first 25 years, southern African limnologists built up a reputation for conducting world-class scientific research, despite the great difficulties of access, equipment and methodology experienced at the time.

THE SILVER JUBILEE

The year 1988 marked the silver jubilee of the Limnological Society of Southern Africa. In recognition of the society's 25 years of existence it was decided that there would be a commemorative issue of the *Journal of the Limnological Society of Southern Africa*. The executive committee and editor at the time commissioned a number of southern African limnologists to write a series of articles on their personal experiences in the field over the past few years.

A short list of about 20 potential candidates was compiled, most of whom were founder members. Half the candidates agreed to participate, including seven founder members, two life members and a LSSA gold medal recipient.



Above: Attendees of the LSSA meeting held in Grahamstown, in 1980.

Right: Attendees of the Southern Hemisphere Limnology Conference and workshop, which were held in Wilderness, in 1984.



Courtesy of SASA/SAPS

THE JOURNAL

The society's journal itself has a very interesting history. At the founding of the society in 1963 a newsletter was agreed upon, which was to be compiled by the secretary who, in his capacity as editor, slipped in *Daphnia gibba* as the emblem of the society on Volume 1, No. 1 (January 1964). At the end of 1974 the Society bade their newsletter farewell, as it became the *Journal of the Limnological Society of Southern Africa* in 1975. This followed the recognition that there was a need for a dedicated regional journal which would reflect the growth of limnology in southern Africa and provide a forum to discuss issues relevant to the region.

THE NEXT 25 YEARS

It was during the late 1980s or early 1990s that the LSSA changed its name to the Southern African Society of Aquatic Scientists (SASAqS). This change came about because the term 'limnology' was seen to be too narrow to describe properly the array of water-related work being carried out by Society members. It was also to create a setting to attract marine and estuarine researchers to become involved.

The 1990s seem to have been a very constructive time for water matters in South Africa. In 1994, with the dawn of democracy in South Africa, Prof Kader Asmal became the first Minister of Water Affairs and faced urgent equity issues over the private ownership of water. He took a strong lead in requiring the drafting of new national water legislature and put in place a strongly stakeholder-driven water law review process including innovative thinking and the results of recent research.

Prof Asmal was open to involvement wider than just the traditionally strong engineering approach to water resource management, resulting in teams highly representative of professions and sectors

being responsible for drafting the White Paper and the Act. A SASAqS member was to serve on the Ministerial Advisory Panel, so the Society organised provincial meetings to compile the inputs of members and nominated Dr Tally Palmer to represent it on the panel.

This gave ecological research a great boost, there was a great deal of technical input from SASAqS members throughout the country and Dr Palmer became an important contributor to the legislation. It was during this process, and with the help of recent research on South African methods on environmental flows by Drs Jackie King and Jay O'Keeffe, amongst others, that Dr Palmer formulated the concept of the Ecological Reserve. This concept emerged as a strong driver of water resource management policy, not only in South Africa, but also internationally.

Finally, in 1997 the White Paper on a National Water Policy for South Africa was accepted by Cabinet, and

in the same year the Water Services Act (Act No. 108 of 1997) was promulgated. 1998 saw the promulgation of the new National Water Act (Act No. 36 of 1998) (NWA).

While all this was happening, SASAqS held its annual conference in association with the International Symposium on Exploring the Great Lakes of the World (GLOW) at Victoria Falls, Zimbabwe, in 1996.

The 35th annual conference in 1999 was also held outside the borders of South Africa – this time in Swakopmund, Namibia. Not only was this a very successful conference which attracted water scientists and managers from all over southern Africa, but it also gave delegates the opportunity to see some of the most water scarce areas on the subcontinent.

The conference ended on a high note with Dr Palmer appropriately receiving the Society's silver medal for her contribution to the ecological principles in the NWA. Prof Charles



Courtesy of SASAqS



Members attending the 1986 conference in Windhoek (above) and the 1990 conference in Bloemfontein (left).



The logo of the Limnological Society of Southern Africa in 1978 and the Southern African Society of Aquatic Scientists.

Breen received a gold medal for a lifetime of excellent contribution to training and research in the field of aquatic sciences. Furthermore, at a ceremony in Pretoria during the

previous week, Prof Asmal was also presented with the Society's gold medal – in his case for his visionary direction for the development of the NWA.

During the next few years managers and scientists gathered in places such as Eco Island (Limpopo), Bloemfontein, Cape Town, Midrand and Grahamstown, holding joint conferences with organisations such as the Southern African Institute of Ecologists and Environmental Scientists, Zoological Society of South Africa, Department of Water Affairs and Forestry, Water Research

Commission and the Entomological Society of Southern Africa. As another 'southern African' venue, Maputo was chosen for the 2006 conference, themed *From Source to Sea*.

Two international meetings took place in South Africa in 2009 and 2010. The first was the conference on International Environmental Water Allocations in Port Elizabeth, while the second was SIL 2010, the first full-scale International Limnological Conference to be held in Africa. The latter took place in Cape Town with Prof Rob Hart, Dr Bill Harding and Dr Peter Ashton delivering plenary papers.

All along, the quality and quantity of research in the aquatic sciences of southern Africa grew from strength to strength and delegates devotedly continued meeting year after year, from Magaliesburg (2009) to Cape St. Francis (2012), to share their research with one another and to discuss pressing matters.

The society's Golden Jubilee was celebrated at Arniston (Waenhuis-krans) in 2013, when Prof Jenny Day received a well-deserved gold medal. Other gold medal winners throughout the years include: Prof Brian Allanson, Dr Mark Chutter, Dr Marjorie Scott, Dr Graham Noble, Dr Arthur Harrison, Prof Bryan Davies, Prof Jay O'Keeffe, Dr Steve Mitchell and Prof Digby Cyrus.

The society is committed to capacity building. There has been an increase in student attendance at recent conferences due to the generous sponsorship of registration fees by the WRC. In 2013, students from seven different universities were supported and for the first time an international student travel award was initiated.

The 2014 SASAQs conference (see website for details <http://www.riv.co.za/sasaqs>) will be held at Black Mountain Leisure and Conference Hotel, near Thaba Nchu in the central Free State, from 22 to 26 June. Another 'southern African' conference in the near future seems in order... □

A JOURNAL FOR AFRICAN AQUATIC RESEARCH

The *African Journal of Aquatic Science* had its origins in 1975 when the Southern African Society of Aquatic Scientists decided to turn their six-monthly newsletter into a formal journal.

From 1975 to 1988 the *Journal of the Limnological Society of Southern Africa* was published twice a year, bearing an image of the water flea *Daphnia gibba* on its plain blue cover. Then, in 1989 it got a triple face-lift in the form of a new cover design, incorporating wave patterns and a seaweed as well as the traditional *Daphnia*, a new format [quarto] and a new name, becoming the *Southern African Journal of Aquatic Sciences* [SAJAQs]. There followed 10 years of stability, with the journal still serving as the mouthpiece of the Aquatic Scientists Society.

In 1998 Mike Coke became the journal's editor, taking over from Prof Brian Allanson. The following year, the journal was incorporated into the National Inquiry Services Center (NISC). The move required the journal to establish an Editorial Board, to adopt yet another new name: *African Journal of Aquatic Science*, with another new cover design incorporating a collage of aquatic organism images – including of course *Daphnia gibba*.

From 2002 manuscript flow began to increase significantly, going from 30 in 2001 to an amazing 157 in 2013. Be that as it may, because the journal had by then narrowed its scope to exclusively 'African' subject matter, up to 60% of incoming manuscripts were rejected, either on grounds of unsuitability or of inadequate content.

At first, all the manuscript submission, reviewing and handover processes were handled by the editor

by e-mail, a task that became increasingly difficult as the flow of manuscripts increased. Eventually, the Editorial Board members got roped in as subject or associate editors and then, as pressures continued to increase, more associate editors were appointed until, by 2013, the journal had 13 of them.

For another seven years two journal issues were produced every year, whilst the number of pages published rose from 150 to over 300 per year. The journal went online-only in 2007, at the same time as enlarging to three issues per year. Meanwhile, it was being assessed for an Impact Factor rating, which eventually arrived in 2010, with a pleasing rating of 0.479.

By this time NISC was publishing in collaboration with Taylor & Francis (T&F), which increased the journal's international visibility considerably. In 2011 manuscripts began being handled via T&F's web-based system, easing both the submission and the handling processes.

But now the journal began to suffer from growing pains - more manuscripts were getting accepted than could be published per issue, or within the annual page allowance. "The only way to catch up with ourselves was to publish a jointly-funded Supplement, which was done in 2013," reports Coke. "At the same time the journal's growth took another step forward, this time to four issues per year plus an increased annual page allowance."

With 240% growth over the past ten years, going from 195 pages in two issues in 2003 to 469 pages in four issues in 2013, the *African Journal of Aquatic Science* certainly looks set to become the leader in its field.



SOUTHERN AFRICAN SOCIETY OF AQUATIC SCIENTISTS

IMPORTANT DEADLINES

- Closing date for submission of abstracts: 3 March 2014
- Closing date for early bird registration: 30 April 2014
- Closing date for regular registration: 13 June 2014

SASAQs 2014 CONFERENCE | 22-26 JUNE 2014

On behalf of the Southern African Society of Aquatic Scientists, Department of Zoology & Entomology, UFS, and FREE STATE DETEA: Biodiversity Research Division, we invite you to attend the 2014 SASAQs conference to be held at Black Mountain Leisure and Conference Hotel near Thaba Nchu in the central Free State

ACCOMMODATION

AVAILABLE AT: BLACK MOUNTAIN LEISURE AND CONFERENCE HOTEL	
Standard Accommodation Bed & Breakfast:	Single R605.00/day
Standard Accommodation Bed & Breakfast:	Sharing R390.00/day
PLEASE MAKE BOOKINGS DIRECTLY AT THE HOTEL	
Remember to state that it is for the SASAQs 2014 conference.	
TEL: 051 871 4200	FAX: 086 750 3199
www.blackmountainhotel.co.za	
EMAIL: conference@blackmountainhotel.co.za	

Interested companies should contact the conference secretariat for more information and to book exhibition space.

TRADE EXHIBITORS

SESSIONS

Categories will include:

- Conservation of Aquatic Ecosystems
- Wetland, Estuarine & Marine Ecology and Management
- Water Availability, Quality and Management
- Ecotoxicology
- Aquatic alien invasions
- Impact of Climate change
- Sustainable utilization of aquatic resources
- Inland fisheries and Aquaculture
- Aquatic Parasitology

PLEASE TAKE NOTE THAT ORAL PRESENTATIONS WILL BE 15 minutes PLUS 5 minutes for questions. DDD's, will include a three minute oral presentation, which will be incorporated into the program.

ABSTRACT SUBMISSIONS

- The deadline for submission is 3 March 2014 and you will be notified by 30 March 2014 if your abstract/paper has been accepted. Please submit abstracts electronically on www.easysabstract.com

SPECIFICATIONS FOR PRESENTATIONS & DDD'S

- Presentation to be generated using PowerPoint software package.
- Windows 8 operating system, Office 2010 will be used.
- The DDD presentation can be done using Office PowerPoint 2010, 2010 and 2007.
- The presentation needs to be done in LANDSCAPE. The screens being used to display the DDD's, are 21 inch touch screens. The screens will be setup in a LANDSCAPE format.
- A maximum of 5 PowerPoint slides will be allowed.
- No PDF presentations will be allowed.
- The DDD's will be displayed on screens in such a way that delegates of the congress can sit down in front of a screen and browse through the DDD presentations at own leisure.

PLENARY/KEYNOTE SPEAKERS

- **Dr Danie Vermeulen, Director of the Institute for Groundwater Studies UFS:** His presentation will deal with the very controversial shale gas development and the sensitive Karoo environment where it is taking place – one of the main questions is whether these two subjects are compatible.
- **Dr John Mendelsohn, Director of RAISON (Research and Information Services of Namibia):** Will present an overview of drainage systems in the central Kalahari Basin, especially the area south of Angola and the Great Equatorial Divide. West to east, these are the Cuvetia, Cunene, Cubango/Okavango, Cuito, Kwando and Zambezi. Some rivers flow west or east to the Atlantic and Indian Oceans, while others end in salt pans or freshwater deltas within the Kalahari Basin. Water in these areas generally have very low mineral concentrations, thus biological productivity is low. Ephemeral flow in certain areas has led to the development of lakes and floodplains that are highly productive.

ROUND TABLE DISCUSSION

- Session I: *Alien invasions in South African Aquatic Systems.*
- Chair: Prof Jo van As
- Session II: *Inland Fishery Bio-assessment, the Way Forward.*
- Chair: Dr Gordon O'Brien

2014 YELLOWFISH WORKING GROUP (YWG) CONFERENCE

The YWG conference will be held prior to SASAQs 2014, on Sunday, 22 June 2014, 08:00 – 17:00, also at BMH. For more information on registration, costs involved and to present an oral presentation (15 min + 5min discussion) at the YWG Conference, contact Leon Barkhuizen at barkh@theea.fs.gov.za or Peter Arderne at mwardern@mweb.co.za

PLEASE NOTE THAT NO CORRESPONDENCE OR REGISTRATION FOR THE YWG CONFERENCE SHOULD BE ADDRESSED TO SAVETCON OR THE ORGANIZERS OF SASAQs 2014!

REGISTRATION

All delegates are required to register online at www.savetcon.co.za. (Registration for the YWG Conference should be done with Leon Barkhuizen or Peter Arderne.)

Registration includes:

- Abstract book
- Conference bag;
- Tea's/Coffee's;
- Lunches (3); Dimmers (3) and Gala event

Registration category	Payment received before 30 April 2014	Payment received after 30 April 2014
SASAQs member	R3 500.00	R3 900.00
SASAQs non-member	R3 800.00	R4 200.00
SASAQs student member	R2 500.00	R2 900.00
SASAQs student non-member	R2 800.00	R3 200.00
Day registration SASAQs member	R1 300.00	-
Day registration SASAQs non-member	R1 500.00	-

PRELIMINARY TIMES OF SESSIONS

Sunday 22 June 2014	
16h00	Registration
19h00-	Cocktail function (Meet & Greet)
Monday 23 June 2014	
07h00-08h00	Registration - Foyer BMH
08h00-08h15	Welcoming
08h15-10h30	Session 1
10h30-11h00	Tea/Coffee Break
11h00-13h00	Session 2
13h00-14h00	Lunch
14h00-15h45	Session 3
15h45-16h15	Tea/Coffee Break
16h15-18h00	ROUND TABLE 1
19h00 BMH	Evening dinner
Tuesday 24 June 2014	
07h30-8h00	Registration - Foyer BMH
08h00-10h00	Session 4
10h00-10h30	Tea/Coffee Break
10h30-13h00	Session 5
13h00-14h00	Lunch
14h00-15h45	ROUND TABLE 2
15h45-16h15	Tea/Coffee Break
16h15-17h30	Session 6
18h00-19h00	Blue movie
19h00 BMH	Evening dinner
Wednesday 25 June 2014	
08h00-8h30	Registration - Foyer BMH
08h30-10h00	Session 7
10h00-10h30	Tea/Coffee Break
10h30-13h00	Session 8
13h00-14h00	Lunch
14h00-16h00	Session 9
16h00-16h15	Short break
16h00-17h30	AGM
19h00-	Gala dinner
Thursday 26 June 2014	
08h30-10h00	Departure

CONFERENCE SECRETARIAT



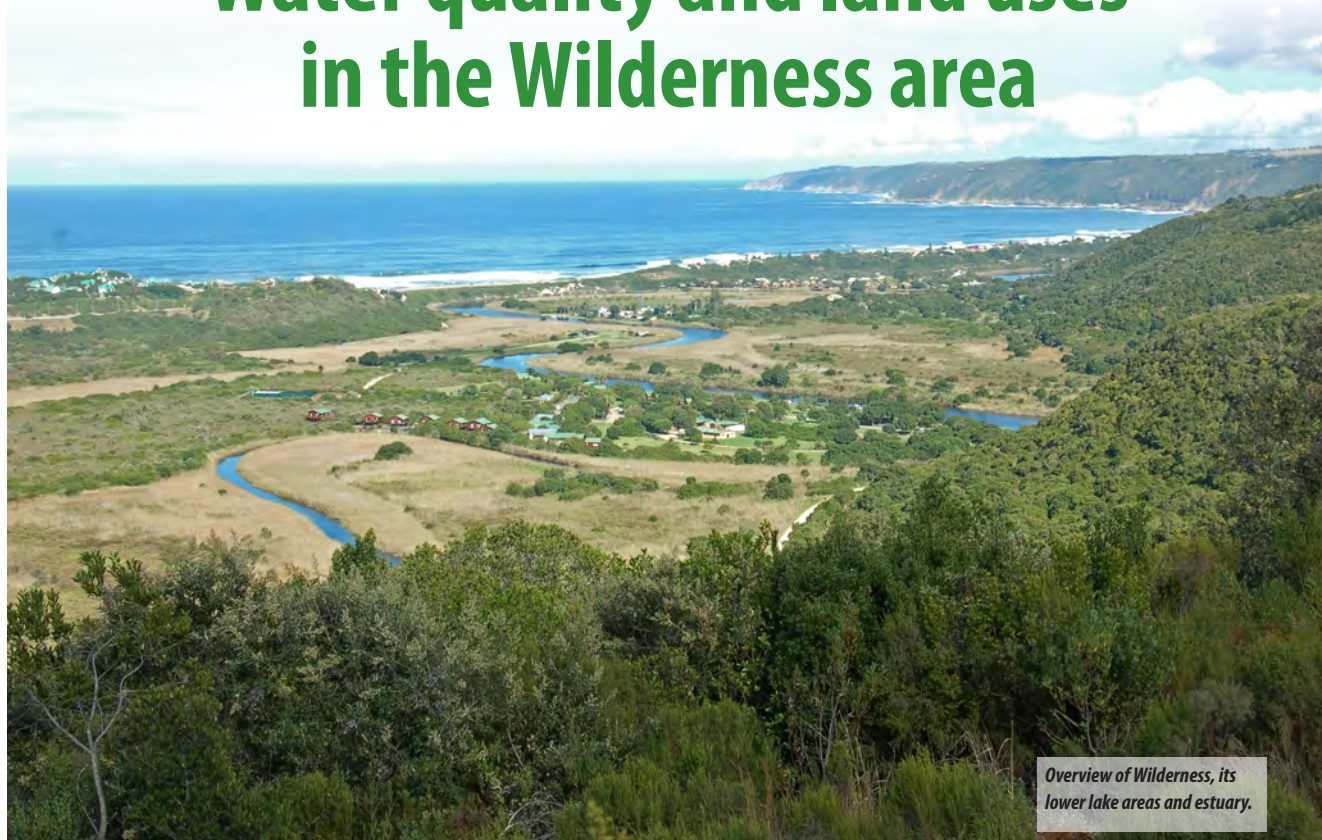
Mrs Petrie Vogel - Registration and administration
 Tel: +27 (12) 346 0687, Fax: +27(12) 346 2929
 Email: petrie@savetcon.co.za

All delegates are required to register online at www.savetcon.co.za



2nd Announcement

Broadening the perspective: Water quality and land uses in the Wilderness area



Pollution of our water resources not only affects water quality but also the land uses dependent on that water. A new project being undertaken by the CSIR hopes to highlight the importance of maintaining the state of South Africa's water resources. Article by Klaudia Schachtschneider.

Too much and too little water are things most South Africans understand well, living in a highly variable and semi-arid environment. However, increasingly, we as South Africans are also becoming sensitised to local issues of water pollution, especially through reports of acid mine drainage entering our water sources such as the Vaal and Olifants catchments.

More frequently, we get stirred by accounts of water pollution by

some land use approaches that break the 'water web' we rely on for our daily services. To avoid this, our perspectives need to broaden, and we need to increase our ability to see the complex interactions between humans and nature, between land and water uses. We also need to ensure that our governing bodies are integrative of these issues, ensuring that they are no longer being dealt with in isolation.

For this reason the CSIR has commenced a challenging three-year project, which aims to integrate and mainstream water quality into land use, water resource and estuary management and decision-making processes in the Wilderness area. The Wilderness area has been identified as a key area at risk of extreme drought and flood events in the last two decades. Stakeholders in the

area understand these risks well, but a third risk is on the rise – namely deteriorating water quality.

Towards the end of 2012, a farmer in the Karatara area related the death of a dozen livestock, suspecting a toxic cyanobacterial bloom in the farm dam. For cyanobacteria to bloom, its host water source requires significant nutrient enrichment.

Other water quality issues that have been highlighted by concerned stakeholders are sediment loss and microbiological pollution. All these form water quality issues, that will, if left unattended, affect the water and land uses that Wilderness inhabitants and visitors rely on.

The Wilderness area is small, almost compact, and has several land uses: forestry, dairy and vegetable farming, some permanent urban settlement and a large seasonal

tourism sector. Previous international research, linking water quality to land use, has shown that forestry is often associated with sediment loss, agriculture is often responsible for adding nutrients to water bodies from fertilisation and subsequent runoff.

Microbiological pollution is associated with human and animal wastes. However, inferring the effect of these land uses on water quality in the Wilderness area is insufficient and requires scientific backing.

A multidisciplinary team of scientists is now mapping out actual land uses in the Touws catchment, creating links to water quality. To do this, they are monitoring water quality from source to sea. This, as well as existing runoff data and land use information are used to design a SWAT (Soil and Water Assessment Tool) model for the Touws River system.

The final model will help to visualise the links between land use practices, typical runoff and/or extreme events and water quality. As such, it serves as a communication tool, but it can also aid as a decision-making tool to simulate land use changes and to help locate the best restoration sites.

Restoration is typically linked to the maintenance or restoration of riparian buffer strips. They are 10 m- to 50-m broad natural vegetation strips that line river tributaries. Ongoing land uses have resulted in the severe degradation, or even complete obliteration of these riparian zones, impacting the ecosystem services that these strips naturally provide.

Again, the value of riparian buffer strips to regulate flow, absorb pollutants and retaining sediment has been described widely in literature. A destroyed or degraded riparian buffer zone cannot perform its usual beneficial services, and downstream users bear the consequence.

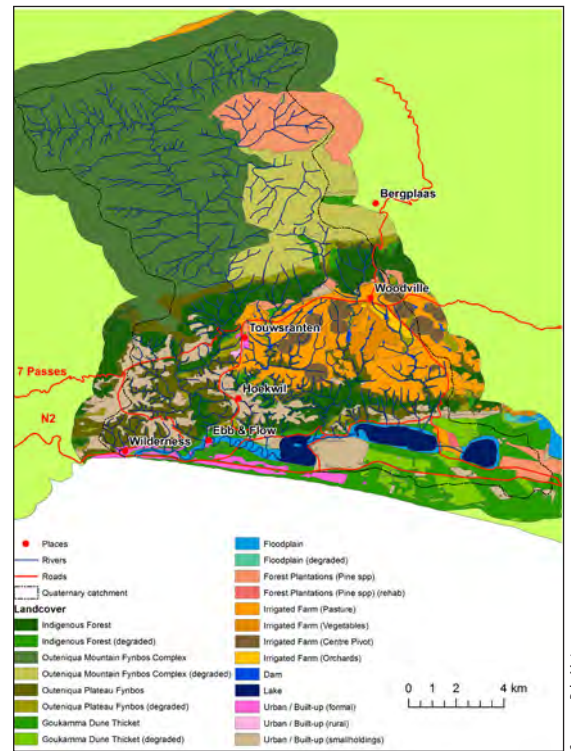
A PhD study forms part of the project, looking at the capacity of intact versus degraded and invaded riparian zones to trap sediment and

to improve water quality. The information is essential to help convince stakeholders and decision-makers of the values that riparian buffer zones can play in the land use, water management interface.

The information generated by this project is closely linked to a Water Research Commission (WRC)-funded project that looks at building resilient landscapes in the Wilderness area. The communication of the water quality findings is tied to the stakeholder engagement process that is central to the WRC project. (See the article 'Exploring the science of involved citizenship' in the July/August 2013 edition of *the Water Wheel* for more information on this research project)

Coincidentally, the two projects are taking place at a time when the area has been earmarked for substantial water-related activity required by the Department of Water Affairs. Firstly, a nationally-driven process of setting up a catchment management agency (CMA) for the Gouritz area is commencing. It means that existing Breede- Overberg CMA is extended to the Gouritz, forming the Breede-Gouritz CMA. Furthermore, the Outeniqua catchments, of which the Touws is one, will undergo extensive scientific studies to set up ecological Reserve determinations.

In lieu of these national-scale endeavours, the water quality and



Courtesy D le Maître

WRC sister-project form an unexpected and, possibly, fortuitous platform, offering stakeholders the opportunity to understand the links between their water resources and land uses. It gives people in Wilderness a chance to formulate their needs in advance of the national processes, and if done well, stakeholders come well-prepared to bring their views and voices to the national water sector changes that are imminent in the Wilderness area. □

Figure 1: Current land cover map based on data supplied by the Garden Route Initiative and SANParks.



Courtesy L. van Rooyen

CSIR team member taking a water sample.

Science expo WATER CONTROL SYSTEM wins special prize

Two students, who were finalists in the 2013 Eskom Young Scientists Expo, have received a special award from the South African Institution of Civil Engineering (SAICE)'s Water Engineering Division for their project entitled: Water Control System. Debbie Besseling reports.



Carlo Kuhn and Marlene Strauss are Grade 11 pupils from the Duineveld High School in the Kalahari, Northern Cape Province. At a special awards function held in November, they were presented with silver medals and acknowledged by SAICE's Water Engineering Division.

Carlo comes from a farming community, and is well aware of the severe impact and damage caused when a dam wall breaks. He has a large dam on the farm where he stays, which previously made use of an old flood gate system that had to be closed manually. One evening the person who was responsible for closing the system, didn't do so, which in turn caused the dam wall to collapse. The effect caused extensive damage, and Carlo knew that he had to find a more reliable system that could be used in the future.

"When a dam wall breaks, it can be at a great expense to the economy and an even greater cost to the surrounding ecosystem.

Ground erosion is but one aspect of the damage caused to the environment. In addition to this is the economic impact caused when people in the vicinity must go without water to drink, or water to irrigate their crops," says Carlo.

He explains that irrigation farmers that use sluice systems frequently allow the water to flow late into the night which means that they then have to shut-off the water source late at night so that the irrigation dams do not break. The person responsible for the flow of the water can easily forget to turn off the water, which can result in damage to, or even breaking of the dam wall.

HOW THE SYSTEM WORKS

The water control system developed by Carlo and Marlene makes use of the mechanics of a metronome, (a device used in music to keep time), to control the amount of water that flows through a sluice gate.

"When we conducted our research we wanted to create a system that would control water with minimal human intervention, that can be used by skilled, or unskilled workers in order to limit water wastage and reduce electricity consumption," explains Carlo. "By winding a spring, kinetic energy is stored. A certain number of turns which will store energy, is directly paired to how long the plate that is fixed to the gears, will turn. You can adjust the speed of the turning gears by moving a small lead weight up or down an axis that has a counter weight at the bottom. The lower the weight on the axis, the faster it swings."

The higher the weight, the slower it swings, and the slower the gears turn, the slower the plate will turn. The plate will then turn according to the adjusted speed and time, so you will have better control over your flow of water and it closes automatically. This is all without any human intervention or electricity consumption



being required. “This technology allows us to control water at different speeds and intervals,” says Carlo.

RESEARCH

Part of Carlo and Marlene’s research involved the compilation of a questionnaire. Marlene says that they spoke to the local farmers, mechanical engineers in the area and persons from the relevant industries who had experienced the particular problem, to obtain more information.

The feedback they received from the questionnaires was organised and further research was undertaken to be able to reach a conclusion and a way to solve the problem. Some of the questions included in the questionnaire were:

- What are the problems that can occur when your control system for regulating water is not properly used?
- Would you support this project if it was incorporated into your local canals and water supply systems?
- Do you think this system is able to replace other systems currently used for water regulating?
- Do you think that it is a good advantage to have a system that does not use electricity?
- Do you think this system is more reliable than other water control systems?

FUTURE DEVELOPMENTS

Carlo says that the system they have devised has tremendous potential for other industries. Conventional water control systems used in the mining sector consume vast amounts of electricity via pumps which wastes precious water resources and is prone to the human-error factor. This increases the risk of damage to the ecosystem as well as a potential loss of profit.

“We have taken this project to another level, one that can be used in large dams. This can now create a flow of water more sustainable by the river by not releasing all the water at once. At companies that use water to create electricity, the problem sometimes occurs that the water pressure is too little, thus the steam that drives the turbines won’t be as effective as usual. This project allows the water to build up enough pressure until it can open the gate”.

And there are other possibilities for the system. In countries that have great shipping ports that go into rivers, they have a very advanced and expensive system that allows the ships to enter the higher river. Now we can do it without electricity and

Above: Carlo Kuhn receiving a silver medal from the South African Institution of Civil Engineers (SAICE). Pictured from left is Dr Chris Herold (SAICE Water Engineering Division), Wanda Rossouw (Duineveld High School teacher), Carlo Kuhn, Peter Kleyhans (SAICE President 2013) and Debbie Besseling (SAICE Water Engineering Division).

Below: A typical irrigation water canal.



still be able to control the height of water levels.

Carlo intends following a career in either civil or chemical engineering. Marlene will be furthering her studies in the field of industrial engineering. □

New research chair for Stellenbosch University

A new research chair at Stellenbosch University (SU), sponsored by ERWAT, is focusing on innovations in water research as well as upping water treatment and water management skills in the water sector. The ERWAT Chair in Wastewater Management will be hosted by the university's Water Institute. Prof Gideon Wolfaardt, a recognised expert and leading researcher in the biological and engineering aspects of water research, is the first research professor to hold the chair.

The focus of the new ERWAT chair is on scientific and technical advances in wastewater management, water quality, water use and demand, as well as fostering partnerships to improve the water research and management skills of scientists, engineers and technical personnel.

Prof Wolfaardt has returned from Canada to take up the post. There he held a research chair in Environmental Interfaces and Biofilms from 2004. According to Prof Eugene Cloete, SU Vice Rector: Research

and Innovation, ensuring a safe water supply for South Africa and Africa is possible, but will require innovation and action. "We are very excited about the establishment of the ERWAT chair and the opportunities it provides for world-class research and innovation in South Africa's water sector. The institute is also the ideal home for this chair, as we pride ourselves on continually exploring new approaches to water treatment that are durable, cost-effective and more efficient."



Courtesy Stellenbosch University

Left: Prof Gideon Wolfaardt.

Below: Seen at the launch of the new ERWAT Chair in Wastewater Management are Prof Eugene Cloete, Vice-rector: Research and Innovation at Stellenbosch University (SU); Pat Twala, ERWAT MD, Prof Louise Warnich, Dean: Faculty of Science at SU and Prof Gideon Wolfaardt, the new ERWAT Research Chair.



Courtesy Stellenbosch University



Short Courses from the Department of Chemical Engineering

Water Utilisation Division

University of Pretoria

Short Course on Environmental Management & Regulation

10-13 March 2014 (First Intake)

08-11 September 2014 (Second Intake)

This course covers aspects of Environmental Engineering and Management. The course is valuable to practicing engineers and scientists in the environmental field. It comprises a knowledge review, discussion forum, and case studies.

Course Fee: R11 330.00 per person.

Short Course on Operation of Water and Wastewater Treatment Plants

23-27 June 2014

The course aims at instructing delegates on the State-of-the-Science in water and wastewater treatment technologies. The lecturers will present the content highlighting on current advancements in the field of water and wastewater treatment, resource recovery and energy conservations. Additionally, common problems encountered at treatment plants and solutions to address those problems will be discussed. Solutions relevant to warmer climates such as South Africa and the neighbouring countries will be highlighted.

Course Fee: R13 300.00 per person.

Short Course on Water Quality Management and Effluent Treatment

18-22 August 2014

The course aims at instructing delegates on the State-of-the-Science in water and wastewater treatment technologies. The lecturers will present the content highlighting on current advancements in the field of water and wastewater treatment, resource recovery and energy conservations. Additionally, common problems encountered at treatment plants and solutions to address those problems will be discussed. Solutions relevant to warmer climates such as South Africa and the neighbouring countries will be highlighted.

Course Fee: R13 300.00 per person.

ENTRY REQUIREMENTS

In order to enrol for these courses, delegates need undergraduate education in sciences and engineering, as well as professional experience in the water sector.

REGISTRATION AND ENQUIRIES

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The Water Research Commission not only endeavours to ensure that its commissioned research remains real and relevant to the country's water scene, but that the knowledge generated from this research contributes positively to uplifting South African communities, reducing inequality and growing our economy while safeguarding our natural resources. The WRC supports sustainable development through research funding, knowledge creation and dissemination.

The knowledge generated by the by the WRC generates new products and services for economic development, it informs policy and decision making, it provides sustainable development solutions, it contributes to transformation and redress, it empowers communities and it leads various dialogues in the water and science sectors.

The WRC Vision is to have highly informed water decision-making through science and technology at all levels, in all stakeholder groups, and innovative water solutions through research and development for South Africa, Africa and the world.

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