

THE
WATER WHEEL

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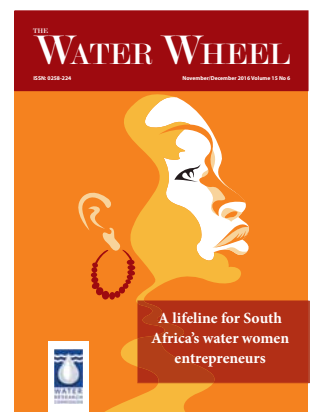
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The Department of Water and Sanitation has launched its Women in Water Empowerment Programme amid much fanfare. See story on p14.



WRC CEO, Dhesigen Naidoo



Fluid Thoughts

Drought 2016 – Ushering in a new cycle of extreme weather patterns

Despite recently good rains, South Africa remains in the throes of a drought episode, and one that mirrors the 2015 phenomenon of a drought-heat wave combination.

This is in spite of the fact that the worst El Niño cycle in more than twenty years has ended. The South African Weather Service predictions are optimistic and indicate that we will have a return to reasonable rainfall patterns this summer in terms of volume, but chronologically shifted. It also appears that one of the important changes, as indicated in earlier Water Research Commission (WRC) reports, is that while the overall seasonal rainfall volume may be similar to normal rainfall years, the rainfall episodes are shorter and more intense.

The recent flash flood episodes are testament to this new pattern. We also know that recovery to normal storage in our dams will be a multi-year project, and we need to be wary of the possibility of an early intense La Niña, flood cycle. In short, our water constraints will be here at least for a while, and we must adjust strategy accordingly.

South Africa's water scarcity is now an undisputed fact, and the vulnerability of all, from ordinary householders to major industrial players are now clear. This has already translated into personal and national hardship, with water restrictions and rationing with many cases of emergency options like water trucks being employed to ensure that basic needs are met. The economy has taken strain with the lack of water representing not only constraints to growth in many sectors, but even threatening survival in some sectors like agriculture.

With the latter, we are seeing the challenge to national food security, and related food price inflation. The knock-on effect on both the national growth forecasts as well as the sustainability of household level economic security has been intensely negative. The long-term consequences may be more dire as farmers that were already on levels of only marginal economic security may be pushed over the edge, on the back of an extended drought, into abandoning agriculture in favour of other short-term economic security measure. Thus, intensifying the risk outlook of South African agriculture. This consequence tree can be mapped for other industrial sectors in the country.

Water security in South Africa cannot be pegged on the hope

of a return to normal rainfall patterns alone. We have to adapt to the new water availability. This means tightening our water belts significantly and striving for higher levels of water efficiency in all areas.

We must make it a goal, as the thirtieth driest country in the world, to move down from our current use of 235 litres/capita/day for total water use, to at least the world average of 177 litres/capita/day. That will result in a saving in excess of 3 billion litres of water per day.

A key part of empowering this move is of course knowledge and information. The WRC is digging deep into its, and its partners knowledge repositories in order to enable this. Access to the research reports and related documents will be facilitated by the launch of a new, much more easily accessed WRC Knowledge Hub.

“Our water constraints will be here at least for a while, and we must adjust strategy accordingly.”

Already in this repository are close to 1 500 WRC documents examining and analysing the phenomenon of drought and various adaptation and coping strategies; as well as the building blocks of better water management to mitigate the impacts of future extreme event episodes. In addition, the new updated DroughtSA portal will be launched as a principal support tool for all stakeholders and the general public as a key information support tool to deal with both the drought as well as more generally water scarcity in South Africa.

We invite everyone to use these knowledge services and become part of the South African Water Ubuntu initiative. What we do individually, positively or otherwise, has huge consequences for the system as a whole. In this season of celebration and giving, the biggest gift we can give is a chance for better water security by being water wise. The best of season's greeting to all our readers.

Special accolade for WRC Research Manager



Water Research Commission (WRC) Research Manager, Bonani Madikizela, has been recognised by the Wildlife and Environmental Society of South Africa (WESSA), who presented him with an honorary lifetime achievement award earlier this year.

Madikizela was one of 90 Lifetime Conservation Achiever Award winners, celebrated for their life dedication to conservation in South Africa. The awards were introduced specially for the organisation's 90th anniversary.

The Lifetime 90 Achievement Award presented to Madikizela was in recognition of his sterling work in fighting against the degradation of South Africa's freshwater ecosystems and for the restoration of biodiversity in natural resources.

Madikizela has spent more than 20 years working with natural resources, focusing in particular on water resource quality and bio-monitoring with respect to inland freshwater ecosystems such as rivers, dams and wetlands. Madikizela is a research manager in the Water Resources unit at the WRC, and has previously worked at the departments of Water Affairs and Environmental Affairs. As WRC research manager Madikizela's role includes prioritising, supporting, and coordinating research done by a variety of organisations and independent consultants across South Africa.

Due to historic lack of attention to wetland health and biophysical integrity, Madikizela's focus is currently biased

towards wetlands and also includes river rehabilitation, with the intention to provide methods and guidelines that ensure sustainable utilisation of these resources, but without furthering biodiversity loss. This quest has led to interactions with experts in aquatic ecosystem research and development at national and international levels.

WRC CEO, Dhesigen Naidoo, said "We congratulate Bonani for receiving such a prestigious award, which positions the WRC personnel as leaders in the applicability of research that is managed in a way that encourages exploratory and innovative investigations."

While expressing his gratitude for the award, Madikizela said, "The 90 Lifetime Conservation Achiever Award means a lot in boosting one's self esteem. Even more inspiring is to be recognised at the time when the country is in dire need of water specialists that need to be turning their heads around due to the ongoing water scarcity challenges facing South Africa".



Water Diary

Sanitation November 19

Each year, World Toilet Day calls on the global community to do more to address the sanitation crisis. This year, the theme of 'toilets and jobs' focuses on how sanitation, or the lack of it, can impact on livelihoods.

Visit: www.worldtoiletday.org

Odour control February 14-16

The International Water Association (IWA) Symposium on Tastes, Odours, and Algal Toxins in Water: Occurrence and Control, will be held at the University of New South Wales, Australia.

Visit: www.iwatando2017.org

Faecal sludge management February 19-22

The Fourth International Faecal Sludge Management Conference (FSM4) will be held in Chennai, India. FSM4 aims to bring together professionals working in the sector, including utilities, service providers, cities, governments, academics, scientists, consultants, donors and industries to support the global initiative of disseminating sustainable solutions for faecal sludge management.

Visit: www.fsm4.susana.org

Water storage and hydropower March 14-16

The International Conference on Water Storage and Hydropower Africa 2017 will be held in Marrakech, Morocco. The event is supported by the International Committee on Large Dams. Email: africa2017@hydropower-dams.com for more information.

Large rivers April 18-21

The Third International Conference on the Status and Future of the World's Large Rivers will be held in New Delhi, India. Topics to be covered include hydrology, hydraulics and water quality; sediment transport and river morphology; ecology and restoration; and integrated river management.

Visit: <http://worldslargerivers.bku.ac.at>

Water history June 15-17

The conference of the International Water History Association will be held in Grand Rapids, Michigan, USA. The conference is co-hosted by the Western Michigan University.

Visit: www.iwha.net



Durban municipality launches WhatsApp line to report leaks



To make it easier and convenient for the public to report any water-related issues and to expedite the Municipality's response, eThekweni Municipality has launched a WhatsApp water reporting line.

The WhatsApp Water Reporting number is 073 148 3477.

The project is part of the City's ongoing effort to make communication with its 3.5 million residents simpler, fast-track service

delivery, reduce the water leak repair turnaround time and water wastage.

The telephone line allows the public to report leaks, burst pipes, illegal connections, blocked sewer drains, water supply interruptions and any other water-related issue to EThekweni Water and Sanitation (EWS) Unit.

The WhatsApp channel also has the facility for consumers to send location pins of problems which will assist in locating problem areas. Customers will have their chat history with EWS kept for reference on unresolved issues.

Customers will at times be asked to take pictures of the leaks or bursts to allow correct coding of faults to be done at capturing stage.

Water department signs agreement with Italy

Water and Sanitation Minister, Nomvula Mokonyane, has signed a landmark water cooperation agreement with Italy.

The memorandum of understanding (MoU), which was signed in October, saw both countries committing themselves to developing initiatives aimed at mitigating climate change by providing sustainable and integrated water resources. Part of the agreement is that both South Africa and Italy will ensure education, training and research in the fields of water quality enhancement, water resource management, water service management and rural sanitation technology.

The agreement will also ensure that both countries work on joint projects that will enhance capacity building, technology

transfer and technical assistance. These projects will mainly focus on empowering previously disadvantaged groups in the society such as women, youth and people with disabilities.

During the signing ceremony in Johannesburg, Minister Mokonyane said the agreement will ensure that both countries share knowledge expertise to fight climate change. She said South Africa's partnership with the Italians is aimed at assisting the country to strengthen its wastewater treatment capacity as well as rural and urban onsite and offsite sanitation systems.

"We have also agreed to cooperate in integrated water management solutions, including the reuse of wastewater for

material and energy recovery. Given our current water challenges as a result of drought, water management is a critical resource and tool required by our government," said Mokonyane.

A Joint Steering Committee will be established to ensure the commitments made in the agreement are carried out. The committee will comprise three representatives from the Department of Water and Sanitation and Italian Republic Department of Environment, Land and Sea.

The signing of the MoU follows a visit by an Italian delegation to South Africa in April. The objective of the visit was to identify implementable joint projects on water.

Spotlight turns to aquaculture in inter-departmental initiative



The Department of Environmental Affairs, in collaboration with the Department of Agriculture, Forestry and Fisheries (DAFF), has commissioned the CSIR to conduct a strategic environmental assessment (SEA) for aquaculture development in South Africa.

The purpose of the assessment is to support the responsible growth of the aquaculture industry in South Africa, noted Lizande Kellerman, CSIR environmental scientist and project manager for the SEA. She explained that the SEA aims to achieve this in two ways: firstly, by identifying suitable areas where environmentally sustainable aquaculture development can be prioritised and incentivised. Secondly, by providing a streamlined and integrated management and regulatory framework to reduce compliance complexities and improve decision-making processes.

The SEA will cover all nine provinces and includes offshore and land-based aquaculture for both freshwater and salt water species.

Aquaculture is the fastest growing food production sector in the world. An additional 50 million tons of fish is required to feed the world population by 2030, and it is anticipated that worldwide, this production will come mainly from aquaculture.

Aquaculture includes the breeding, rearing and harvesting of plants and animals in salt or freshwater. In South Africa, aquaculture is still in its infancy and has thus been identified by government as a priority area for economic growth. However, the sector faces several challenges, including the over-regulation of the sector, production being focused on a few high-value species, scarcity of freshwater and a harsh marine environment, among others.

Food prices driving increase in 'hidden hunger'



Huge food price increases mean that many South Africans are eating less, skipping meals and buying filling food that lack nutrients.

Food inflation has risen rapidly over the past year, fuelled by the drought, a weak Rand, and, some say, market manipulation by retailers.

A 25 kg bag of maize meal – South Africa's staple food – has increased by almost a third in the past year, now costing R225.82. Meanwhile, onions cost 75% more and potatoes 70% more than a year ago.

"The prices really get your heart beating. All of the big things have gone up," a woman told the Pietermaritzburg Agency for Community Social Action (PACSA), which monitors the cost of food.

Speaking in a focus group, women said that because of high prices, they prioritised food that filled them up – maize meal, flour, rice, sugar and oil – and cut back on meat, vegetables, and dairy. "We make maize meal porridge for breakfast and uphuthu (stiff porridge) for lunch or dinner," one explained.

PACSA tracks the cost of a basket of 36 basic foods, and found that the average

annual increase was 15% – double the average wage increases, and more than double the increase of state pensions and child support grants.

A quarter of households report experiencing hunger, with a further 28% at risk of going hungry.

It now costs R3 027 to feed a family of five with a nutritionally complete diet, according to PACSA. But the average monthly salary for skilled workers in 2015 was R3 650 – which means that low-income households are unable to afford a balanced diet.

"Households prioritise the payment of transport, education, electricity, burial insurance and the repayment of debt before food. Food is typically the last expense households prioritise because it is one of the few expenses households can control," noted PACSA researchers Mervyn Abrahams and Julie Smith. The researchers warned that women are at greatest risk of damaging their health "because they absorb inflation in their bodies: they eat last and their plates are least diverse."

Source: www.health-e.org.za

Water department achieves first clean audit in years

Parliament's Portfolio Committee on Water and Sanitation has commended the Department of Water and Sanitation for achieving its first unqualified audit since 2009.

The department in November tabled its 2015/16 annual report to the Parliamentary Portfolio Committee on Water and Sanitation. The report showed that underspending at the department was reduced from R3 billion to R189 million.

All accruals from previous financial years were addressed during the financial year under review. The average timeframe for paying suppliers was reduced from 86 days to an average of 23 days. Fraudulent activities by officials worth R4.5 million were uncovered and have been addressed through disciplinary processes.

"Twelve cases of financial misconduct were opened and 11 cases were won by the department. Charges included fraud, negligence, violation of supply chain management procedures and fruitless

expenditure.

"Sanctions imposed for financial misconduct included dismissals, suspensions and demotions, suspensions without pay and written warnings," the department said in its presentation.

Eleven bulk water schemes were completed, benefitting over 78 000 households and 34 816 households were provided with interim or basic water supply in the 27 priority districts. The department also implemented the River Eco-status Monitoring Programme in 62 rivers.

A total of 116 licences were issued to strategic sectors, 79 of which were in agriculture, 12 in mining, 11 in industry and 14 in energy, releasing 11.9 million m³ of water for productive use. For these achievements, Auditor-General, Kimi Makwetu has named the Department of Water and Sanitation the most improved national government department.

The Portfolio Committee extended

its support to the department and encouraged officials to actively engage the committee on challenging areas, especially on inter-governmental relations. Water and Sanitation Minister, Nomvula Mokonyane, said the unqualified audit opinion came amid a challenging environment.

"Below normal rainfall during the 2015/16 summer rainfall season resulted in the meteorological, hydrological, socio-economic and agricultural drought that was experienced across the country. As a result, a number of emergency interventions had to be implemented in the provinces of KwaZulu-Natal, North West, Free State and Eastern Cape.

"Those emergency interventions, however, had the unintended consequence of contributing to an increased amount of irregular expenditure during the financial year under review," said Minister Mokonyane.

Source: SAnews.gov.za

Schools benefit from toilets that mimic nature



Eight Johannesburg schools are benefiting from the installation of Arumloo toilets, a new sanitation innovation.

The micro-flush toilet is one of the technologies that have been selected for demonstrated by the Water Technologies Demonstration Programme (WADER) – a joint programme of the Department of

Science & Technology and the Water Research Commission (WRC). Developer, Jonny Harris, explains that with a design based on the well-known Arum lily, the Arumloo toilet is capable of flushing on less than two litres of water compared to conventional toilets, which typically use between six and nine litres per flush. The toilet is also designed to work as a pour flush toilet (where water is poured in by hand) utilising greywater.

According to Dr Valerie Naidoo, WRC Executive Manager of Business Development and Innovation, the development of the Arumloo is both exciting and encouraging since it shows how WRC research and development funding for biomimicry can catalyse innovation, thereby supporting competitive product development and enterprise development. Biomimicry is an approach to innovation that seeks sustainable solutions to human

challenges by emulating nature's time-tested patterns and strategies.

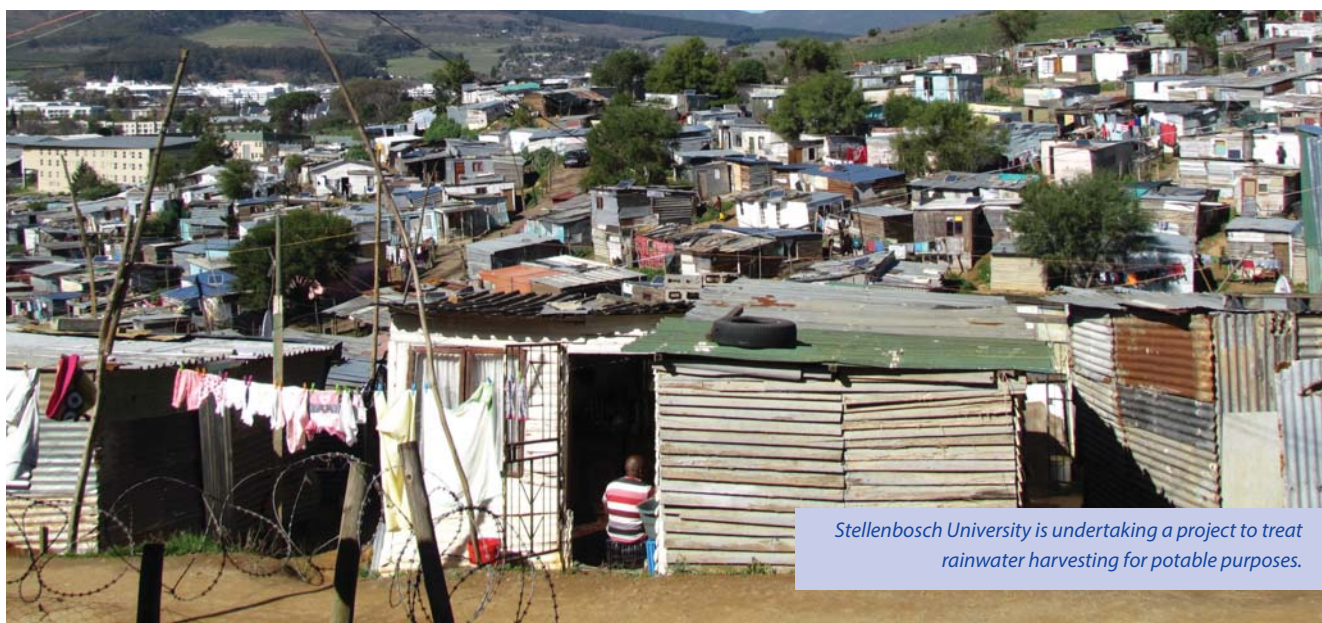
The technology was selected for demonstration after WADER, in partnership with the South African Local Government Association (SALGA), put out a call for innovative water and sanitation technologies and solutions that will contribute to improving water conservation, efficient use, cost-effectiveness and efficient management of water and waste in the municipal environment. Johannesburg Water has helped to identify eight schools where 60 Arumloo units are being tested on a pilot scale.

WADER Manager, Dr Manjusha Sunil, said that such innovative and potentially disruptive water savings solutions are essential for our water sector since South Africa is predicted to have a 17% water deficit by 2030.



Projects in Progress

Upscaling rainwater harvesting for domestic use



Stellenbosch University is undertaking a project to treat rainwater harvesting for potable purposes.

A microbiologist from Stellenbosch University, Dr Wesaal Khan, is part of an international consortium of specialists that have been tasked to develop a range of sustainable solar disinfection (SODIS) technologies that will provide affordable access to safe drinking water to remote and vulnerable communities.

Dr Khan, who heads the water resources laboratory in the Department of Microbiology, will focus on the use of SODIS systems to treat rainwater harvested on household and community level.

“South Africans living in rural areas are familiar with the concept of rainwater harvesting. But while communities in the Eastern Cape can routinely use the rainwater for drinking purposes, our research shows that this is not the case in especially urban areas,” she explains.

Rainwater in these areas become contaminated with heavy metals due to air pollution. The debris of plants and

faecal matter from birds and small animals also tend to collect on roofs and then pollute the rainwater harvested from these roofs with microorganisms.

Dr Khan warns that the disease-causing organisms isolated from rainwater tanks during their trials are associated with a number of diseases, such as diarrhoea, pneumonia and intestinal worm-related infections, among others.

The aim of the current project, called WATERSPOUTT, is to upscale and develop new large-scale solar disinfection technologies. WATERSPOUTT is the acronym for ‘water sustainable point-of-use treatment technologies’.

The ideal is to design a system that will produce sufficient quantities of treated per day so that it can be used in both household and community settings, such as schools and clinics.

“The idea is to supplement municipal services, supplying drinkable water, with

the rainwater harvesting technologies so that people can use the rainwater for domestic activities such as washing the dishes, laundry and personal hygiene,” she adds.

Based on 30 years of research, SODIS is one of the simplest and cost-effective water treatment technologies currently available. It uses the combined effect of ultraviolet radiation and the heat from sunlight to inactivate the whole spectrum of microbes and even bacteria such as *Vibrio cholera* and protozoa such as *Cryptosporidium*. The only requirement is that the water should be stored in a clear plastic or glass bottle and left in full sunlight for six to eight hours.

The project is funded by the European Union’s Horizon 2020 programme and is led by Prof Kevin McGuigan from the Royal College of Surgeons in Ireland. He has been involved with SODIS research for more than 20 years and pioneered the use and promotion of the two-litre bottle SODIS technology.



Global

The world needs more women engineers, says global firm



In the developing world, far more young minds need to be attracted to engineering and, in particular, women, who remain under-represented in many fields, must be part of the solution.

This is according to consulting

engineering firm, Aurecon.

Earlier this year, the company hosted 25 female Grade 10 and 11 learners from schools in South Africa, Zambia and Zimbabwe at its Tshwane office as part of a programme to promote

science, technology, engineering and mathematics (STEM) careers among girls. The programme was run by Taungana, a movement that seeks to empower rural South African high school girls by providing them with the opportunity to access and explore STEM careers. This year marked Aurecon's third successive year of supporting the movement.

One of the key aims of the programme is to help the girls identify potential entrepreneurial projects in their communities and to develop these ideas into a business case. To support this, the firm took the girls through a design thinking session, a human-centred methodology that necessitates innovation and creativity to solve critical problems.

The learners were required to 'ideate' – a process that encourages the exploration of different possibilities and solutions for the challenges they encounter in their respective communities – specifically in the spheres of agriculture, health, public transport and education.

Foreign farms increase the risk of conflicts in Africa – study

For the first time, researchers point to areas in Africa where foreign agricultural companies' choice of crops and management of freshwater are partly responsible for the increased water shortages and greater competition for water.

This, in turn, increases the risk of outright conflicts between all those who need water – plants, animals and humans.

During the twenty-first century, foreign companies have lease large tracts of

land in Africa – more so than in other parts of the world – in order to produce cheap food, cheap timber and cheap raw material for biofuels. An interdisciplinary study from Lund University, in Sweden, shows that about 3% of the land leased in Africa by foreign companies have been registered as currently in production, for the purpose of growing crops. For various reasons, the companies have either pulled out or not started producing on other leased land.

The study also shows that the crops that

foreign investors decide to grow often require more water than the traditionally grown crops. Furthermore, it shows that the same crop can have very different needs for water, depending on the climate where it is grown and which irrigation systems the companies use.

The researchers in Lund, together with a colleague in France, have developed a model that shows how much water is needed for different production systems, in different types of climates, in different parts of the continent. The model takes

into account both the size of the land and the type of irrigation system.

This model has enabled researchers to distinguish between areas where rainwater accounts for the largest share of irrigation water, and areas where large foreign agricultural companies satisfy more than half of their water needs by using freshwater sources, such as groundwater, rivers and ponds.

This has allowed the researchers to highlight the areas around the continent where increased competition for water escalates the risk of water-related conflicts between different sectors and ecosystems.

“Our research can perhaps lead to foreign investors showing greater consideration for how much water is necessary, in relation to how much water is actually

available,” said physical geographer, Emma Li Johansson, who was in charge of the study. “Hopefully, the results can serve as a basis for documents that regulate the water consumption of large-scale farming companies.”

The results have been published in the journal, PNAS (www.pnas.org)

Young children most vulnerable when it comes to nutrition



Five in six children under two years old are not fed enough nutritious food for their age, depriving them of the energy and nutrients they need at the most critical time in their physical and cognitive development, according to a UNICEF report released earlier this year.

“Infants and young children have the greatest nutrient needs than at any other time in life. But the bodies and brains of millions of young children do not reach their full potential because they are receiving too little food, too late,” said France Begin, Senior Nutrition Adviser at UNICEF. “Poor nutrition at such a young

age causes irreversible mental and physical damage.”

UNICEF data show that poor nutritional practices— including the delayed introduction of solid foods, infrequent meals and lack of food variety – are widespread, depriving children of essential nutrients when their growing brains, bones and bodies need them the most.

The findings reveal that, among others, young children wait too long for their first bites. One in five babies hasn't been fed any solid foods by the age of 11 months.

It also shows that half of children aged six months to two years are not fed the minimum number of meals for their age, increasing their risk of stunting.

In addition, less than one-third of children in this age group eat a diverse diet – meaning from four or more food groups daily – causing deficiencies in vitamins and minerals.

In sub-Saharan Africa and South Asia, only one in six children from the poorest households aged six to 11 months eats a minimally diverse diet, compared to one in three from the richest households.

Improving nutrition for young children could save 100 000 lives a year.

Making nutritious foods affordable and accessible to the poorest children will require stronger and more targeted investments from governments and the private sector. Cash or in-kind transfers to vulnerable families; crop diversification programmes; and fortification of staple foods are key to improving nutrition for young children.

Community-based health services that help caregivers learn better feeding practices, and safe water and sanitation – absolutely critical in preventing diarrhoea among children – are also vital.

“We cannot afford to fail in our fight to improve nutrition for young children. Their ability to grow, learn and contribute to their country's future depends on it,” Begin concluded.

THE WATER WHEEL

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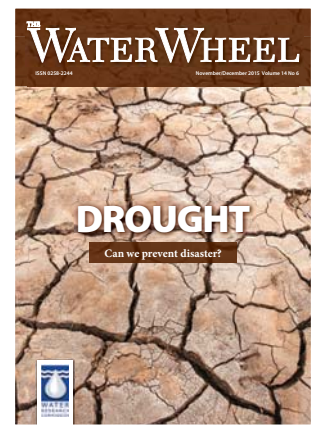
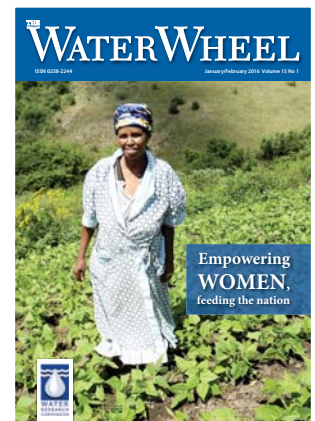
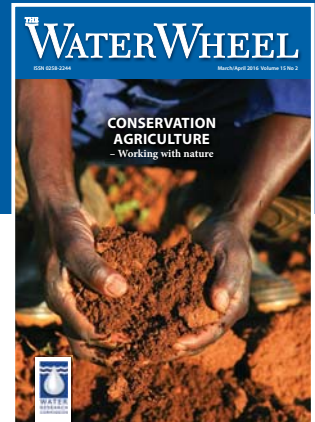
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New WRC reports



Report No. TT 661/16

Nutrient and energy recovery from sewage: towards an integrated approach

The transition to a low-carbon and resource-efficient economy has begun, also in South Africa. Wastewater is increasingly viewed as a 'water-carried waste', presenting opportunities for recovery of nutrients and energy, as well as water.

Ecologically and economically more sustainable sanitation and wastewater management solutions are being explored and implemented. Amongst the sewage-borne resources, phosphorus is an important, non-substitutable nutrient for all life forms, particularly in the growth of plants, and is therefore essential in ensuring universal food security. Human activities have disturbed the natural phosphorus cycle and remain heavily dependent on mining of non-renewable rock phosphate. As a result, there is a particular interest in phosphorus recovery. This technology transfer report firstly explores phosphate recovery possibilities from wastewater, relative to its potential South African market and developments in wastewater treatment. It is structured to address the following aims: Investigate available nutrient recovery technologies and their products, focusing on phosphate; describe a number of cases that have adopted nutrient recovery and assess these from a sustainability perspective; investigate the characteristics of recoverable fertilizer products and obtain viewpoints of experts along the fertilizer-produce value chain on likely social acceptance; present and analyse two cases of how a nutrient recovery process could be incorporated together with energy recovery via anaerobic digestion.

Report No. 2242/1/16

Polycyclic Aromatic Hydrocarbons (PAHs) in the aquatic ecosystems of Soweto/Lenasia

Polycyclic aromatic hydrocarbons (PAHs) consist of fused benzene rings and the congeners have varying numbers of benzene rings, usually between two and six. They have a widespread distribution due to their formation by incomplete combustion of organic materials and are continuously released into the environment making them ever-present. Anthropogenic activities largely increase the occurrence of these pollutants in the environment. A measurable amount of these PAHs are expected to find their way into aquatic ecosystems. In a previous study completed for the Water Research Commission (Project no. K5/1561) on persistent organic pollutants in freshwater sites throughout the entire country, the PAHs had the highest levels of all of the organic pollutants analysed for. According to this study Soweto/Lenasia was particularly burdened with high PAH levels which was the main motivation for further, in-depth

investigation into this area, focusing on the PAHs only. In this study the potential exposure of humans and wildlife to the 16 priority PAHs was investigated. The sites were selected in the suburban areas of Moroka, Lenasia, Fleurhof, Eldorado Park, Orlando West, Orlando East, Nancefield and Dobsonville. The main aim of this study was to determine the levels of the 16 priority PAHs in the Klip River that flows through the densely populated urban areas of Soweto and Lenasia. In addition, the pollutant profile of the 16 parent PAHs in the sediments was investigated, by comparing site PAH composition percentages to determine origin of the pollution, i.e. pyrogenic vs petrogenic. The final aim of this study was to determine the toxicity posed by the PAHs in the study area.

Report No. KV 356/16

Knowledge brokering and dissemination of irrigation management guidelines for training of extension advisors

South Africa faces particular challenges regarding water supply. Parts of what was already a dry country have become noticeably dryer over the past 30 years. Rising temperatures and changing rainfall patterns will have further consequences for food production and water supply. The National Development Plan 2030 proposes the advancement and expansion of agricultural development through effective land reform and growth in irrigated agriculture. This goal, however, requires skilled and well trained agricultural advisors to support smallholder farmers with decision making on opportunities open to them. For many farmers, but especially smallholder farmers, extension advisors play a pivotal role in building capacity through programmed learning and access to information. Appropriate training of extension advisors is urgently required that can respond effectively to the needs of smallholder farmers and to enable them to successfully integrate into the food value chain. The better the extension service – the better the smallholder operation. This report starts by providing the rationale for brokering and dissemination of the learning material, which is followed by an overview of agricultural education and training pathways in South Africa. A brief description of the current training programs offered at agricultural colleges and universities of technology approached precede syntheses of the bilateral discussions and workshop outcomes. Finally, concluding thoughts and the way forward for the implementation and uptake of the learning material is provided.

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Transformation and water

New ministerial initiative to transform water sector



Minister of Water Affairs, Nomvula Mokonyane.

The Minister of Water and Sanitation, Nomvula Mokonyane, along with the Water Research Commission (WRC), has launched a Women in Water Empowerment Programme (W-WEP) to mentor and transform women entrepreneurs in the water sector.

The purpose of the programme, which was launched at a special event on 14 October, is to provide support to women-owned and led enterprises to be effective and efficient in delivering proper water and sanitation-related services to the public. The programme will run over three years.

"The historical position of a woman has for many centuries been the one of subservient. Women have always been viewed as homemakers who must pander to the whims of men whenever required to do so," said minister Mokonyane at the launch. "Their economic role has never been appreciated in the same manner as that of their counterpart. This situation is compounded by the fact that the economic levers of our society are by and large controlled by men. As a result, business opportunities are skewed in favour of men."

The W-WEP hopes to change this perception. The programme will provide a safe and supportive environment where new entrepreneurs, especially from previously disadvantaged groups are able to start-up and sustain their businesses and access available opportunities in the water and sanitation sector.

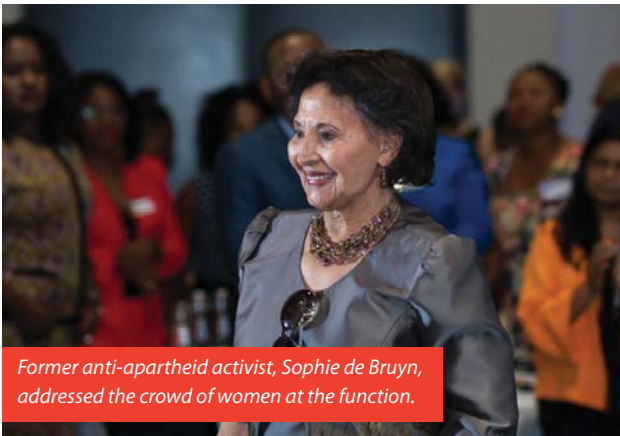
According to the minister, an investment in women was one of the most important investments the country could make to address the triple challenge of poverty, inequality and unemployment. "In turn, such an investment would bring

about the triple benefits of growth, prosperity and international competitiveness."

Among the speakers at the launch were anti-apartheid icon, Sophie de Bruyn, the last surviving leader of the 1956 Women's March. She highlighted the keywords for the morning as "standing together."

"The power of the 1956 march was that we knew exactly why we were standing together as women, what exactly we were standing up against and the future we wanted for our children and our families. We rose up against a system that victimised, oppressed and limited us, where our freedom of rights and economic opportunities was denied.

"The programme will provide a safe and supportive environment where new entrepreneurs are able to start-up and sustain their businesses and access available opportunities in the water and sanitation sector."



“The conversation we are having today is knowing what your battle, your cause and your principles in life are.”

The launch follows the Women in Water Consultative Conference held in Tshwane on 31 August, 2015, where the Minister made a commitment in regard to the launch of such a three-year national Women in Water Empowerment Programme. The scope of the programme covers all women-owned businesses that are competent and excellent in the provision of services to the department.

The programme comprises two legs, namely the W-WEP Mentorship Programme and the W-WEP Entrepreneurship Incubator.

The objectives of the programme are to:

- Identify and address the key gaps between the current scenario and expected future scenario for the participation of women-owned businesses in the water sector
- Accelerate the growth and success of women entrepreneurial companies through an array of business support resources and services. This includes, among others, capital, coaching, common services, and networking connections.
- Develop business talent to enhance performance of women professionals and women-owned businesses and create readiness for transition to the next level of operation
- Develop a succession and retention plan for professionals and women-owned businesses to sustain organisational excellence in terms of service delivery
- Measure business impact and effectiveness of the programme during and after implementation.

A total of 90 women-owned companies have been identified to be assisted in the programme.

The minister was under no illusions that the current economic environment will make implementation challenging. “We know that the transformation is under attack. There are active forces against the further development of an inclusive economy. Ironically, the lack of growth in our local economy, and indeed the global economy is often cited as the reason for holding the status quo. The second reality is that we know that the precise pathway out of the bondages of recession onto the pathway to prosperity is exactly the opposite. It is the path of inclusion. It is the path of expanding economic participation to realise our

full demographic dividend. It is the development of women as the investment in the future prosperity and sustainability of the South African economy.”

The beneficiaries of the W-WEP will comprise three cohorts:

- Beginners (women-owned enterprises in business, however, with no sustainable growth)
- Intermediates (women enterprises in business, however, not as established as big enterprises)
- Established (women-owned enterprises at intermediate stages that function as fully-fledged businesses but that require additional support to take their businesses to the next level of operation and compete nationally and globally).

These three cohorts will be drawn from various sectors, namely research and development (including technological innovation), engineering, construction, local community initiatives and construction supply.

A mentorship programme will match women entrepreneurs active in the water sector with a mentor who will provide ongoing, individual support to the business owner. This support typically focuses on the more tacit and experience-based insight that new or emerging entrepreneurs may lack.

Mentorship is always based on agreement between mentor and mentee that is grounded in the experience the mentor can share and the needs that the mentee has.

Broadly, there will be a focus on four areas, namely building a network of partners (product development, refinement and distributions, clients, business services support); support on how to manage partners, networks and clients; refining the product/service offering; and critically reflecting on the business model the mentee adopts.

There will be a range of spaces for mentor and mentee to interact, such as introductory workshops, interactive sessions, and reflection sessions to explore how the mentorship process is assisting. Where needed, there will be specific training provided based on identified gaps or needs.

In turn, the Women in Water Entrepreneurship Incubator is aimed at creating a developmental platform for women-owned companies that are at various stages of establishment (emerging, intermediary and established) and requiring varying degrees of support.

The project will cover undertaking business and entrepreneurship readiness analysis; skills and development assessments and support; mentorship based on support gaps identified and links to and embedding in relevant and appropriate funded national, regional and local projects that will align with incubate business aspirations and business development goals.

It is envisaged that women entrepreneurs will be offered the opportunity to be part of numerous water-related projects, including full-scale dam construction and rehabilitation projects, sanitation projects, river rehabilitation projects, and the current DWS programme looking at the rehabilitation of irrigation canals.

Sanitation and health

Study aims to break the cycle of disease

A newly-completed study, funded by the Water Research Commission (WRC), has made important discoveries around the practice of open defecation, and the ingesting of soil, with potentially serious implications for the transmission of disease in South Africa.

Article compiled by Lani van Vuuren.



Every year, on World Toilet Day (19 November), we are reminded of the plight of the estimated 2.4 billion people worldwide who do not have access to a safe toilet. Safe sanitation is not only an issue of dignity; it is also of crucial importance to the preservation of human health and well-being, especially among children.

There is an urgency to serve the remaining communities – without toilets, people defecate in the open and the faecal contamination of the environment that results is responsible for tragic and preventable death and disease. While the diarrhoeal disease responsible for a high number of deaths among young children and vulnerable persons are often in the spotlight, open defecation is also a virtually sure route for the spread of helminthic (parasitic worm) infections.

Infections with intestinal worms are widespread in South Africa, especially among children. Studies have shown as many as 90%

of children are infected with one or more type of worm in South Africa.

When infected individuals defecate in the open helminth eggs are passed into the soil. While helminthic infections often occur through accidental consumption of eggs from soil on dirty hands, a factor which makes the presence of this 'egg bank' in the soil even more hazardous is the practice of intentionally eating soil – scientifically known as geophagia.

Researchers, Bobbie Louton and Director, David Still, at Pietermaritzburg-based, Partners in Development (PID), became aware of the potential relationship between these three factors, i.e. open defecation, helminthic infections and geophagia, during previous WRC-funded research. The latter phenomenon, especially, has received little attention in South Africa from a research point of view. This prompted the current study, which was completed earlier this year.



Intestinal worm infections are especially prevalent among children. Studies have shown that as many as 90% of children can be infected with one or more type of worm in South African communities.

“People reported all kinds of reasons for ingesting soil from satisfying a craving, attraction to its smell, taste or texture, or because of the pleasurable feeling the person experienced during or after eating it.”

The main objective of the study was to increase understanding of the beliefs, knowledge, attitudes and practices and consequences associated with these three phenomena and explore the role that open defecation and geophagia may play in the transmission of helminthic infections and diarrhoeal diseases.

The study was conducted across 11 local municipalities in the provinces of Limpopo, KwaZulu-Natal and the Eastern Cape. Structured interviews were conducted with 376 householders from four language groups and 32 focus groups were conducted with children aged 8 to 14.

Open defecation in the presence of a toilet

Over the last two decades, the South African government has

made considerable progress in rolling out sanitation services to previously unserved communities. Nationally, access to safe sanitation has increased from 62% (in 2002) to 80% (in 2015). This compares well to the global figure of 68% of people who are using an improved sanitation facility.

While, in the past, the provision of a toilet alone was considered a sure way to end open defecation, research is increasingly showing that this is not necessarily the case. While studies on the matter are increasingly emerging in countries such as India, Pakistan, and Peru, the preference of choosing open defecation above using a toilet remains wholly under-reported in South Africa.

In a survey conducted for the WRC in three communities in KwaZulu-Natal, published in 2012, PID found that open defecation was practiced by a significant number of children, and occasionally adults, in communities provided with indoor low flush latrines. The percentage of households which reported that open defecation was practiced ranged from 26% to 35% across the three communities.

In addition, disposal of greywater, which may include faeces in water used for washing nappies or bottoms, into the household environment ranged between 55% and 88% across the three communities. This represents another hidden form of open defecation.

Why would people with access to a toilet not use it? The practice of open defecation in the presence of available sanitation shows that the mere provision of infrastructure does not automatically equate to service delivery, notes Dr Sudhir Pillay, WRC Research Manager. "There are many other factors to take into account, such as social behaviours and preferences, as well as regular operation and maintenance that need to be looked at more carefully for the long-term sustainability of any toilet solution provided."

In the current study, households interviewed painted a vivid picture of open defecation occurring routinely in the presence of government-built ventilated improved pit (VIP) toilets. Nearly half (43%) of householders interviewed did not consider their VIP toilet safe for children for fear of, for example, the child falling into the pit or the pedestal collapsing into the pit.

Roughly a quarter of householders interviewed at least one member of the household who was denied access to the toilet for this reason, while 21% had at least one member who elected not to use the toilet sometimes or always. Other problems and safety issues associated with VIP toilets which were found to contribute to open defecation (particularly at night) were the dangers inherent in having the toilet located far from the house and the tendency of snakes to be attracted to the toilets.

These results underpin the importance of not only involving community members in sanitation interventions – such as the design and choice of sanitation technologies provided – but also measuring the effectiveness of the sanitation intervention. "Without this decision-makers – most of whom probably don't have VIP toilets themselves – don't realise that the pit toilet potentially represents a sanitation solution for only some members of the household, but not for others," says Louton.

Alternative sanitation technologies, such as the pour flush toilets which has been developed by PID with WRC funding, may offer

a solution, as it offsets the pedestal from the pit. This eliminates the risk of falling into the pit while using the toilet. "The commercialised product developed from the WRC pour flush toilet also incorporates a child-friendly seat," explains Dr Pillay. "During our extensive demonstration programmes to introduce the technology the pour flush became known simply as the 'safe toilet' among households."

He encourages designers of sanitation technologies to consider designing the pit off-set rather than under the toilet seat – even for VIP latrines.

Because pour flush toilets significantly reduce offensive smells they can also be built inside the house or attached to the house, notes Louton. "This can address some of the other reasons people defecate outside, such as the fears or inconvenience associated with going to an isolated pit toilet, particularly at night or in inclement weather."

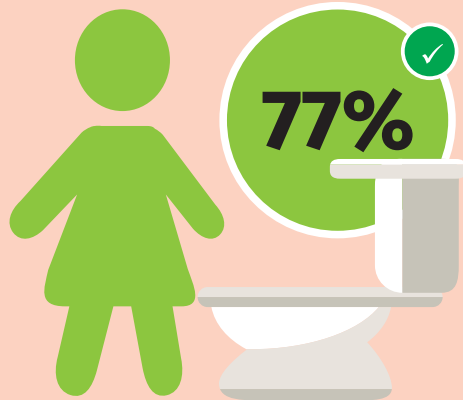
The practice of geophagia

Geophagia has been practiced for thousands of years all over the world. In this study, almost a third (29%) of respondents reported that someone in their household practiced geophagia. This is an interesting finding, since 80% of people interviewed said that eating soil can cause health problems. People reported all kinds of reasons for ingesting soil from satisfying a craving, attraction to its smell, taste or texture, or because of the pleasurable feeling the person experienced during or after eating it.

In general, the practice was perceived as potentially dangerous and viewed with mild disapproval but tolerance. It was not found to be sustained on any cultural basis, but rather was initiated in response to observing others practice it or by experiencing a direct craving in response to the smell of soil, possibly linked to nutrient deficiencies.



About a third of respondents buy their soil from street vendors. Here Ibovu (red) and umnchako (white) soils are sold together in Pietermaritzburg.



77% of interviewed households indicated that they felt their toilet was safe.



Only 53% of interviewed households thought their toilet was safe for children to use.

Where do people get the soil from? Roughly a third of soils were reported to be collected from the immediate household environment and roadsides, where the risk of faecal contamination may be particularly high. A quarter of soils reported were purchased from a vendor, where the buyer had no knowledge of the source of the soil.

The remainder of soils were reported to be collected from the natural environment, where faecal contamination of the soil by humans may not be a serious concern. Natural water bodies were a significant source for geophagic soils in the Eastern Cape, while ant and termite soils accounted for a significant percentage of soils mentioned in Limpopo. Soils were also collected from the nearby bush, forests or hills, while some people described collecting soil from the house structure itself.

Interviewees told many stories of health crises, operations and even deaths caused by eating soil. The data identified an important gap between the knowledge and perceptions of patients and those of healthcare professionals around geophagia, where patients may believe that doctors have operated on them because of a blockage caused by soil while the doctor involved may be unaware that the practice of geophagia even exists.

Knowledge of the transmission of helminthic and diarrhoeal infections

While experiences with helminthic infections were common, the study showed that people generally had little knowledge of routes of transmission of helminthic infections or the epidemiology of different worms. When people were asked about the route of transmission of helminthic infections (how one gets infected and how one can prevent getting infected) knowledge was very limited.

This is a serious knowledge gap that needs to be addressed. "When families don't understand how diseases are spread they are helpless to protect themselves and their children," Louton points out. "We found that respondents typically had some understanding of how diseases caused by bacteria and viruses

are spread, but many had completely inaccurate ideas about how intestinal worm infections are spread. Training specifically dealing with worm infections needs to be incorporated into the training of healthcare professionals and community health workers as well as community and school health education programmes."

This study demonstrated that both open defecation and geophagia are common practices within the household environment in South Africa, and may contribute to the high incidence of intestinal worm infections, as well as diarrhoeal disease.

The research team has started sharing information on the study, particularly through the National Institute of Communicable Diseases, and plans are afoot to engage with government departments, such as the Department of Health to encourage the incorporation of the findings into training on diarrhoeal diseases in the curriculum of nurses, doctors, environmental health practitioners, and community health workers.

It is hoped that, in this way, the message will spread that while geophagia is not necessarily detrimental to a person's health if practiced carefully, the public needs to be armed with an accurate understanding of how diseases are transmitted and an awareness of the risks of eating soil where there may be faecal contamination.

To order the report,

Investigating the practice of open defecation post-sanitation provision and the practice and implications of ingesting soil which may be contaminated (Report No. 2379/1/16), contact Publications at Tel: (012) 761 9300, Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.

Estuaries

Plans afoot to save Cape Town's largest estuary

What management interventions are most appropriate for Cape Town's largest estuary, degraded by 150 years of human impact?

Sue Matthews reports.



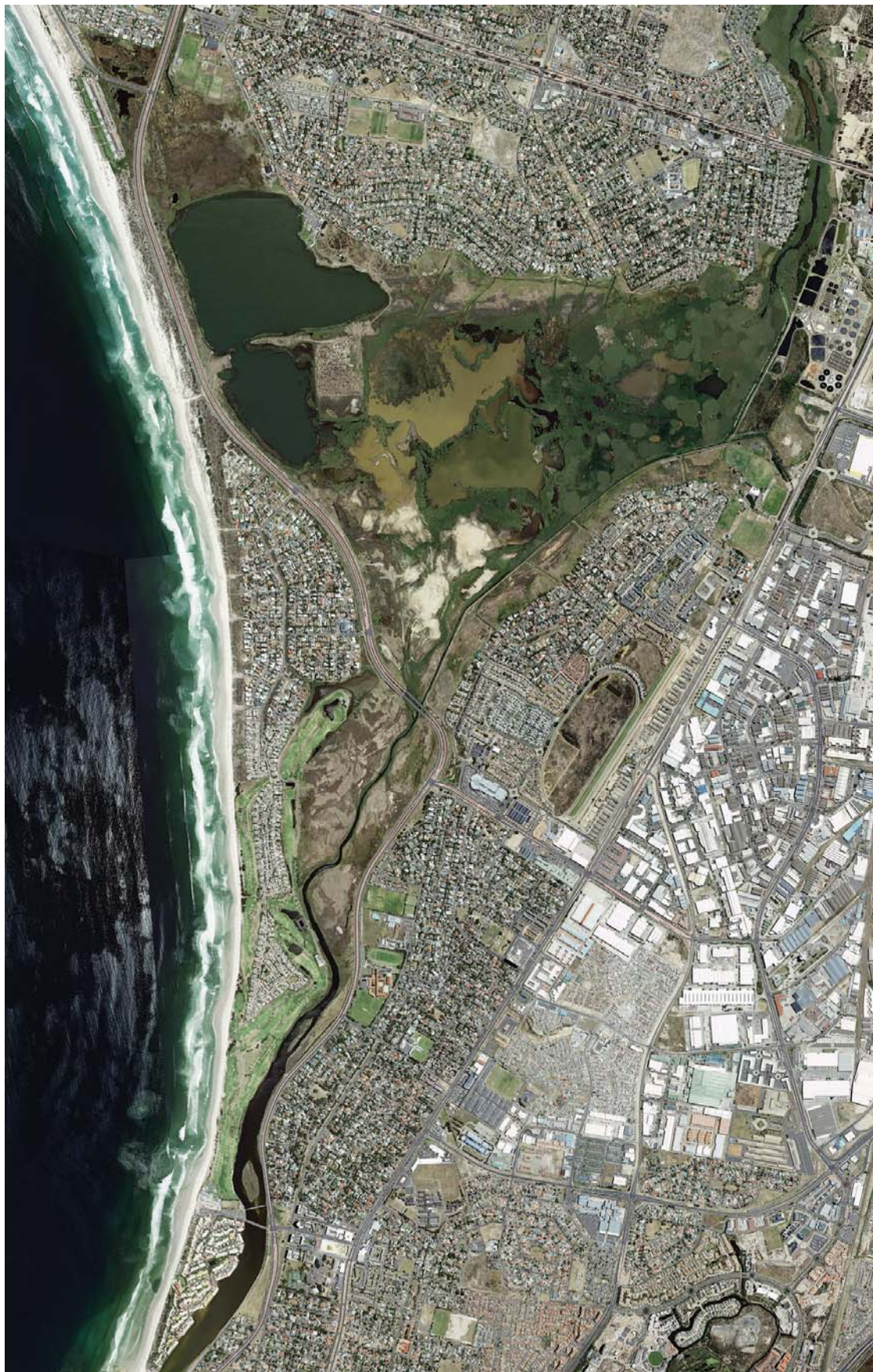
Photographs from the first aerial survey of the south-western Cape, conducted in March 1938, show the sandy course of the Diep River opening out into the vast, dried-out pans of Rietvlei, then reforming into a channel before entering the sea some 5 km north of Table Bay Harbour. Apart from a racecourse, a few roads and a handful of houses set amongst rows of empty plots – the nascent suburb of Milnerton – the land is undeveloped, but even then there is evidence of human impact on the estuary. The lower reaches are constrained between hardened banks, while a weir near the mouth dams the flow, designed to raise the water level for rowing and sailing regattas.

In fact, the estuary had already been dramatically altered by that stage. The earliest maps of the area show it joined by a backwater channel to the adjacent Salt River, resulting in an extensive wetland with two openings to the sea. The systems were separated during road and railway construction at the

start of the 20th century, and at about the same time the lower lagoon was dredged for the first time.

Today, the estuary mouth, Milnerton Lagoon and Rietvlei are hemmed in by intensive urban and industrial development, while the rural reaches of the Diep River flow through a patchwork of wheatfields and vineyards. There was even talk about 50 years ago of converting Rietvlei into a fishing harbour or marina, when two large basins were excavated to provide sandfill for extensions to Table Bay Harbour. Instead, these new deep-water lakes, now called Flamingo Vlei, became the home base of the Milnerton Aquatic Club, and remain popular for power-boating, sailing and windsurfing, as well as angling.

The property was also donated by Transnet (or SA Transport Services as it was then called) for incorporation into a Nature Area, which included Rietvlei's seasonal pans and the Milnerton



National Geo-spatial Information

The Diep River Estuary, comprising Rietvlei and the Milnerton Lagoon, is surrounded by intense urban and industrial development.



depositing salts from the catchment's Malmesbury shales that formed a saline crust as the seasonal pans evaporated. These days, the much-reduced flow diverts into the channel and bypasses Rietvlei, unless the river is in flood, when it can overtop the channel banks. The seasonal pans are now filled by stormwater runoff from the surrounding suburbs, as well as groundwater rising to the surface in winter, but some suspect that the channel acts as a sub-surface drain, causing the pans to dry out faster than before. Apart from the fact that the pans provide important habitat for flamingoes and other wading birds when inundated, fine dust blown off the exposed surfaces by the area's notorious south-easterly winds is a nuisance to local residents.

Area Manager responsible for the reserve, Koos Retief, has the difficult task of addressing these issues and evaluating various possible management interventions. He is guided by the Diep River estuary management plan (EMP), developed between 2008 and 2011 by external consultants with stakeholder participation, which lists one of the long-term objectives to be the optimal functioning of Rietvlei as a wetland – with the pans undergoing seasonal cycles – and appropriate tidal flows and salinity levels in the lagoon.

"It was also stated in the EMP that in order to answer questions about what is happening ecologically and how to manage the system, we need to have a thorough understanding of how the system operates hydrologically and geohydrologically," says Retief.

The City of Cape Town therefore advertised a tender in August 2014 for a study involving the collection of data on surface water and groundwater, and the development of a hydrodynamics model for use by reserve staff. The contract was awarded to the Civil Engineering Department at the University of Stellenbosch, but the team includes a number of independent specialists. Consultant hydrogeologist, Ross Campbell, is responsible for data collection and equipment, as well as assisting with project management.

"There's a big monitoring component to the project, so we're collecting surface and groundwater levels, temperature and

salinity data with automatic loggers, which take measurements every half hour, plus we've installed an automatic weather station," he explains. "We've now got an enormous amount of very interesting hydrological data for the estuary, which has never been monitored in such detail before."

Loggers for surface water monitoring have been installed at four sites – one in Flamingo Vlei and three at the various road bridges across the river, approximately 1 km, 4 km and 8 km upstream of the mouth – while eight groundwater monitoring wells housing piezometers were drilled with hand augers in various parts of the wetland. The latter have already revealed how groundwater salinity increases as the water table rises, bringing brackish water towards the surface or re-suspending salts locked up in the soil, while inundation of the pans by stormwater tends to dilute the salts.

"We're getting very high salinities of 70 to 80 ppt in some of the groundwater in the central areas of Rietvlei," says Campbell. "The salt crust that forms on the surface of the dried out pans in summer is partly held in place by halophytic plants, but without new salt coming in – whether from the catchment or the sea, as in historical times – the salinity profile in the soil is probably moving down. This means there may not be enough salt in the upper layers any more to form a strong crust or keep a cover of halophytes, which could be contributing to the dust problem."

The main focus of the modelling effort is on the surface water, and involves simulating water flows and salinity from the mouth to the road bridge 8 km upstream. Early next year, the team will be training the reserve staff and other key municipal officials to use it.

"We're hoping that such a model will assist us in future decision-making," says reserve manager, Retief. "When there are changes in hydrology, such as increased volumes from Potsdam or more reuse of the effluent, we need to be able to predict what the outcomes will be in the system downstream. Should we perhaps be filling in the bypass channel, and would this increase the flood risk to properties upstream that lie within the 1:100 year floodline? When do we need to remove sediments from the system, and where should we do it?"

"We're even considering establishing a population of hippopotamus at Rietvlei, because they would trample canals through the reedbeds and allow water to flow through to places where it currently doesn't reach."

He explains that the freshening of the system has facilitated the invasion of the seasonal pans by the couch grass *Paspalum*, which now grows as thick tussocks in areas that were once either exposed ground or covered with saltmarsh vegetation.

"It needs a heavy bulk-grazer to keep it under control, because that habitat is useless to migrating birds, and it's a fire hazard too," he says. "Hippo would also be a tourism drawcard, of course, but we would have to strengthen our fences to ensure they don't go walkabout in the surrounding suburbs!"

Water and biofuel

Extensive research hopes to answer - Should we 'grow' our future fuels?

Are biofuels the answer to an energy-scarce future? Do we have enough water resources in order to grow biofuels? These are some of the questions an intensive research project, led by the University of KwaZulu-Natal (UKZN) and funded by the Water Research Commission (WRC) aimed to answer.

Article by Kim Trollip.



All photographs courtesy of UKZN

Biofuels remain a viable option in South Africa, despite being a water-scarce country – but there are a number of provisos. For example, we need to cultivate sustainable, water-efficient feedstocks and make viable decisions regarding land use change. Land use change that threatens the cultivation of food, or has a negative impact on biodiversity, or significantly reduces the availability of water to downstream users, should certainly be avoided. This is the conclusion of an eight year-long study that will guide amendments to existing biofuel-related policy, as well as help the biofuels industry plan the way forward.

The project has ensured that more precise knowledge is now available on water use and what biofuel crops can be considered

(based on highest water use efficiency), the geographic location of suitable production areas for each crop and potential impact on streamflow reduction. Producing crops for biofuels is definitely still an option, with crops for bioethanol being more water use efficient. The study has also concluded that water availability (and not land availability) will determine limits for biofuel production potential in rain-fed areas of South Africa.

Within the innovation cycle, research on water use of biofuel crops was initiated through a scoping study. Following the determination of a wide range of potential crops, more detailed research was done on a range of variables influencing water use and the impact on run-off with rain-fed production of priority



Sugarbeet was one of the crops studied during the research project.

bioethanol and biodiesel crops. During the third phase of research, attention is now being given to water use and related agronomic practises with budgets of income and expenditure per hectare for advising emerging farmers who are interested in including these crops in farming operations.

WRC Executive Manager for Water Utilisation in Agriculture, Dr Gerhard Backeberg, urges actors in the public and private sectors to study the available research output in order to improve the biophysical basis for a sustainable biofuels industry in South Africa.

Principal investigator on the project, Richard Kunz, who is a hydrologist at UKZN, says the biofuels industry has the potential to bring underutilised arable land back into production, particularly in rural areas. He adds that the industry will also provide an alternative market for certain crops.

“For example, the expected demand for grain sorghum will encourage farmers to grow this crop. This will help reverse the declining trend in sorghum cultivation over the past decade. The Provisional Growth and Development Plan for KwaZulu-Natal (UKZN) highlighted the need to expand agriculture by almost a million hectares by 2030. The biofuels industry will certainly assist the provincial government in reaching this goal!”

The study has also delivered a decision support tool to determine the impacts of biofuel feedstock production on water quantity.

Key messages to stakeholders

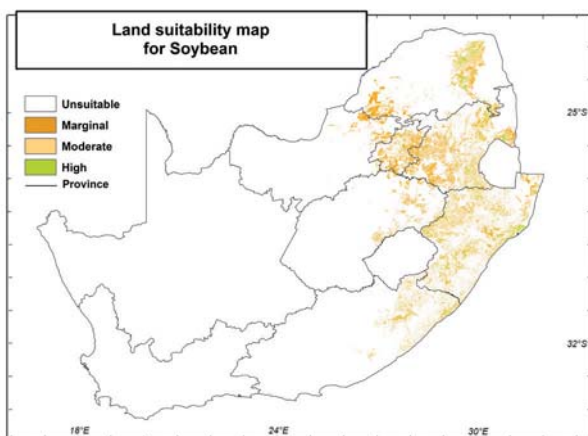
The project output will benefit different end-users in various ways. It will assist the Department of Energy (DoE) to revise

the country’s biofuel production potential; the Department of Water and Sanitation (DWS) to assess the streamflow reduction potential of selected feedstocks in sub-catchments; and it will help biofuel manufacturers to identify and target areas where feedstocks should be cultivated and the preferred location of processing facilities by using the land suitability maps. The knowledge is of great use to agricultural extension officers to advise emerging farmers on which crop is best adapted in a particular farming region. Water use planners can now be guided by water use efficiency estimates of crops towards making the most beneficial use of available water resources.

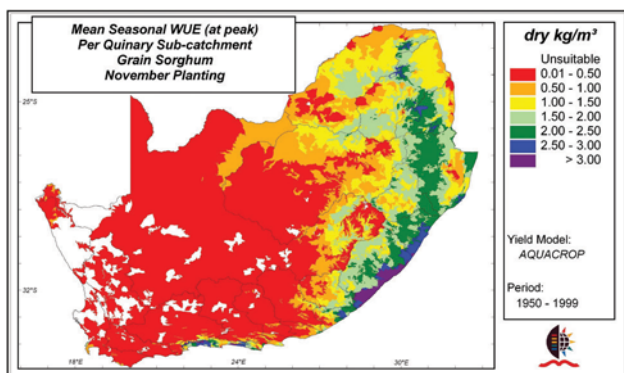
Produced as part of the study, the maps showing the inter-seasonal variability in simulated crop yields are useful in determining the risk of crop failure, which both farmers and the insurance industry may find beneficial.

Six private companies have already approached the DoE with proposals to set up biofuel manufacturing plants in South Africa, according to Kunz. Collectively, these companies would be able to produce some 1.3 billion litres of biofuel annually – three times the conservative target of 400 million litres initially suggested by the Biofuels Industrial Strategy back in 2007.

“Water use planners can now be guided by water use efficiency estimates of crops towards making the most beneficial use of available water resources.”



The report produced a number of maps to indicate the water and land suitability for the production of biofuel crops. This map shows the land suitability for growing soybean.



Looking at water use, sugarbeet is best grown along the east and southern coast of South Africa.

Kunz believes the strategy is overdue for revision and recommends that the Biofuels Task Team (responsible for revising this policy document) take cognisance of the research findings contained in the studies funded by the WRC. "Policymakers should promote the sustainable production of biofuels in South Africa. Foremost, feedstock should be cultivated under rain-fed conditions. In the Cradock region, the planned irrigation of grain sorghum and sugarbeet for biofuel production needs to be re-evaluated. Irrigation water should rather be used for food and feed production, not fuel production."

"The highest priority areas for poverty alleviation and rural development exist in KwaZulu-Natal and the Eastern Cape. Thus, biofuel-related policy should encourage and incentivise the use of currently unproductive arable land in these two provinces, for feedstock cultivation. Furthermore, the use of highly productive arable land for biofuel production is not recommended. Such land should rather be used for food production."

Biofuel policy needs to cap or limit the volume of biofuel production in South Africa. The higher this target volume, the greater the impact on the country's available land and water resources. South Africa's biofuel production potential is limited by the need to minimise the impact of large-scale feedstock

cultivation on the country's water resources.

More effort is required to remove existing barriers which prevent smallholder farmers from participating in the biofuels supply chain. For example, other research at UKZN has shown that South Africa's current Cooperatives Act needs to be amended to allow private investment in traditional producer-owned cooperatives. This is deemed important if smallholder farmers are to participate in the biofuels supply chain.

Rolling out biofuels in South Africa: considerations

The petroleum industry has stated that compared to bioethanol, it is easier and cheaper to blend biodiesel into the fuel supply chain. However, the research shows that biodiesel production in South Africa requires far more land area than bioethanol production. For example, an additional 3 000 ha of land is required to cultivate sufficient feedstock to produce 1 million litres of biodiesel from soybean (i.e. 3 180 ha), compared to the same volume of bioethanol produced from sugarcane (i.e. 180 ha). Thus, if the availability of arable land in a particular region or province is limited, then the cultivation of bioethanol feedstocks should be preferred. To meet the feedstock production and supply demands, the companies would require a total area of arable land of 2.3 million hectares. According to a 2012 Department of Agriculture report, South Africa has about 2.5 million hectares of underutilised arable land.

"From the research to date, we now know that, to be sustainable, biofuel feedstock production must take place only under rain-fed conditions, and these crops must be grown in rotation with food crops such as maize and wheat," says Kunz. "With the support of training and resources, the production of biofuel feedstocks must also be promoted in rural areas where agricultural crop production is non-existent or sub-optimal. The production of these crops must strive towards the most beneficial use of available water resources."

The research also shows that some crops are more efficient users of water than others. For example, crops that contain sugar (e.g. sweet sorghum) are more water use efficient than feedstocks that produce starch (e.g. grain sorghum). In addition, the water use efficiency of sugar crops (e.g. sugarbeet) is much higher than crops that produce vegetable oil (e.g. soybean). The study maps highlight the spatial variability in water use efficiency, which may help to guide land use planners in striving towards the most beneficial use of the country's available water resources.

The reports highlight two crops which may negatively impact the availability of water to downstream users, especially if grown on a large scale in catchments that are already water stressed. Thus, the DWS will find the database of simulated reduction in streamflow generation useful in deciding which crops may need to be declared as stream flow reduction activities.

The researchers also looked at areas of South Africa where biofuel feedstock would grow under rain-fed conditions. They found that large parts of Mpumalanga, KwaZulu-Natal and the Eastern Cape were best suited to sugar beet planted in September, where at least 6 t/ha dry matter production was attainable. According to Kunz, a coastal section of the

Eastern Cape would yield the “largest crop per drop” of 2 kg to 2.5 kg of dry matter production per cubic metre of water used. However, sugar beet is particularly prone to fungal disease when cultivated in hot and humid areas.

Biofuels timeline:

2005	Cabinet approves the development of a strategy to create jobs through biofuels
2006	A feasibility study, conducted in preparation for the development of the National Biofuels Industrial Strategy (BIS) noted a likely increase in pressure on water resources from energy crops and called for more research by the WRC into the effect of commercial and small-scale biofuels production on both water quality and quantity prior to the roll-out of the strategy
2007	Government releases BIS and targets 400 million litres of biofuel production within five years
2007	WRC begins scoping study into biofuels, producing data on water use and growing conditions of some biofuels crops and highlighted areas where knowledge was lacking
2009	WRC launches dedicated, multi-million rand biofuels study to assist the Department in assessing the potential impact of large-scale feedstock production on water resources
2009	The (then) Department of Water Affairs and Forestry releases a statement highlighting the fact that South Africa is a water-scarce country which can ill afford the use of current or potential irrigation water for fuel production rather than growing crops for food
2010	Worldwide biofuel production reaches 105 billion litres
2012	National target of 400 million litres of biofuel as captured in the BIS is not met, but government announces that the petroleum industry must blend a minimum of 2% of locally produced bioethanol into its petrol from October 2015 onwards
2015	WRC completes R7,4 million research project to determine the water use and production impact of various feedstocks suitable for biofuel production in the country
2016	In July, an SAA flight from Johannesburg to Cape Town was powered by petroleum-based jet fuel blended with biofuel. The biofuel was derived from the oil of nicotine-free tobacco plants grown by farmers on underutilised land in the Limpopo province
2015	The WRC funds another research project that will run until 2020 to develop agronomic practices for best production of biofuel crops by emerging farmers, as well as the economics of producing these feedstocks in rural areas.
2050	International Energy Agency goal for biofuels to meet more than a quarter of world demand for transportation fuels

The potential for biofuels in South Africa

Bioethanol and biodiesel can be blended with petrol and diesel, reducing dependency on fossil fuels. The sugar and starch extracted from feedstocks are converted into bioethanol, and the vegetable oil into biodiesel. A valuable by-product is animal feed. About 1 t of sugarcane can be used to produce 80 ℓ of biofuel and 280 kg of bagasse; 1 t of grain sorghum can be used to produce 417 ℓ of biofuel and 221 kg of animal feed.

Looking ahead

The WRC has funded 13 years of biofuels research. The initial scoping study (2007-2009) focused on the feasibility of biofuel production and highlighted potential feedstocks. The scoping phase was followed by the research phase where the WRC initiated and funded a more detailed 6-year study (2009-2015).

This is now being followed by the implementation phase, where the WRC is funding an additional five-year study (2015-2020). This project considers the economics of feedstock production by smallholder farmers, as well as developing guidelines to advise emerging farmers on agronomic practices of feedstock cultivation. It focuses on two feedstocks in particular, namely grain sorghum and soybean, selected by the DoE as reference feedstocks to determine the pricing framework for bioethanol and biodiesel production.



Grinding of sweet sorghum stems as part of the biofuels study.

Regional groundwater management

Southern African groundwater sector gets new champion

Groundwater management in southern Africa has received new impetus following the launch of the Southern African Development Community Groundwater Management Institute (SADC-GMI) in Gauteng earlier this year. The institute is working within the 15 members states to collaboratively strengthen the management and development of groundwater for social and economic development in the region.

Article compiled by Lani van Vuuren.



Containing 9% of the world's water resources and 11% of the world's population, sub-Saharan Africa is not necessarily 'water poor'. However, the region faces numerous water-related challenges that threaten economic growth and jeopardise livelihoods.

Traditionally, the development and management of water resources in SADC has focused on surface water. However, there has been a realisation in recent years of the important role groundwater can play in the socio-economic development of the region not only as a local source for rural communities, but

also as a feasible resource for bigger settlements.

Some member states, such as South Africa, have actively integrated groundwater into their water resource management policies and laws, but generally groundwater does not feature prominently in institutional frameworks to manage water at both national and transboundary levels. It is increasingly acknowledged, however, that regional approaches to the management of shared waters can provide improve water security and more sustainable management.

Aquifer types of the SADC region

- **Unconsolidated intergranular aquifers** – Examples include the Mushawe alluvial aquifer in the Limpopo River basin and the extensive shallow aquifer of the quaternary alluvial plain in the Democratic Republic of Congo
- **Fissured aquifers** – Aquifer systems associated with Karoo formations are found extensively throughout the SADC-region. The formations normally have low permeability and are generally low-yielding. The Cape Fold Mountains of South Africa are also associated with fractured rock aquifers.
- **Karst aquifers** – Karst aquifers are water-bearing, soluble rock layers in which groundwater flow is concentrated along secondary enlarged fractures, fissures, conduits and other interconnected openings. Extensive use is made of karst aquifers in Botswana, Namibia, South Africa, Zambia and Zimbabwe.
- **Layered aquifers** – The Kalahari/Karoo aquifer system shared between Botswana, Namibia and South Africa is an example of a layered aquifer. In the Stampriet Artesian Basin there are two confined regional artesian aquifers in the Karoo sediments, overlain by the Kalahari sediments that often contain an unconfined aquifer systems.
- **Low permeability formations** – Low permeability formations are normally associated with basement aquifers. These formations occur extensively throughout the SADC-region.

Source: Position paper: Groundwater management in the Southern African Development Community

The many challenges that face the region – particularly in the water sector – are best addressed through cooperation and integration at the regional level. Strengthening regional initiatives and institutions can also contribute to ending poverty and promoting shared prosperity.

Groundwater occurrence in southern Africa is characterised by a large variety of geological structures and climatic differences that condition the regional hydrogeological settings. Up to 65% of the SADC is covered by crystalline rocks with aquifer systems developed in the weathered regolith and fractured bedrock.

The aquifers developed in these areas are largely unconfined, locally developed and not spatially extensive. While large-scale groundwater well-field developments are not feasible, modest groundwater supplies can be abstracted.

It is estimated that SADC member states have a total of 2 491 m³/capita/annum in renewable groundwater – this is more than what is available in Europe or Asia. Yet, only 1.5% of groundwater

is currently utilised. This small percentage of groundwater use is stretching far, however. This creates enormous opportunity for further development.

Groundwater does play a significant role in especially rural water supply in southern Africa, being the only water source for up to 70% of the SADC population of 250 million people. Even the region's capital cities, such as Tshwane, Lusaka, Dodoma and Windhoek, are partly dependent on groundwater for their water supply.

Groundwater also plays an important role in supporting food security in the sector. In Angola, for example, groundwater irrigation is important in areas where the rainfall is not sufficient for crops and where rivers are unreliable. In Zimbabwe, alluvial aquifers associated with the Shashani River, a tributary of the Limpopo River, supply water to a number of irrigation schemes.

Many ecosystem services have a direct linkage with groundwater storage, recharge and discharge in southern Africa. The interaction between surface water and the groundwater strongly influences the structure and function of the Okavango wetland ecosystem in northwestern Botswana. The cycling of seasonal floor water through the groundwater reservoir plays a key role in creating and maintaining the biological and habitat diversity of the wetland, and inhibits the formation of saline surface water.



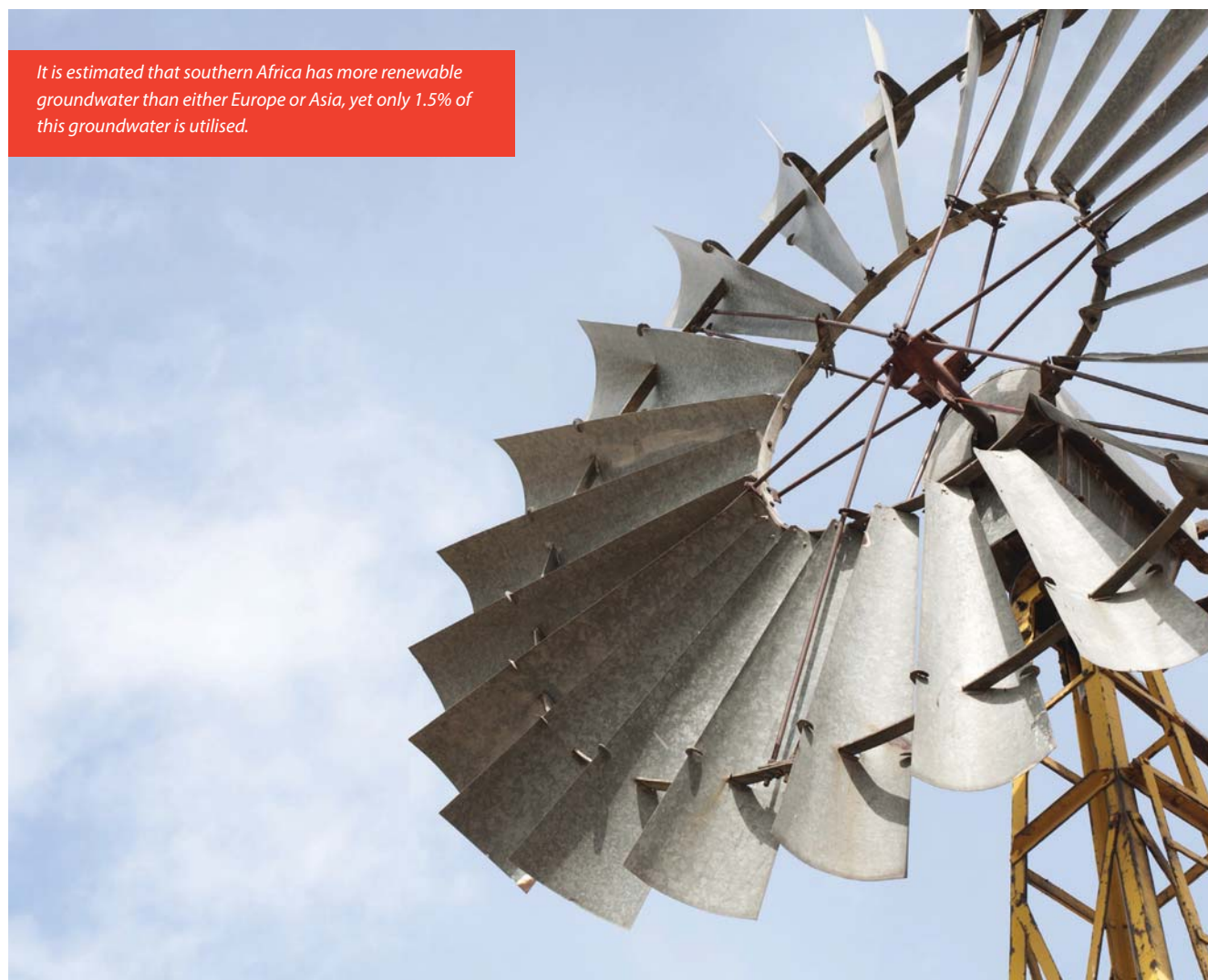
An estimated 70% of the 250 million residents in southern Africa are dependent on groundwater for their daily water requirements.

SADC members – Groundwater availability in terms of total water availability

Country	Total water availability (surface and groundwater)	Groundwater availability (as % of total water availability)
Angola	5 915 m ³ /capita/annum	23%
Botswana	5 410 m ³ /capita/annum	20%
Democratic Republic of Congo	16 605 m ³ /capita/annum	12%
Lesotho	1 415 m ³ /capita/annum	4%
Madagascar	13 905 m ³ /capita/annum	10%
Malawi	1 004 m ³ /capita/annum	17%
Mauritius	2 179 m ³ /capita/annum	Very small fraction
Mozambique	7 760 m ³ /capita/annum	10%
Namibia	7 207 m ³ /capita/annum	11%
Seychelles	Not calculated	
South Africa	910 m ³ /capita/annum	10%
Swaziland	3 504 m ³ /capita/annum	9%
Tanzania	1 800 m ³ /capita/annum	22%
Zambia	6 489 m ³ /capita/annum	18%
Zimbabwe	1 282 m ³ /capita/annum	8%

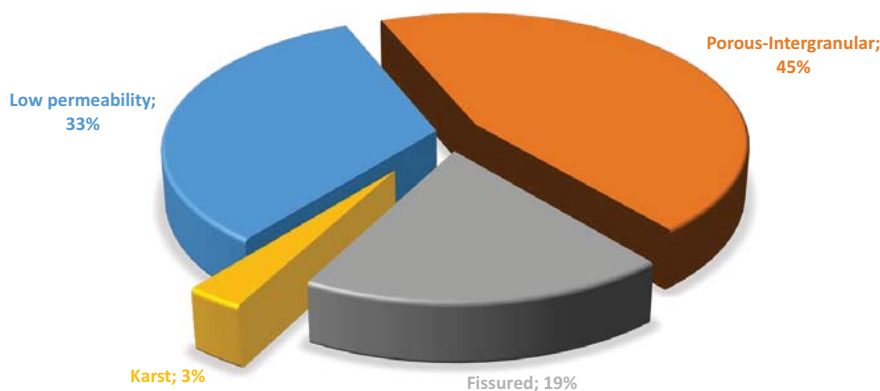
Source: Position paper: Groundwater management in the Southern African Development Community

It is estimated that southern Africa has more renewable groundwater than either Europe or Asia, yet only 1.5% of this groundwater is utilised.





Large southern African capital cities, such as Pretoria and Windhoek, are at least partially dependent on groundwater.



Groundwater occurrence in SADC (Source: Position paper: Groundwater management in the Southern African Development Community)

There have been numerous efforts to understand and manage groundwater in SADC in recent years, involving both regional and international organisations. These include, for example, the Transboundary Water Management in SADC Programme (2005-2015), led by GIZ with other funding organisations; the Groundwater and Drought Management Project (2009) supported by the World Bank, the SADC Hydrogeology Map and the SADC Groundwater Grey Literature Archive.

The SADC-GMI intends to build on these and other achievements related to groundwater management in the region. The initiative is promoting sustainable groundwater management and solutions to groundwater challenges in the region through, among others, building capacity, providing training, advancing research, supporting infrastructure development, and enabling dialogue to exchange groundwater information.

According to SADC-GMI Director, James Sauramba, the challenges of climate change, pollution and rapidly growing water demand in southern Africa make building a sustainable groundwater management programme in the SADC member states critical for the region's future development. His vision for the institute is to ensure that groundwater management issues are granted equal priority in national and international water

management discourses, and prominently featured in water legislation and policies in southern Africa.

At the same time, he wants the SADC-GMI to substantially elevate cooperation on shared aquifers in the region, in alignment with the revised SADC Protocol on Shared Water Courses. "There are over 30 identified shared aquifer systems across southern Africa and member states often share similar groundwater challenges," noted Sauramba. "Managing and developing these in a sustainable manner will positively contribute to the social and economic development of the people residing within the region."

SADC-GMI is managed by the SADC Secretariat, and is hosted by the Institute for Groundwater Studies at the University of the Free State. Finance is being provided by World Bank and the multi-donor trust fund, Cooperation in International Waters in Africa (CIWA).

It is expected that the institute will go a long way towards creating a regional platform for knowledge sharing and cooperation on the sustainable management of southern Africa's groundwater resources.

To find out more, Visit: www.sadc-gmi.org

Water and food

Smallholder farmers need a leg-up to adapt to climate change

Unless action is taken now to make agriculture more sustainable, productive and resilient, climate change impacts will seriously compromise food production in countries and regions that are already highly food-insecure. This is one of the main messages emanating from the Food and Agriculture Organisation's (FAO's) latest State of Food and Agriculture Report, published earlier this year. This year's report is focused on climate change, agriculture and food security.



By 2050, global food demand is projected to 60% more than current levels. This constant increasing demand for food is driven by population and income growth, as well as rapid urbanisation. It is anticipated that the highest population increased will be concentrated in regions with the highest prevalence of undernourishment and high vulnerability to the impacts of climate change.

The effects of climate change on agricultural production and livelihoods are expected to intensify over time, and to vary across countries and regions. Beyond 2030, the negative impacts of climate change on the productivity of crops, livestock, fisheries and forestry will become increasingly severe in all regions.

Productivity declines would have serious implications for food security. Food supply shortfalls would lead to major increases in food prices, while increased climate variability would accentuate price volatility. Since the areas most affected would be those with already high rates of hunger and poverty, food price

increases would directly affect millions of low-income people.

While climate change is but one driver of poverty and food insecurity, its impacts are expected to be substantial. In the absence of climate change, and with continuing economic progress, most regions are projected to see a decline in the number of people at risk of hunger by 2050. With climate change, however, the population living in poverty could increase by between 35 and 122 million by 2030 relative to a future without climate change, largely due to its negative impacts on incomes in the agricultural sector.

The increase in the number of poor would be biggest in sub-Saharan Africa, partly because its population is more reliant on agriculture. For the reasons outlined above, food and agriculture must be central to global efforts to adapt to climate change, through policies and actions that address vulnerabilities and risks and promote agricultural systems that are resilient and sustainable.

Potential impacts of climate change for agriculture in sub-Saharan Africa

- Overall impacts on yields of cereals, especially maize, are negative across the region.
- The frequency of extremely dry and wet years increases.
- Much of southern Africa is drier, but rainfall increases in East and West Africa.
- Rangeland degradation and drought in the Sahel reduce forage productivity.

FAO warns that a “business as usual” approach could put millions more people at risk of hunger compared to a future without climate change. Most affected would be populations in poor areas in sub-Saharan Africa and South and Southeast Asia, especially those who rely on agriculture for their livelihoods. Future food security in many countries will worsen if no action is taken today.

Overhauling farming and food systems will be complex due to the vast number of stakeholders involved, the multiplicity of farming and food processing systems, and differences in ecosystems. Yet, efforts must begin in earnest now as the adverse impacts of climate change will only worsen with time, the report emphasises.

The FAO report underscores that success in transforming food and agriculture systems will largely depend on urgently supporting smallholders in adapting to climate change. Developing countries are home to around half a billion smallholder farm families who produce food and other agricultural products in greatly varying agro-ecological and socio-economic conditions. Solutions have to be tailored to those conditions; there is no one-size-fits-all fix.

The FAO report describes alternative, economically viable ways of helping smallholders to adapt and making the livelihoods of rural populations — often the most exposed to the downside risks of climate change - more resilient. The report provides evidence that adoption of ‘climate-smart’ practices, such as the use of nitrogen-efficient and heat-tolerant crop varieties, zero-tillage and integrated soil fertility management would boost productivity and farmers’ incomes.

Widespread adoption of nitrogen-efficient practices alone would reduce the number of people at risk of undernourishment by more than 100 million, the report estimates. It also identifies avenues to lower emission intensity from agriculture. Water-conserving alternatives to the flooding of rice paddies for example, can slash methane emissions by 45%, while emissions from the livestock sector can be reduced by up to 41% through the adoption of more efficient practices.

FAO’s road map also identifies policies and financing opportunities for the sustainable intensification of agriculture.

The way forward

Negative global effects of climate change are already being felt in some cereal crop yields. Climate change will likely lead to a loss of nutritional content of some foods, such as declining zinc, iron and protein counts in staple cereals, and trigger new health issues — including diarrhoea for humans and an array of transboundary animal diseases.

Beyond 2030, according to scientific evidence, negative pressures on food production will be increasingly felt everywhere. Until then, adverse impacts of higher temperatures are sharply skewed towards developing countries, pointing to dimmer prospects for their food self-sufficiency.

Helping smallholders adapt to climate change risks is critical for global poverty reduction and food security. Close attention should be paid to removing obstacles they may face and fostering an enabling environment for individual, joint and collective action, according to the report.

FAO urges policy makers to identify and remove such barriers. These obstacles can include input subsidies that promote unsustainable farming practices, poorly aligned incentives and inadequate access to markets, credit, extension services and social protection programmes, and often disadvantage women, who make up to 43% of the agricultural labour force.

The report stresses that more climate finance is needed to fund developing countries’ actions on climate change. International public finance for climate change adaptation and mitigation is growing and, while still relatively small, can act as a catalyst to leverage larger flows of public and private investments.

More climate finance needs to flow to sustainable agriculture, fisheries and forestry to fund the large-scale transformation and the development of climate-smart food production systems.



Adaptation and mitigation of climate change must occur in tandem. Without action, agriculture will continue to be a major contributor to global greenhouse gas emissions. But by adopting climate-smart practices and increasing the capacity of soils and forests to sequester carbon, emissions can be reduced while stepping up food production to feed the world’s growing population, the report said.

Food systems can further contribute by minimising food losses and waste, as well as by promoting healthier diets that also leave a lighter environmental footprint.

To access the report, Visit: www.fao.org/publications/sofa/en/

Knowledge dissemination

Scientists have much to gain by sharing their research with the public

For most scientists sharing research with the public is a road strewn with thorns that they would rather avoid. But it does have its advantages, writes Marina Joubert.



Academic life is a juggling act. It involves research, teaching, applying for grants, writing scientific articles and peer reviewing others' work. There's also student supervision and administration.

These days, academics face an extra demand: to make their work more visible and accessible to the public and policymakers. But what's in it for these time-stressed, busy scientists?

"Science can be very lonely," admits distinguished Swedish astrophysicist, Bengt Gustafsson. We were chatting after he'd delivered a talk at Stellenbosch University and I asked what motivated him to make time for public engagement. He replied: "Occasions like these where I can share my work with people, especially children, keep me going. It gives meaning to my work and even sparks new ideas for my research."

Gustafsson's attitude is echoed in a report from the UK: *What's in it for me? The benefits of public engagement for researchers*. It emphasises how public engagement can open up fresh perspectives on research and encourage more people to embark on scientific careers.

But these intrinsic rewards aren't enough to convince many researchers that public engagement is worth their while. Luckily the evidence is mounting to show them how it can be done and why it's time very well spent.

Professional rewards

Scientific articles in accredited journals, book chapters, whole books and monographs all add to a research's professional reputation. These achievements count towards promotions. In South Africa, they also bring significant financial reward from the Department of Higher Education and Training.

But where are the rewards for writing a popular article, doing a radio interview, speaking at a science café, or tweeting about your research findings?

Science communicator, Matt Shipman, has offered some answers to this question. He argues public communication helps scientists to attract top students, impress their funders, network with other researchers, form new collaborations and draw interest from industry and government.

His stance is bolstered by peer-reviewed evidence. A group of US social scientists has demonstrated a link between “h-index” – a measure of the quality and influence of a researcher’s work – and whether the researchers in question interacted with journalists and were mentioned on Twitter.

“Doing both – traditional media and social media – is more powerful in boosting citations than doing just one of the two,” Dominique Brossard, University of Wisconsin-Madison professor of life sciences communication, told me. She took part in the research project.

“Instead of thinking of time spent on social media as a distraction, researchers should see it as a way of making their work more accessible to broad audiences.”

Conrad Matthee, an evolutionary genetics researcher at Stellenbosch University, has seen for himself how media visibility can boost reach within the scientific community.

He was the corresponding author of a recent research paper that estimated white shark numbers along the South African coast based on dorsal fin photos and genetic data. The research was featured on global media channels, including CNN and the BBC. The number of downloads of the original paper skyrocketed.

“This proves that getting media exposure for research is a sure-fire way of getting other scientists to take note of your work,” he said during an interview with me.

Universities also crave publicity for their academics’ work. “Our research needs to be visible. This is absolutely critical for ensuring sponsorship and sustaining support from government and industry partners,” says Therina Theron, research director at Stellenbosch University.

If professional rewards aren’t enough to convince researchers about public engagement, there are other factors to consider.

What about the moral imperative?

Researchers have privileged access to new evidence that can underpin informed decision-making. It is often argued that scientists have a duty and even a moral obligation to be heard in public debates and to influence public policy. If scientists keep quiet, these public debates may be dominated by people with questionable credibility and doubtful agendas.

Andrew Wright, an environmental scientist at George Mason University, has called advocacy “an almost inescapable part of modern science”. He argues that scientists have a societal obligation to deliver credible information to those who can use it. Failing to do so, he suggests, leaves scientists at risk of becoming irrelevant.

Accountability is another principle reason for researchers to share their work with the public. After all, the bulk of research in public universities and science councils is funded by taxpayers. Scientists have a responsibility to tell the public what they are doing with its money.

David Eagleman, the director of Texas’ Baylor College of

Medicine’s Initiative on Neuroscience and Law, has written a manifesto, *Why Public Dissemination of Science Matters*. In it, he stresses scientists’ responsibility to inspire critical thinking. He also says that although most scientists may not be specifically trained to communicate to the public, they have what it takes.

“You have been trained to think with rigor, to integrate large bodies of data, to weigh evidence, to value intellectual humility, to retain nuance when speaking about complex issues, and to write precisely what you mean to say. So speak up. The future needs your voice.”

Getting started

Scientists who are up for the challenge will find that there are many spaces in which to start sharing their research with the public. These include:

Researchers can use social media throughout the research cycle to bolster collaboration and make new findings available to broad audiences, including science journalists.

Videos drive traffic and shares on social media, so platforms such as YouTube and Vimeo cannot be ignored.

Planning communication into research, and making it part of one’s research identity, will not necessarily deliver overnight fame and fortune. But it has the potential to connect scientists to new audiences and add value, meaning, reach and impact to their work. It is a way to see how their science makes a difference to real people.

Marina Joubert is a science communication researcher and lecturer at CREST (Centre for Research on Evaluation, Science and Technology), Stellenbosch University.

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Eight rules when communicating through social media

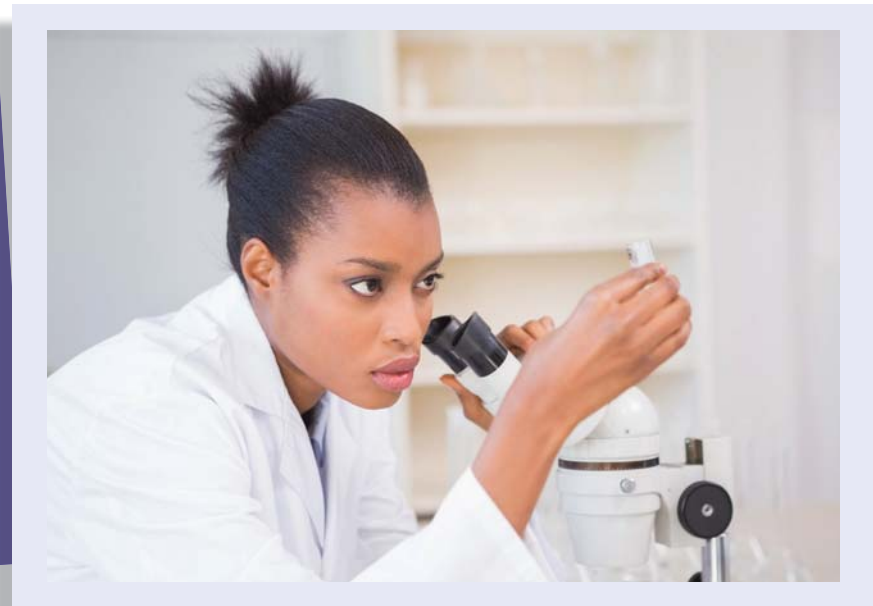
- Don’t just talk at people – aim to actively engage with them.
- Ask questions to encourage interaction and discussion.
- Interact with other pages/people (comment, share, retweet).
- Respond politely and respectfully to comments. Sometimes it is best to just ignore.
- Maintain your professionalism. Don’t let your emotions rule when posting or responding to comments.
- Use spell check – it only takes a minutes.
- Be consistent – check your site regularly and build a cohesive social media presence.
- Don’t post sensitive or confidential information – if in doubt, leave it out.

Source: www.sciencemediasavvy.org



Careers in water – The importance of water for jobs

Research, development and innovation is needed to continuously improve water management and so the jobs that people do in water.



Water influences every aspect of our lives, but few people realise just how important water is to jobs – water is not only central to human survival and the environment, it is also important for the economy.

Today, almost half of the world's workers – that is 1.5 billion people – work in water-related sectors and nearly all jobs depend on water and those that ensures its safe delivery. It is estimated that 95% of jobs in the agriculture sector, 30% of jobs in the industry sector, and 10% of jobs in the services sector are heavily dependent on water. Further, worldwide, some of the most water-intensive sectors employ great number of people: 22 million in food and drink (with 40% women), 20 million in chemical, pharmaceutical, and rubber and tyres, as well as 18 million in electronics.

Water supply and wastewater facilities employ about 80% of the workers in the water industry. Jobs in the water sector fall under one of three main categories: water resource management; building, operating and maintaining water infrastructure; and the provision of water-related services, including water supply, sanitation and wastewater management. A number of ancillary jobs also enable employment in water-dependent jobs. These include jobs in regulatory institutions within public administrations, infrastructure financing, real estate, wholesale and retail trade, and construction.

Water and sanitation also has a strong impact on workers' lives and health. Around 2 million work-related deaths happen every year. Out of those, 17% are water-related (poor quality drinking water, poor sanitation, poor hygiene and lack of knowledge).

The basic provision of adequate water, sanitation and hygiene services at home and in the workplace enables a robust economy by contributing to a healthy and productive population and workforce, with benefit-to-cost ratios as high as 7 to 1 for basic water and sanitation services in developing countries.

Conversely, people who have the least access to water and sanitation are usually the most likely to have poor access to healthcare and stable jobs, thus feeding the cycle of poverty. In this regard, equality gaps persist between people living in urban and those in rural areas, across genders, and between the richest and poorer segments of the population.

Water also affects workers lives through its presence, quality and quantity. In the irrigation agriculture sector, for example, which represents 70% of freshwater withdrawals worldwide, a farmer's job depends on their ability to manage the available freshwater while at the same time facing challenges such as water resource depletion, drought, climate change and water scarcity.

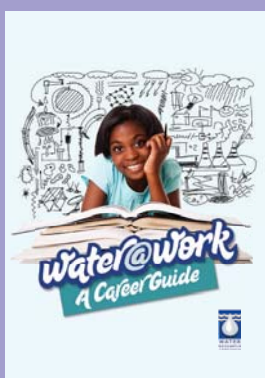


Around 95% of the jobs in the agricultural sector are heavily dependent on water.

Sustainable water management in its broadest sense, which encompasses ecosystem protection and restoration, integrated water resources management as well as infrastructure development, operation and maintenance, combined with access to a safe, reliable and affordable supply of water and adequate sanitation services, creates an enabling environment for long-term employment opportunities, as well as development and growth across different economic sectors.

Research, development and innovation in the water sector contributes to the continuous improvement of water management, with the related benefits to economic development and decent jobs. In addition to their potential efficiency, effectiveness and performance improvements, innovations can have important implications for water-dependent and water sector employment opportunities.

Innovation resulting from the shift towards a greener economy is changing the range of tasks associated with various jobs, as well as working conditions, due to new technologies, processes and practices. Innovation will change the number and nature of jobs and the required skill sets and competencies.



To explore South African careers in water, read the WRC's Water@Work career guide at <http://www.wrc.org.za/Pages/CareerGuide.aspx>

This year water and jobs was the theme of World Water Day. Click here to watch the trailer as well as other videos about water and jobs here,

Five facts about water and jobs

1. Three out of four jobs that make up the entire global workforce are water-dependent.
2. The farming, fisheries and forestry sectors alone, which are among the most heavily water-dependent, employ nearly one billion people.
3. Water scarcity and disruptions in the supply of freshwater threaten jobs in water-dependent sectors and limit the growth potential for decent, high-quality jobs across the economy.
4. Access to safe and reliable water supply and sanitation services at home, school and the workplace is critical for maintaining a healthy, educated and productive workforce.
5. Investments in water-related infrastructure can be highly cost-effective and generate positive returns across different sectors of the economy.

Source: www.unesco.org



Three out of four jobs that make up the entire global workforce are water-dependent.



Think tank deliberates climate change, food and agriculture connection



Attendees at the workshop.

Abou Mohamed Ali

On 18 October, delegates from agri business, research institutions, government departments, and universities gathered to deliberate the challenges facing the agricultural sector in the face of persistent food insecurity and climate change.

Organised by the Water Research Commission together with its partners, the universities of Pretoria and KwaZulu-Natal, the Agricultural Research Council and the Department of Agriculture, Forestry and Fisheries, the workshop discussed possible solutions to the challenges related to food security and nutrition, as highlighted by World Food Day (16 October).

The workshop was also used as a platform to share information on the WRC's latest research on this topic, including research exploring the potential of increased production of food crops to meet nutritional requirements of rural poor people, and studies investigating the nutritional water productivity of various indigenous food crops.

Debates centred around centralising knowledge, ensuring effective Communication and cooperation among government

entities and practical application of the new knowledge to the benefit of communities.

"Agriculture is arguably one of the oldest human activities in the world," noted WRC Group Executive, Dr Mandla Msibi. "Food is a basic need, however, South Africa's three-tiered challenge of poverty, unemployment and inequality means we have people in South Africa that are unable to put a nutritious plate of food on the table. At the same time, agricultural production is becoming more difficult in the face of decreasing soil fertility, increasing competition for land, and climate change."

Dr Msibi noted that the South African research community had to work together with policy-makers to come up with solutions to these challenges.

Wetlands Training Course

Workshop and site visit on the taxonomy of wetland plants 2 February 2016, Gauteng

Rationale and objective: Wetlands are fascinating and dynamic ecosystems that provide indispensable ecosystem services. Commonly referred to as marshes, swamps, bogs or vleis, they constitute about 7% of South Africa's surface area. They support a range of specialised plant, insect, bird and mammal life and also supply wild food, grazing, building and craft materials to people. They absorb flood waters, improve water quality and regulate streamflow, helping to maintain ecosystem functioning downstream.

Like many countries in the world, South Africa's wetlands are threatened by anthropogenic activities. The country has already lost an estimated 50% of its wetlands to mining, agri-culture and industrial development, urbanisation and pollution.

South Africa possesses a large body of research on its

wetlands, much of which has been funded by the Water Research Commission (WRC). One of the Commission's most popular products are its Wet-Series – a set of integrated tools for assisting users to achieve well-informed and effective wetland management and rehabilitation. A recent addition, Easy identification of wetland plants (Report No TT 479/10) has proved especially popular.

This has prompted the WRC to host a training workshop on the taxonomy of wetland plants in South Africa. The training will include a site visit to practice plant identification in the field.

- **Due to the nature of the training limited space is available. Delegates have the option of attending the technical training only (excluding the field trip).**

DEEPLY ROOTED IN SOUTH AFRICA WATER SOCIETY

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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 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, in innovative water solutions through research and development for South Africa, Africa and the world.

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