THE WATER WHEEL

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AGRICULTURE

Improving smallholder development

FRESHWATER FISHING

Livelihoods can benefit from artisanal fishing on SA dams

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WATER RESEARCH COMMISSION

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Researchers are calling for the diversity of smallholder farmers to be taken into account in their development and support. Read the article on page 12.

FLUID THOUGHTS

WRC CEO, Dhesigen Naidoo

New models to build the South African economy: a sanitation case study

South African President Cyril Ramaphosa's Investment Conference concluded in October with great accolades having by the end of the Summit garnered 21 companies announcing R290 billion in new investments in South Africa while a total of R400 billion in pledges have been made.

It appears that Team SA is on course toward the target of R1 trillion in new investments with this catalytic start. This is an important boost in investor confidence and bodes well for the South African economy. What is even more important than the investment and pledge numbers is the signalling change in investor appetite and, perhaps even more crucially, investment culture.

But the real test is whether or not that investment culture can penetrate and impact South Africa's many economic strata – former President Thabo Mbeki's two economies may have developed a few more layers in the interim. And, can we develop more innovative models for participation in the economy so that real inclusion at the lowest of levels for the most basic of services.

The answer is yes, and here it one example. A few years ago, Jay Bhagwan and Dr Kevin Wall developed a novel concept called 'Social Franchising'. The Water Research Commission (WRC) together with its local and international partners funded a demonstration in the Eastern Cape. The basic design was to develop a servicing model with a standardised operation procedures and success parameters and centralised support, much like a classical franchise. The social component has several facets. The first is that the candidate franchisees are from the local communities. Secondly, they are not required to make a capital investment nor is there a franchise fee. It is exactly the ladder to the first step that most economic models miss.

The latest example of the model's success was celebrated at the WRC Women's Summit presided over by Deputy Minister Pam Tshwete in East London recently. The partners to the project are the African Development Bank, Eastern Cape Department of Education and Impilo Yabantu Services as the franchisor. The five women-owned franchise companies are currently successfully providing sanitation removal and cleaning services in 302 schools ensuring that 93 492 learners and more than 1 100 teachers and staff have access to safe, clean and dignified sanitation. These five companies have already provided jobs for 25 people.

The impact has gone beyond janitorial services and repairs. Already Sanitation Clubs have been created and functional in 240 of the schools. These clubs comprising teachers and learners that not only educate the school on good sanitation and hygiene practices, but also take responsibility of making improvements to the sanitation environment. In addition, menstrual hygiene management campaigns have begun in ten of the schools with a view to eventually covering all 302 schools.

The good story does not end there. The compounding challenge in many of our peri-urban and rural environments is the treatment of the faecal waste matter. Faecal sludge management is a global conundrum of the Global South. The Sanitation Social Franchise has introduced a novel value-add solution. The waste is removed from the schools to locally constructed plants where the waste is converted into biochar. The latter has many potential uses. The two most popular being direct use for energy with biochar being a safe source and alternative to coal and wood. The second is as an additive to fertilizer and has the potential to vastly increase agricultural productivity. In addition, biochar is also an effective mechanism for carbon capture and storage.

Clearly the sanitation solution is the thin edge of a very promising wedge. If one considers the impact of this school sanitation on the sustainable development goals (UN SDGs), we see a multiplier effect. There is direct and positive impact on SDG 1 (poverty eradication), SDG 2 (food security), SDG 3 (health), SDG 6 (water and sanitation), SDG 7 (energy access), SDG 8 (decent work) and SDG 13 (climate action). In addition, such a project has positive contributions to SDG 11 (sustainable cities), SDG 12 (patterns of consumption and production), SDG 15 (life on land) and SDG 17 (partnerships).

This School Sanitation Social Franchising model has been demonstrated effectively in the Eastern Cape and continues to go from success to success fundamentally changing the lives of both the Schools – learners and staff – as well as the surrounding communities in a value-added manner while providing the possibility of sustainable livelihoods and job creation. It should be seriously considered as one of the modalities to be used in the President's SAFE initiative and be considered as a viable model for other sectors of the economy beyond sanitation. South Africa's innovation and ingenuity like this model hold the key to a much brighter socio-economic future.

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President Cyril Ramaphosa opening the South African Investment Conference, held at the Sandton Convention Centre in October.

WATER DIARY

Sanitation
19 November 2019
World Toilet Day is celebrated around the world under the theme 'When nature calls'. The theme looks at nature-based solutions to the global sanitation and water crisis. This includes the use of composting latrines and human-made wetlands, among others.
Visit: www.worldtoiletday.info for more information and resources.

Process control
28 November
The Water Institute of Southern Africa (WISA) and its Process Controllers Division (Western Cape) will be hosting its 9th Process Controller Workshop in collaboration with the Department of Water and Sanitation (DWS – Western Cape) and the Cape Agulhas Municipality. For more information,
Visit: www.wisa.org.za

Urban water management
13-16 January
The 10th International Water Association (IWA) Specialist Conference on Efficient Urban Water management will be held in Manila, Philippines. The conference will bring together a high-calibre pool of urban water and wastewater professionals to reflect on shared challenges and promote efficient solutions to urban water management. A simultaneous exhibition will feature some of the most innovative technologies from around the world. For more information,
Visit: www.efficient2019.org

Faecal sludge management
17-22 February
The 5th International Faecal Sludge Management Conference (FSM5) will be held in Cape Town. The conference will advocate and share good practice and innovation to improve how faecal sludge is managed and contributes to meeting the sanitation needs of 4.5 billion people lacking access to sustainable sanitation services. The event will be co-hosted with AfricaSan. For more information,
Visit: https://fsm5.susana.org/en/

Science education
6-12 March
South Africa's National Science Festival, Scifest Africa, will be celebrating its 23rd anniversary event in Grahamstown, Eastern Cape. For more information, **Visit: www.scifest.org.za**

Intermittent water supply
7-9 April
The first IWA Intermittent Water Supply Conference will be held in Kampala, Uganda. The conference aims to advance the knowledge and share experiences on intermittent water supply (IWS) and to frame the problem of IWS within its technical, institutional, financial and social contexts For more information,
Visit: www.iws2019.org

Young water professionals
23-27 June
The International Young Water Professional (YWP) Conference will take place in Toronto, Canada. This conference is one of the vehicles in which the IWA supports YWPs to develop themselves to be at the forefront of decision-making. For more information,
Visit: iwa-youngwaterprofessionals.org

World water
25-30 August
Hosted by the Stockholm International Water Institute, World Water Week will be held in Stockholm, Sweden, with the theme 'Water for society – including all'. For more information,
Visit: www.worldwaterweek.org

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NEWS

New anti-malaria initiative ready for testing

South Africa has made significant progress in reducing its malaria burden and is now striving towards elimination within its borders.

However, says the Department of Science & Technology (DST) current efforts have not completely eliminated the transmission of the disease, necessitating a reflection on current control strategies, especially vector control interventions.

"It has become apparent that indoor residual spraying (IRS) using DDT and pyrethoid insecticides as a standalone vector control tool, while it may be sufficient for effective control of the disease, is unlikely to achieve malaria elimination, without supplementation," the department said in a statement. "IRS mainly targets indoor feeding and resting mosquitoes, and is not effective against vectors that feed and rest outdoors, such as *Anopheles arabiensis*. This species has recently been implicated as a major contributor to outdoor transmission in South Africa's malaria-affected provinces.

Given the lack of alternative vector control intervention tools, the sterile insect technique (SIT) was identified as a potential means of addressing this challenge. A consortium of collaborating parties assisted by the International Atomic Energy Agency has developed a multi-year SIT project for South Africa.

The project is coordinated and cooperated under the auspices of the Nuclear Technologies in Medicine and the Bioscience Institute (NTeMBI), a platform of the DST. The long-term goal of the project is to establish an industrial scale mass-rearing facility capable of producing sterile male mosquitoes in sufficient numbers to support large-scale, area-wide SIT field programmes in malaria-affected areas in the country.

This is a critical initiative, as it will increase the number of available vector control interventions, while reducing dependency on the use of insecticides, as the country moves towards malaria elimination. The DST is providing funding support for a small-scale field demonstration of SIT aimed at confirming the technical feasibility of the technology.

The SIT programme aims to provide an insecticide-free alternative for tackling an epidemic that has plagued the continent for decades. The programme complements related research initiatives in the country, such as the anti-malaria drug discovery programmes of the South African Medical Research Council and the University of Cape Town, among others.

Mzimvubu water project set to start in January

A project to dam the Mzimvubu River, one of the last remaining undammed rivers in the country, is set to begin in January.

This is according to the Department of Water and Sanitation. The Mzimvubu Water Project, which was announced by former President Jacob Zuma in 2014, comprises two multi-purpose dams (Ntabelanga and Lalini) on the Tsitsa River, a major tributary to the Mzimvubu River. The entire project (2017 figures) was expected to cost more than R15 billion.

Minister of Water and Sanitation, Gugile Nkwinti, and Deputy Minister, Pamela Tshwete, held a consultative meeting with stakeholders on the project in East London earlier this year. At this meeting, Water and Sanitation Eastern Cape Provincial Head, Portia Makhanya, provided a progress report on the work done to date. She announced that TCTA had been appointed to assist in sourcing more funding for the project so as to fast-track the initial stages of the project. This includes the relocation of households located in the area to be inundated by the dams.

According to Nkwinti, an agreement had been reached with National Treasury that phase one of the project would be undertaken by local contractors. This is despite the fact that the Chinese government had shown an interest in investing in the project. Nkwinti said the department is working tirelessly to ensure that funds are allocated for this project to ensure that there are no delays.

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Commercial farming census underway

Commercial farmers have been urged to participate in an agricultural census being conducted by Statistics South Africa (Stats SA).

The census, which kicked off in October, is seeing 600 field staff visiting commercial farms across the country to establish the number of commercial farmers, farm size, crop type being farmed in different geographic areas, and agricultural inputs such as irrigation usage.

This year marks the centenary of agricultural censuses for the country. South Africa conducted its first Census of Commercial Agriculture in 1918. South Africa last conducted an agricultural census in 2007.

The agricultural census will cover commercial farmers, which are farms producing for income or profit. It would assist government with providing data for assessing the severity of food insecurity, noted Statistician-General, Risenga Maluleke.

"The general objective of the census of commercial agriculture is to collect basic quantitative information on South Africa's agricultural sector and provide a snap shot of the sector. This information is essential for planning, policy formulation, and measuring food security."

The census is expected to be completed by June next year, with results expected to be released in November 2019.

New senior professor joins Free State university agri department

Prof Ashok Chapagain has been appointed as Senior Professor in the Department of Agricultural Economics in the Faculty of Natural and Agricultural Sciences at the University of the Free State (UFS).

According to Prof Chapagain, the position provides a unique opportunity to help establish the university at the forefront of water research in South Africa. He is looking forward to cross-departmental collaborations on innovative research projects, working with water-related sectors, such as agriculture, business and mining, among others, and establishing a water hub that would be key in external collaborations with other research institutes in South Africa and beyond.

Prior to his formal appointment at the UFS, Prof Chapagain has been remotely involved with the Department of Agricultural Economics since 2017 through his support to a number of research projects funded by the Water Research Commission.

He is experienced in managing and coordinating international and multidisciplinary projects, ensuring technical quality and project delivery. He has vast cultural and geographical work experience and specific water-related experience in the fields of integrated water resource management, water footprint assessment, industrial and agricultural efficiency and sustainability, irrigation, hydrology and watershed modelling, flood-risk management, river-basin planning and management, and environmental impact assessment.

He has recently left the Water Footprint Network (based in the Netherlands), where he worked in the capacity of Science Director. Prior to joining the WFN, Prof Chapagain worked as Senior Water Advisor at WWF-UK for about six years.

Source: UFS

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GLOBAL

Half-degree of warming could have big impact on water availability

Approximately 117 million more people could face water shortages if global temperatures increase 2 °C above pre-industrial levels compared to a 1.5 °C increase in temperatures, a new study suggests.

The world's water cycle, including evaporation and precipitation, is expected to intensify with global warming, according to the study. This could affect the distribution of freshwater and constrain the global water supply, which poses risks to national food security, economic prosperity and societal well-being.

In a new study, published in ***Geophysical Research Letters***, a journal of the America Geophysical Union, researchers examined how global freshwater could change under 1.5 °C and 2 °C increases in temperatures, targets set forth in the Paris Agreement.

Researchers used a newly-released model to determine a global assessment of water availability below normal conditions. The new model, called HAPPI experiments, is specifically designed to differentiate impacts between 1.5 °C and 2°C warming targets. "This is the first study to explore how limiting warming would benefit global population exposure to water shortage using the HAPPY experiments," noted Wenbin Liu, lead author of the study and assistant professor at the Chinese Academy of Sciences. "Some regions would be better off, but some regions would be worse off."

Previous research found more people worldwide would suffer from water shortages when temperatures increase. The new study shows the benefit of maintaining global warming at 1.5 °C. Limiting global warming to 1.5 °C translates to a less-severe decrease in water availability below normal conditions across most regions, including east and south Asia, east and west Africa and central Europe. For a few regions however, this limit would be ineffective.

Southeast Asia, northern Asia, southern Africa, southern Europe, the Mediterranean, eastern Canada, Greenland, Iceland, Alaska and northwest Canada would experience worsening water availability below normal conditions under both 1.5 °C and 2 °c of warming.

"Notably, limiting global warming at 1.5 °C instead of 2 °C would constrain the number of people suffering water shortage induced by water availability below normal conditions in many regions," second author Wee Ho Lim, of the Chinese Academy of Sciences and University of Oxford said. "Nonetheless, such a limit is less effective in Alaska and northwest Canada, southeast Asia and the Amazon."

The findings of the new study provide international policymakers with information about the societal impact of water shortages triggered by freshwater availability below normal conditions on global and regional scales, according to the study.

To access the article,
Visit: https://bit.ly/2yhZ2ai

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UN study highlights plight of world's children

Around 6.3 million children under the age of 15 died from mostly preventable causes last year, the equivalent to one child dying every five seconds.

This is according to a report compiled by a group of United Nations agencies. Newborn babies account for half of the deaths.

The new mortality estimates study was released by the UN Children's Fund (UNICEF), together with the World Health Organisation, the UN Population Division, and the World Bank.

According to Laurence Chandy, UNICEF Research Director, major progress in reducing child mortality has been made in the last quarter century, with the toll dropping by more than half since 1990, but "millions are still dying because of who they are, and where they are born."

Children from Sub-Saharan Africa are disproportionately affected, with half all deaths of under-fives taking place in the region. One third are in Southern Asia.

Chandy added that, without urgent action, 56 million children under-five will die between now and 2030, and half of them will be newborns, but that "with simple solutions like medicines, clean water, electricity and vaccines, we can change that reality for every child."

Most deaths of children aged five and under are due to preventable or treatable causes such as pneumonia, malaria or complications during birth. For older children between the ages of 5 and 15 injuries become a more prominent cause of death, particularly road accidents and drowning.

Even within countries wide disparities are found, with under-five mortality rates on average 50% higher in rural areas than in urban areas. Education is also a factor, with those born to uneducated mothers more than twice as likely to die before turning five than those born to mothers with a secondary or higher education.

Reacting to the study, Tim Evans, Senior Director of Health Nutrition and Population at the World Bank, said: "Ending preventable deaths and investing in the health of young people is a basic foundation for building countries' human capital, which will drive their future growth and prosperity."

To access the report,
Visit: https://bit.ly/2D77Y7c

Organisation launches guidelines on sanitation and health

Safe sanitation is essential for health, from preventing infection to improving and maintaining around mental and social well-being. Worldwide, 4.5 billion people live without access to safely managed sanitation services.

In October, the World Health Organisation (WHO) launched its first guidelines on sanitation and health. The guidelines provide comprehensive advice on maximising the health impact of sanitation interventions. The guidelines summarise the evidence on the links between sanitation and health, provide evidence-informed recommendations, and offer guidance for international, national and local sanitation policies and programme actions.

The guidelines also articulate and support the role of health authorities in sanitation policy and programming to help ensure that health risks are identified and managed effectively.

The main audience for the guidelines is national and local authorities responsible for the safety of sanitation systems and services, including policy-makers, planners, implementers, and those responsible for the development, implementation, and monitoring of standards and regulations. This includes health authorities and, since sanitation is often managed outside the health sector, other agencies with responsibilities for sanitation.

To access the report,
Visit: https://bit.ly/2E1X2Z8

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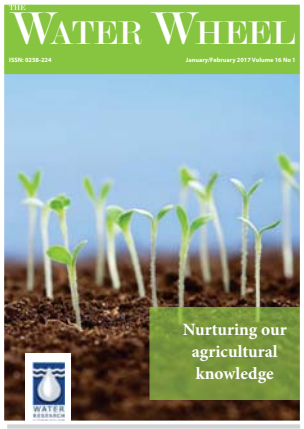

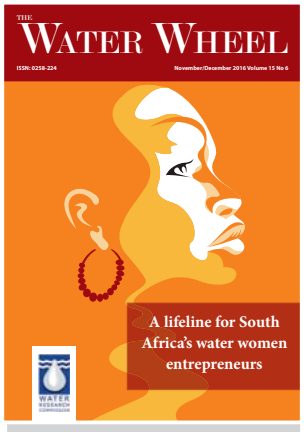

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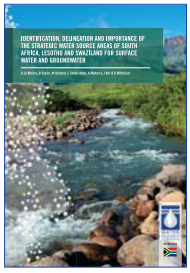
NEW WRC REPORTS



Identification, delineation and importance of the strategic water source areas of South Africa, Lesotho and Swaziland for surface water and groundwater

Water source areas have historically been defined using the criterion of the production of relatively large volumes of runoff which sustain lowland areas downstream. This report builds on a previous study by WWF-SA and CSIR which identified 21 strategic water source areas which covered 8% of South Africa and supplied 50% of the mean annual runoff. This study redefined what is meant by a water source area to include groundwater, has refined the strategic water source areas for surface water and has identified a number of strategic water source areas for groundwater. Strategic water source areas are now defined as areas of land that either supply a disproportionate quantity of mean annual surface water runoff in relation to their size.

Report No. TT 754/1/18

Integrating agriculture in designing on-site, low-cost sanitation technologies in social housing schemes

The main aim of this project was to generate information on recycling of nutrients from decentralised wastewater treatment systems (DEWATS) technology and other human excreta-derived materials that will inform policymakers and town planners in the design of new social housing developments that include an agricultural component. The specific objectives were to, among others, identify suitable agricultural areas in terms of liquid loading capacity, soil and climatic variables; to evaluate the effect of wastewater use on soils and crop production; to assess the quality of wastewater and its effects on the environment; and to generate information that could be used to develop protocols that integrates agricultural into social housing schemes.

Report No. TT 700/18

Rural development and the governability of water-linked ecosystems in transitioning economies: The market value chains of Baleni salt in Limpopo

Goods and services from water-linked ecosystems have been used in subsistence economy settings since time immemorial. However, as people began to specialise in limited economic activity, these ecosystems goods and services *inter alia* became increasingly merchandisable. Undeniably, markets are a useful instrument for transferring products to people who are willing to pay more for them. In the context of natural resources, this may provide options to enhance rural livelihoods using fewer quantities and generate funds for protecting threatened ecosystems. The overall aim of this study was to develop a clear understanding about current trends in the commercialisation of natural resources and agriculture in traditional rural community contexts.

Report No. 2353/1/18

Appropriate entrepreneurial development paths for homestead food gardening and smallholder irrigation crop farming in KwaZulu-Natal Province

Under-performance of the existing smallholder irrigation crop production is of a serious concern to farmers who depend on them for their livelihoods and to the government of South Africa that has made massive investment in their development. Homestead irrigated food production, in particular, is in poor condition as it is not properly maintained to increase productivity and the timing of water supply is also unreliable. The general objective of this study was to review and evaluate appropriate development paths for expansion from homestead food gardening to smallholder irrigation farming, increased water use productivity of crop production and improved livelihoods on selected smallholder irrigation schemes.

Report No. 2278/1/18

Assessing the state of the water-energy-food (WEF) nexus in South Africa

Water, energy and food are three of the key pillars upon which humanity exists and develops. But, these pillars are not independent. Rather, a multitude of connections and trade-offs and synergies exist between them. The nexus approach to resource sector management seeks to understand the linkages, dependencies, and trade-offs associated with the core elements within the particular nexus under assessment. The basis of the nexus approach is an attempt to balance different uses of ecosystem resources. There are clear interactions between water, energy and food that may result in synergies or trade-offs between different sectors or interest groups.

Report No. KV 365/18

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SMALLHOLDER AGRICULTURE

Recognising the differences between farmers key to smallholder development

Acknowledging the heterogeneity of South African smallholders farmers is a necessary consideration towards the successful revitalisation of irrigation schemes. This is according to Morris Fanadzo and Ernest Dube.

In recent years, the Water Research Commission has funded numerous projects on revitalisation of smallholder irrigation schemes. Under-producing smallholder irrigation schemes are a prominent political concern and major government budget item. It is understood that these schemes have high potential for growth, food production, employment creation and poverty alleviation. Many irrigation schemes continue to attract substantial government funding annually in the hope of visible returns. In most instances, however, these programmes fail to achieve the target outcomes.

Failure to clarify terminology and acknowledge diversity of the smallholder agricultural sector may be a serious barrier to implementation of appropriate solutions for revitalisation of the irrigation schemes. A quick analysis of current literature shows that most definitions used for smallholder farmers are ambiguous. There is frequent and interchangeable usage of the term 'smallholder' with terms such as 'small-scale', 'emerging', 'communal', 'subsistence', 'resource poor', 'low-income', and 'low-input' farmers. The term is also widely used to define Black farmers, most of whom reside in the former homelands.

In fact, smallholders in South Africa form a highly diverse group such that the term 'smallholder' resists a universal or even

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national definition. A proper definition of a smallholder farmer is important in policy formulation that seeks to promote the development of the sector.

Prof Ben Cousins argues that the term 'smallholder' is problematic because "it suggests that small-scale farmers are homogeneous, often resulting in misleading assumptions of common interests in development planning." He further argues that this term also fails to distinguish between those producers for whom farming constitutes only a partial contribution to their livelihoods, those for whom it meets most of their livelihood requirements, and those for whom farming produces a significant surplus.

Continual usage of the term 'smallholder' may have resulted in misleading emphases on common interests in attempts to organise small-scale farmers, when divergent interests are often real obstacles to such attempts. Prof Cousins adds, "The term 'smallholder' does have a certain degree of descriptive power, when it is qualified by adjectives such as 'semi-subsistence', 'semi-commercial', or 'commercially oriented'. These sub-categories indicate at least some key differences in how land, labour and capital are combined within different households and production units and their associated farming systems, if somewhat imprecisely."

The government generally appreciates the heterogeneity of smallholder farmers. The National Department of Agriculture, Forestry and Fisheries has sub-divided these farmers into two distinct categories, namely emerging and subsistence farmers. Under the government-funded Comprehensive Rural Development Programme, smallholder farmers have been divided into five categories: subsistence, commercial-ready subsistence, expanding commercial smallholders, well-established black commercial, and financially capable, and aspirant black commercial farmers.

As Prof Cousins notes, acknowledging diversity in the smallholder sector is "crucial and needs to be addressed if farmer-focused and farming systems research approaches are utilised in order to design and implement effective rural development policies." One way of addressing the abovementioned challenges is the use of what is termed farm typologies or farming styles. This is because heterogeneity amongst farmers is a reflection of social differences, and is manifested through diversity in farming styles.

For policy development, analysis of farming styles is particularly useful because it provides insight into the real world of agriculture as farmers experience it.

Farming style is an integrating concept that portrays a particular way of practising agriculture. For policy development, analysis of farming styles is particularly useful because it provides insight into the real world of agriculture as farmers experience it. Smallholder irrigation is a highly case-specific entity influenced by a considerable number of internal and external driving forces and factors.

Jonathan Denison and Siyabu Manona (**WRC Report No. TT 308/07**) write, "The adoption of generic strategies applied to widely different schemes is unlikely to meet the diverse

Table 1: **Four farming styles common in South African smallholder irrigation systems**

Smallholder farmer	The 'smallholder farmer' is typically a plot holder with diversified livelihood strategies and where farming plays a smaller role in their livelihood. They prefer to engage in lower risk farming styles and do not rely on farming alone for income. They may struggle to be financially sustainable on larger schemes and pump systems with high running costs, but can survive on those schemes with low running costs. Their operations are more suited to gravity schemes with lower annual costs. They will generally reduce their inputs to reduce risk, and consequently achieve lower yields.
Business farmer	'Business farmers' are individuals with greater commercial interest, skills, market capability and financial resources. They usually have high skill levels, an understanding of markets and greater financial resources. These farmers are likely to accept higher risks and aim for higher crop yields. They operate larger plots of about 5 to 40 hectares. The one exception is where higher value crops are grown on smaller holdings. The business farmers are more externally oriented with cash focus, farming is main income, needs land leasing efforts.
Food producer	The 'food producer' may be plot holders on a scheme, usually gravity schemes with low running costs. They have limited access to resources such as labour and finance. These are usually people facing real poverty and their objective is simply to supply their households with food. They either farm in allotted food plots or get informal permission to use unused plots on the schemes. They want to avoid risk completely and may not use irrigation, due to the initial costs, risks and their low skill level. In their position of poverty, they are unlikely to let go of their irrigated plot in an informal arrangement, lest they lose it as this presents one of the last few resources in their hands. The 'food producer' is important because he or she is one of the reasons for unutilised plots on schemes.
Equity labourer	The 'equity-labourer' is typically a collective of plot holders on large, complex or expensive irrigation schemes where the reality of scheme running costs and operational management call for commercial partners to invest and run the farming enterprise. They consist of a number of plot holders who enter commercial partnership arrangements because they are unable to farm in a business farmer model. Instead, an outside commercial partner operates the farming enterprise, and the plot holders become equity labourers who make their resources – soils, water and infrastructure – available. As equity labourers, the plot holders enjoy the benefits of employment and receive dividends from the enterprise profits. A 'business farmer' maintains a level of autonomy while the 'equity labourer' is simply a worker.

Source: WRC Report No. TT 308/07

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Lani van Vuuren

Irrigation infrastructure has to take the heterogeneity of smallholder farmers into account.

opportunities, plot holders' needs and operational realities of schemes in any one province." Typologies are used to categorise farmers into homogenous groups, based on a certain criterion. These farmers face similar constraints and incentives, and are influenced by external factors in a similar way.

Denison and Manona identified four farming styles common on smallholder irrigation schemes in South Africa as shown in Table 1. The needs of these different groups of farmers are sufficiently distinct such that they must be catered for with different strategic packages. The farmer types are closely linked to the level of risk the farmer is willing to accept.

"The implication of the observed diversity at the level of the individual farm enterprises found on smallholder irrigation schemes was that best management practices should be tailored to suit the specific objectives of farming households."

A study by two water engineers, Adrian Hards and Dr Kobus du Plessis based at Stellenbosch University, revealed important findings that need to be considered in the design of new irrigations schemes or the revitalisation of existing ones. They investigated the impact of different designs on the amount of water and land used, and resultant costs of the infrastructure. The results showed that a smallholder irrigator using a scheme designed for commercial production can have up to 29% higher annual costs.

The study clearly showed that the farmer type should be considered when designing each irrigation scheme. On many smallholder schemes, the system has been designed for commercial crop yields and water use. The result of this is that smallholders never achieve commercial levels of production, they have "over-capitalised and subjected themselves to additional operational strain."

Commercial under-use occurs when a smallholder irrigator is placed on a commercially designed scheme, but still operates like a smallholder. Hards and Du Plessis further argue that "new irrigation systems may have been designed for commercial operation because the designer either had not taken into account the irrigator type or had expected that the smallholder irrigator would attain a commercial status. If the irrigator has neither the desire, necessary skills, maintenance support, sufficient training, access to credit, nor links to markets needed to attain a commercial level of production, they would continue to operate at a smallholder level, but with the additional challenges associated with the cost of water, due to the over-designed system."

For successful revitalisation of existing schemes, the individual circumstances of each scheme and the farmers involved in

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it must be understood. Business farmers are likely to require schemes designed for commercial production since they have financing to cover the higher inputs and have market access to sell their larger amount of produce. Smallholder farmers will require a design based on the smallholder level of supply given their more risk-averse farming style where inputs are reduced and reliance on outside assistance is not an important component. Thus, the revitalisation process should involve end user consultation to determine their main objectives and ability to manage risk.

A study by Prof Wim Van Averbeke (**WRC Report No. TT 344/08**) clearly showed that the plot holders within the schemes were a heterogeneous group sharing different farming objectives. Upon an analysis of the livelihoods of the farmers, a total of nine livelihood types were observed. Upon analysis of the diversity of farming, Prof Van Averbeke also identified four farming styles namely profit makers, employers, food farmers (type 1) and food farmers (type 2) which conformed to the characteristics described by Denison and Manona.

Profit makers sold more than 50% of their total annual value of their production and high quality inputs and service. They hired temporary labour during times of peak demand, and their immediate concern was finding markets for their produce. This contributed considerably to the total variable costs of production usually resulting in negative gross margins. Food farmers farmed mainly for home consumption. The only difference between type 1 and type 2 food farmers was that on a small scale, type 2 food farmers were also prepared to take higher risk.

Prof van Averbeke writes, "The implication of the observed diversity at the level of the individual farm enterprises found on smallholder irrigation schemes was that best management practices should be tailored to suit the specific objectives of farming households. Consequently, a 'one size fits all' approach is unlikely to be successful when developing and disseminating best management guidelines for use at the farm enterprise level." One of the most important findings by Prof Van Averbeke was that a scheme for smallholder irrigators should not be designed on the assumption that they will, over time, become business farmers. The objectives of the farmers determine their type. Only when the objectives of the farmer alter would they move into a different type. The scheme design must therefore be based on direct interaction with the farmers so that the design matches the farmers' objectives.

Because irrigation schemes are highly case-specific, the diversity of farmers within schemes means that different kinds of interventions are needed to respond to varying farmers' needs, resources and agricultural contexts. Indeed, a lack of appreciation of the diversity of farmers in irrigation schemes is what may have led to the Government's core focus on rehabilitation, which has resulted in a general failure of state-funded interventions to achieve farmer development objectives.

Lani van Vuuren

Diversity in the smallholder sector is crucial and needs to be addressed if farmer-focused and farming systems research approaches are utilised in order to design and implement effective rural development policies

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DROUGHT

Severe drought wrap-up delivers answers, and more questions for the future

The recent drought inflicted large-scale damage to many areas in South Africa, but inside our most famous protected area, the Kruger National Park, it provided a long-awaited opportunity to test novel management strategies. Article by Petro Kotzé.

All photographs courtesy Petro Kotzé

Drought is a regular phenomenon in South Africa. The latest large-scale drought conditions experienced over South Africa saw livestock number plummet, crops wither and several towns and cities being close to running out of water. Drought was also experienced in our most famed protected area.

During its latest drought experience the KNP has emerged as a testing ground for some of the most innovative water management strategies in South Africa and beyond. Most notably, these included the practical implementation of a river's legal right to water, as enshrined in the National Water Act of 1998. In the Act, this right is known as the ecological reserve or environmental water requirements (EWN). The latest drought occurrence also created a practical testing ground for the South African National Parks (SANParks) strategic adaptive management (SAM) philosophy. This management practice centres around a 'learning-by-doing' approach, allowing for management strategies to be adapted according to lessons learned.

By all account the latest drought was a record-breaker. For some areas in the KNP it developed into the most extreme on record yet, both in terms of lack of rainfall and soaring maximum temperatures. Effectively broken when the region received average rainfall again in the 2016/17 hydrological year, park management has since had time to take stock of what happened.

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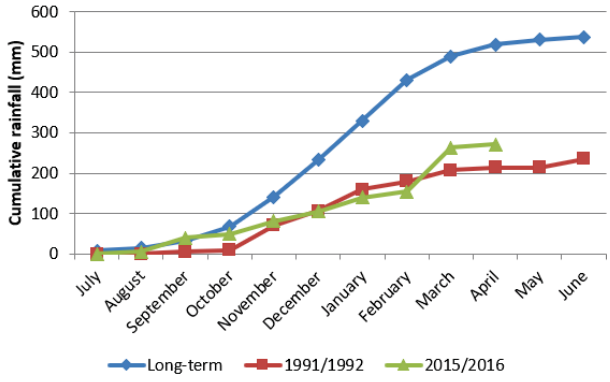
A drought like no other

Drought runs through the history of the KNP like a fine thread. Severe drought has been intimately associated with management decisions for much of the park's existence. Predominant droughts were reported in the sixties and early seventies and then again intermittently from 1982 to 1997. Until the most recent drought, the most severe on record were the droughts of 1982/83 and of 1991/92.

Though rainfall in the KNP varies significantly in any given year, a drought technically takes place when there is only 70% of the average annual rainfall in an area. When less than 50% of the annual average amount of rain falls, this is defined as extreme drought.

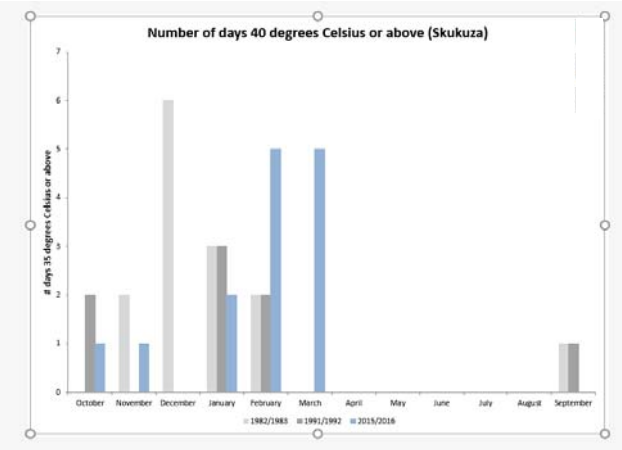
At Skukuza, the park's main rest camp and administrative headquarters located in the south of the park, the average rainfall within a hydrological year (measured from October to September, i.e. the start of the rain season to the end of the dry season at the eastern seaboard of South Africa) is 558 mm. Yet, double this amount fell in 1999/00, when the park experienced floods. During the hydrological years of 1982/83 the area received 51% less than the average rainfall (extreme drought). In 1991/92 the area received 58% less rain than the usual yearly average. The impact of this extreme drought was compounded by below average rainfall for the two preceding years as well.

In comparison, the 2015/16 hydrological cycle notched only 35% of the annual rainfall, a severe drought fortified in strength by a dry 2014/15 hydrological year, during which only 64% of the average rainfall was received. In combination, from a rainfall perspective, the 2014 to 2016 hydrological cycle can be considered the most extreme drought on record (at least for the region around Skukuza).



Average annual rainfall for the Kruger National Park, compared to the rain received during the 1991/92 and 2015/16 drought years.

Yet, this drought came with more weapons in its arsenal to test the park (and many South Africans') resilience. The period also saw the hottest days on record. During 2015/16 a "significant" number of days pushed the quicksilver over 40, as compared to other drought years. These temperatures aggravated water stress due to considerably higher evapotranspiration rates.



The number of extremely hot days experienced during the KNP's worst drought years.

Though the situation seemed much worse at face value, the protected area that experienced it appeared, by all accounts, better off. "This time, we emerged from the drought much healthier," says Danie Pienaar, head of SANParks Scientific Services. Dr Eddie Riddell, the park's manager for water resources and aquatic biodiversity and SANParks river bio-technician, Jacques Venter, reports "significantly improved performance" of the five perennial rivers that run through the park, in comparison to the droughts of the early eighties and nineties. And, the mass die-offs of many large mammals that marked previous droughts, were not as severe this time around.

This was not achieved overnight. The basis for this success story was laid decades ago, and entailed sustained experimenting, learning and adapting. Throughout this time, decisions and choices were based on rigorous scientific enquiry, often at the price of public approval. Neither was this achieved in isolation. The success story is dependent on intensive and constant collaboration with stakeholders upstream and downstream of the park, including across the border.

Ensuring the rivers' right to survive during crisis

Five perennial rivers drain the KNP and flow into Mozambique: the Crocodile; Sabie; Olifants; Letaba; and, Luvhuvhu rivers. All of the rivers are used extensively upstream of the park borders, mostly for agro-forestry and commercial irrigated agriculture, so much so that little further development of the water resources is possible. Mining and industrial uses also take place in all catchments.

In comparison to many other catchments in the country, the EWR of these five rivers have progressively been implemented, and the EWR targets for each river have been gazetted by the Minister of the Water and Sanitation in recent years, says Dr Riddell. "In fact, over the past ten years or so the KNP along with upstream stakeholders had been implementing draft ecological reserve targets, which assisted with the co-operative arrangements required during the time of crisis," he says. This made a big difference when the flow of some rivers ran dangerously low.

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Earlier management strategies in the Kruger National Park saw the establishment of artificial watering points across the landscape of the park, though many of these have since been closed.

Park management thus had a legal standing when they made calls for the flow of certain rivers to be increased; through reducing abstraction from the river by other users (irrigation) or allowing more water into the waterway (releases from upstream catchment dams). Using the EWR targets as guidelines, they were able to maintain flows in the rivers accordingly, and were mostly successful, says Venter. "In some cases the absolute minimum flows were reached but the rivers never went below that or stopped flowing during the drought," he says.

This time around, stakeholders also communicated more effectively, and the use of real-time communication (WhatsApp groups) has been highlighted as a game changer. This allowed for quicker and more efficient communication between KNP and upstream institutions for river operations, creating a sense of urgency and accountability to initiate management responses. Venter explains that their rapid response system communicated different reactions or worry-levels, which then led to a selection of management actions, including releases from dams, restrictions on irrigation or domestic and industrial uses.

Help for the KNP's rivers came from the most unlikely of places – namely dams. Releases from dams such as the Tzaneen, De Hoop, Blyde, Kwena and Inyaka dams were essential in maintaining the river flows in KNP at the height of the drought period. "If dams are managed according to proper operating rules it can actually be an asset," says Venter. Before relying on dam releases to supplement flow, however, all users restricted themselves first. The maintenance of the rivers' flow was thus often achieved by restricting water available to somebody else and, in general, the 2014/16 hydrological cycle is described as a "considerably trying time for river operations for all users in the Lowveld region".

In summary, a number of elements have been highlighted as key to the park's achievement to keep the river flowing. First, it is essential to have a proper communication system with all role players involved, says Venter. Second, flow data must be available, and accessible. Hydrological modelling and water resources accounting systems to inform decisions are necessary and then, there must be a system to evaluate the result of the decisions.

Before the onset of drought, the KNP's continued investment with stakeholders and established sister water resources management organisations such as Catchment Management Agencies and the Water Boards was integral. This ensured that the necessary socio-technical processes to facilitate the needed management actions were in place.

Except for management of the rivers draining the KNP, artificial water supply in the park has also changed substantially since the nineties. Though fewer man-made waterholes were now spread through the park, the decision ensured the survival of much of the park's wildlife during drought.

A more resilient park creates a safer haven for its inhabitants

During drought, as reported before in ***The Water Wheel***, animals mostly die not due to a lack of water, but rather a lack of food. Where waterholes are ample, vegetation is not, as vegetation close to water is trampled and grazed. In a landscape where water is evenly provided, vegetation is thus also uniformly degraded.

In the KNP, waterholes were steadily opened to provide water in an environment perceived to be 'drying out' from 1911 to the 1990s. As many as 300 borehole-fed waterholes were opened and various dams built in rivers. When the drought hit in the early nineties, this landscape benefited some animals, to the detriment of many others. Plains game such as zebra and blue wildebeest, who graze shorter grasses did well, though numbers of long grass feeders such as buffaloes and the rare roan, tsessebe and reedbuck species plummeted. Thousands of hippos, warthogs, kudus, impala and bushbuck also died. Some predators and scavengers also benefited from dry conditions.

Since the early nineties, many of the artificial waterpoints have been closed down. Fences separating the KNP from some neighbouring protected areas have been dropped, enlarging the areas available to animals to roam. Now waterholes are

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spread unevenly across the landscape, allowing for natural plant and animal distribution patterns, and for vegetation far from waterpoints to recover from trampling and grazing.

The latest drought tested the park's new water management strategy. Post-drought census counts show that the KNP did not experience any large die-offs of animals as had been experienced during the previous drought. "This time, the buffalo population, for example, only fell with around 12 000," notes Pienaar. Buffalo numbers dropped in KNP between 2015 and 2017 by 26% in comparison to 48% during the previous drought (and less than those reported in fenced private game-reserves in the 1982/83 drought).

This result has been put down to grazing that accumulated in areas far from water, or so-called "buffer" forage areas. Analysis of rainfall and grass biomass indicated less severe drought condition in the north of the park which, combined with larger distances between rivers and other water sources, resulted in greater grass forage reserves. Accordingly, buffalo appear to have migrated from the south of the park to make use of these reserves. "We also did not see the large-scale mortalities of impala, warthogs and bushbuck," says Pienaar. "We had more herbivore biomass, but fewer animal losses."

Two species that deserve special mention are elephants and rhinos, both which tend to withstand drought conditions for longer. The real impact of the drought will take some time to unravel as birth rates only respond after a drought, says SANParks large mammal ecologist, Dr Sam Ferreira. During drought, fewer cows conceive, but because of the gestation periods of rhinos (16 months) and elephants (22 months), we will only detect this for rhinos roughly one year after, and for elephants, roughly two years later, he says. "The year following that we will see many more births, because cows tend to synchronise conceptions after such droughts, though this becomes unsynchronised again over time," he says. Still, against expectations, elephant numbers in KNP increased by 13% between 2015 and 2017. During the drought, a number of white rhino mortalities were noticed.

Therefore, the period for lessons learned and adapting accordingly is not over.

The 2014-2016 hydrological cycle in Kruger National Park developed into the most severe drought on record yet.

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In the wilderness, dry conditions are to the detriment of some species, while benefiting others.

Severe drought ends, but the dry cycle continues

Though the severe drought was officially broken during the 2016/17 hydrological year when the park received rainfall within the annual average again, the area is continuing to experience a dry cycle. "At present, we are borderline drought again, says Dr Riddell, with approximately 70% of the mean annual precipitation gracing the park during the 2017/18 hydrological cycle. This would be classed as a hydrological drought according to the regional definition," he says.

Though this is not technically a severe drought, the park is entering this time with less water available in storage (dams) than before the severe drought. Forecasts by the South African Weather Service indicate that the area is likely to experience a hot, dry spring with a short rain season into early 2019.

This situation will undoubtedly continue to test the park's resilience going forward, especially since the park is so intimately dependent on stakeholders that share its precious water resources. Will management be able to continue maintaining the rivers' flow when times are tough? And inside the park, how will animals respond to continued pressure on the environment? What will happen to elephant and rhino numbers?

Once again, only time will tell.

Sources:

- *Testing Strategic Adaptive Management during crisis: management of the perennial rivers of the Kruger National Park during drought by ES Riddell, S Pollard, H Retief, B Jackson and S Mallory. 14th International Water Association Specialist Conference on Watershed and River Basin Management, Skukuza, Kruger National Park, 2017*
- *The ecology of drought, a workshop report by Anthony Swemmer, William J. Bond, Jason Donaldson, Gareth P. Hempson, Johan Malherbe and Izak Smit (South African Journal of Science, September/October 2018)*
- *Drought - nature's lessons in overdrive in Kruger National Park by Lani van Vuuren (The Water Wheel, September/October 2016)*
- *Kruger getting house in order for severe drought by Petro Kotze (The Water Wheel, September/October 2015)*

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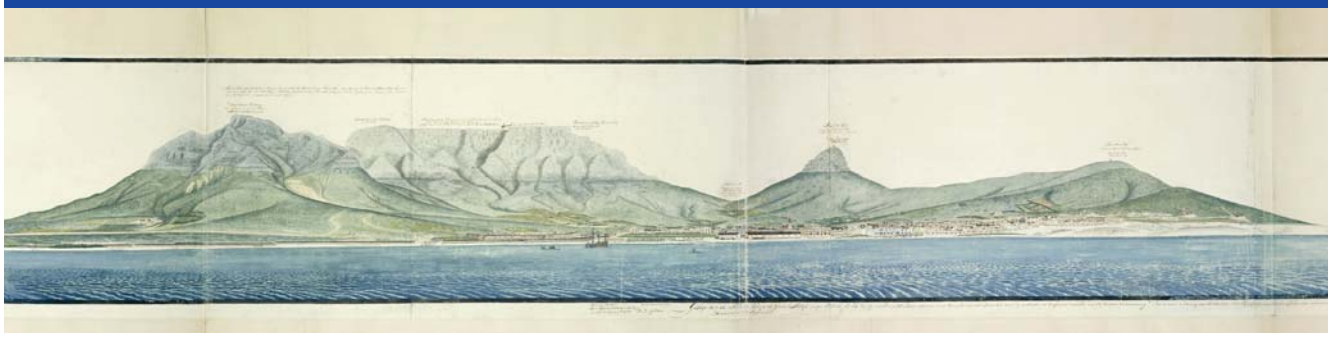
WATER HISTORY

Water history – The travels of RJ Gordon Part 1

The travel journals of Robert Jacob Gordon reveal interesting snippets about the Cape's water resources in the late 1700s. Sue Matthews traced his route in this first part of a multi-part article.



All images attributed to Robert Jacob Gorden, courtesy of the Rijkmuseum

Robert Jacob Gordon was born in the Netherlands in 1743, and followed in the footsteps of his father – of Scottish descent – to join the Scots Brigade in the Dutch military, although he also attended university. He initially arrived in Cape Town in early 1773 and stayed until May the following year. During this visit he went on a six-day hike in the surrounding mountains with the botanist Carl Thunberg and the plant collector Francis Masson, a trip to the Berg River on the west coast and another along the south coast to Mossel Bay, although any journals he kept during this time have not been found.

It was only after he had been appointed second-in-command of the Dutch East India Company's garrison at the Cape that he returned, arriving on 1 June 1777. Just over four months later, he left on the first of four expeditions, for which he kept daily journals, with drawings of people, plants, animals, settlements and landscapes, as well as maps and meteorological observations. Since he was always accompanied by the same artist, it is sometimes unclear to whom the drawings should be attributed, but these were acquired by the Rijksmuseum in Amsterdam in 1914, while the journals were purchased by Harry Oppenheimer for his Brenthurst Library in Johannesburg in 1979. The Rijksmuseum has recently made a dedicated website available to unite this material, with the late Patrick Cullinan's translations slightly amended in places to bring them as close as possible to Gordon's original Dutch.

The journals are a fascinating account of life at the Cape at that time, but they also tell us a little about particular water resources in their natural, pristine state. Here, we follow Gordon on his first expedition, comparing his descriptions of easily identifiable sites with their current situation.

Gordon set off from Cape Town on 6 October 1777 with his artist Johannes Schumacher, the botanist William Paterson and a small team of ***handlangers***, heading towards the False Bay coastline. After spending two nights at the farm ***Bergvliet*** to wait out rainy weather, the group travelled along the shore of Zandvlei to Muizenberg. Gordon noted there were many flamingos in the estuary, which was "shallow except in heavy rains and when the sea washes over into it, which happens here in the time of heavy storms. (But it can always be crossed, even by wagons, at Muizenberg.) The mouth … was blocked by sea-sand. When fording this place one must do so close to the sea side, on account of the quicksand."

Since those days, a road bridge has been built over the mouth, but the estuary has been irreversibly altered by human interference. It was dredged three times between the late 1940s and early 1960s to facilitate recreational boating, a canal system was carved out of the eastern shore to create the Marina Da Gama housing estate in the 1970s, and the banks of the main vlei were hardened too. A rubble weir was constructed at the mouth to maintain the water level, and the outlet channel now flows through a concrete canal to the beach, where the sandbar is regularly bulldozed to open or close the mouth. This

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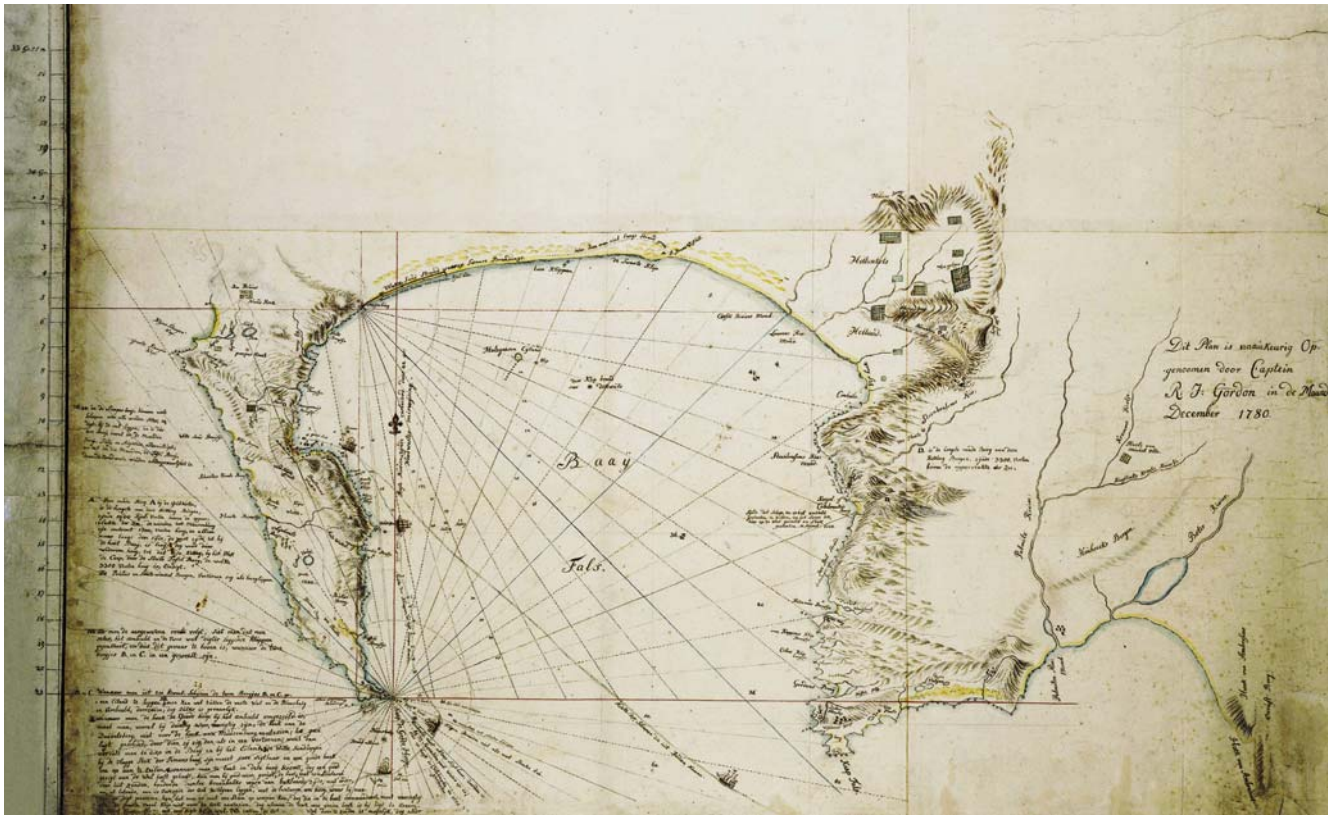
is necessary in order to prevent flooding and reduce erosion of waterside properties in the Marina at high water levels, flush out excess nutrients that promote nuisance weed and algal blooms, introduce seawater to maintain salinity, and allow movement of fish and invertebrates between the estuary and the sea. Unfortunately, the overly frequent artificial breaching has caused a dramatic build-up of marine sand washed into the mouth, hampering tidal exchange, so the lower reaches need to be dredged again. Work was started in 2015, but halted when funds were diverted to deal with Cape Town's water crisis.

Once across the Zandvlei mouth, Gordon and his group followed False Bay's coastline to the area later developed as Strand. Here they turned inland and arrived after dark at the farm ***Vergelegen***, established by Governor Willem Adriaan van der Stel, but by then owned by one De Waal and in a state of decay. After a few days botanising in the area, Gordon and a small party rode to the bay that would one day bear his name, and then continued along the coastline at the base of the mountains, while the wagon was sent over the Hottentots Holland range on the wagon route that can still be seen from Sir Lowry's Pass today. Upon reaching the chasm at the Steenbras River mouth, Gordon realised it was impossible to ride any further, so the horses were sent back and the group continued on foot, first climbing a little higher to cross the river upstream. Gordon's companions wanted to do the same at the Palmiet River, but he persuaded them to wade in chest-deep water across the mouth.

"The current nearly swept us off our feet but each supported the other," he noted. "From here the mountains begin to fall away up to three hours from the shore, and form a large plain through which the Bot River flows, the large mouth of which was blocked by sand and lies to the east, at the Onrust Mountain. But the smaller mouth of the river, which is flowing, is an hour and a half from Palmiet River."

The smaller mouth he refers to is what gave Kleinmond its name, and the Bot-Kleinmond estuarine system still opens naturally at this point more frequently than at the larger Bot mouth, which only breaks open during major flood events. For more than a century, however, the Bot mouth has been periodically dug or bulldozed open, originally to replenish populations of marine-dependent fish for fishing, and more recently to prevent flooding of low-lying infrastructure and maintain an estuarine – rather than freshwater-based – ecosystem.

Heated debate about such artificial breaching gave rise to a six-year research programme on the system in the early 1980s, and the resulting breaching criteria recommended by scientists were formally adopted in 1995. These were amended on the basis of new scientific input over the years, and – since the promulgation of the National Environmental Management Act: Environmental Impact Assessment Regulations in 2010 made artificial breaching illegal unless it was in accordance with a maintenance management plan agreed to by the relevant environmental authority – have been incorporated into the Mouth Management Plan, recently revised. Artificial breaching is considered necessary because the Bot estuary is an important nursery area for marine fish, but natural openings would be even less frequent today due to topographic changes caused



Robert Jacob Gordon's map of False Bay, drawn in 1780, depicts the Bot River flowing into the sea through the smaller Kleinmond mouth. It also shows Gordon's Bay at what is known as Pringle Bay today. Gordon named the bay after himself when he passed this way in 1777, and it was only later that the current Gordon's Bay near Strand was named after him.

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The confluence of the Orange and Caledon rivers, as seen by Gordon on 24 December 1777.

by dune stabilisation, and a reduction in flows caused by water abstraction and alien infestation in the catchment.

We called this river the Orange River; it is the same, we believe, that flows out at the Namacquas, the Garie or Great River."

Gordon's party turned inland up the Bot plain to rendezvous with the rest of the group. The following day they arrived at a farm in the area that later became Caledon, where they visited the hot springs – the Baths then housed within a 'dirty little hut' rather than the swish spa hotel that exists today. They continued on to the Landdrost's headquarters at Swellendam, which Gordon noted "has good wheat, bad wine and where it does grow the fruit is no good", most of the orange trees being infested with scale. It was here too that he ate hippopotamus and rhinoceros, possibly for the first time, commenting: "The first tastes much like bacon but is tougher, not as tasty as bacon, though in the pea-soup it could have deceived anyone into thinking it pork. The rhinoceros meat was tough and unpleasant, both having been salted for some time."

From Swellendam Gordon's group travelled east to the far end of the Swartberg range, and then further inland to cross the Camdeboo plains around present-day Graaff Reinet. They went up and over the Sneeuberg mountains and along a river they named the Plettenbergs, but is now known as the Seekoei. "The river comes from the Sneeuberg, flows north at first, then east to here, then, say the savages, it again flows north into the Gariep or Great River." The group killed nine hippo here before turning around, crossing back over the Sneeuberg and then heading east to present-day Somerset East. They went north along the Great Fish and Tarka rivers, and continued north-east past the Bamboesberg until they came upon a wide and strongly flowing river. "We called this river the Orange River; it is the same, we believe, that flows out at the Namacquas, the Garie or Great River."

Gordon and his party recorded the presence of several animal species on their travels.

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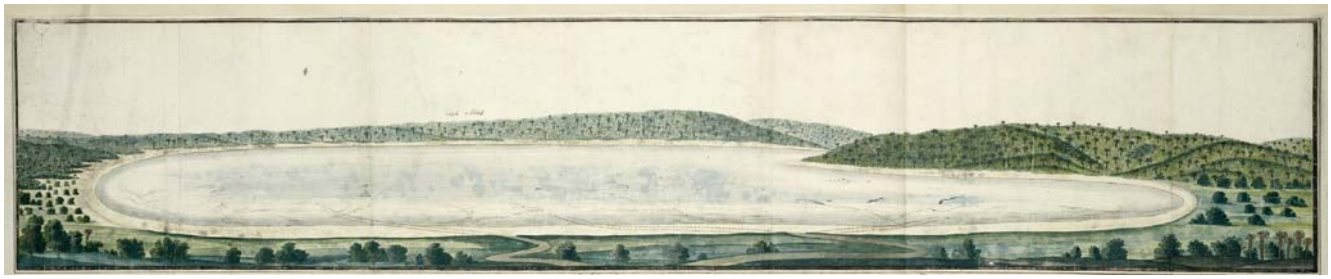

The saltpan Gordon encountered between the Coega and Swartkops rivers on 16 January 1778.

The following day – Christmas Eve, 1777 – Gordon climbed the mountain next to the river and saw the large tributary just upstream, which he called the Wilhemina's River after the wife of the then Prince of Orange, William V. Today we know this as the Caledon River.

Unable to cross the Orange River, Gordon's group turned back and later headed south-east, visiting the meeting point of the Great and Little Fish Rivers before following the Boesmans River to the mouth. They then took a slightly inland route down the coast, crossing the Sundays River before they "reached a small stream, the Cougha, which means 'soil-river'." Today it is known as the Coega, and the name is understood to refer to groundwater – large-scale abstraction occurs from the much larger Coega Ridge Aquifer underlying its catchment area.

The group rode through thick undergrowth to the closed mouth, where Gordon recorded seeing lion and rhinoceros tracks, as well as many buffalo and waterfowl, including flamingo. He noted that the river becomes brack in the dry season and flows into the sea "only once in seven or eight years". Nowadays, the river discharges into a deep-water harbour – the Port of Ngqura – that was carved out of the coastline in the early 2000s to serve the Coega Industrial Development Zone (IDZ). Long before that, however, the system had already been completely transformed by the diversion of the river into an earth channel and the construction of salt pans in the floodplain, which are still in use by Cerebos today. While the original saltworks buildings dating back to the 1950s have been demolished in the past few years, Cerebos is now operating from an advanced, new salt-processing facility in the IDZ.

Hippopotami were hunted during the expedition.

Gordon mentioned a few natural salt pans in the area, but he was particularly taken with a very large one between the Coega and Swartkops Rivers, which can be easily identified on Google Earth by his description of its long, narrow neck. This too is still in operation, although the housing developments of Motherwell are encroaching ever closer.

"It is surrounded by undergrowth on all sides and makes a beautiful spectacle, even when one is standing on it, just like a field of ice after snow has fallen and frozen after a light thaw. Walked across it and found in the middle about a foot of water on top of this salt which was there so hard that I could not break through it with an iron pick. Towards the ridges of the pan the crust of the salt is a thick as the span of hand," he wrote. "One can always collect very white salt here, both fine and rough; the former however is best in the summer. This pan supplies even the farmers of the Camdeboo and Sneeuberg regions with salt. They come with their wagons every year, riding onto the pan and in this way breaking it out with iron tools."

Gordon and his party stayed for a few days in the area that was to become Port Elizabeth – but only in 1820, when 4000 British settlers arrived by ship. Gordon referred to it as "Baay de la Goa" (now Algoa Bay), and the only inhabitants at the time were indigenous people and a few farmers allocated land by the Dutch East India Company. "In the middle of the west side a small river runs out, called the Baakens River because a beacon or coat-of-arms of the Company has been placed here," he wrote. "If one digs in the dunes one gets good water here and there; otherwise water is scarce."

In the next issue, we follow Gordon as he makes his way back to Cape Town, and learn more about his other expeditions.

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OPINION

When the state fails: Responding to water resource insecurity in the uMngeni River Basin

The Umgeni River, a major source of water to urban, agricultural and industrial residents in KwaZulu-Natal is experiencing serial decline. Duncan Hay explores some the options to improve conditions in this important river system.

A recent historical context

In 2013, the Water Research Commission, University of KwaZulu-Natal and Durban University of Technology convened a symposium entitled 'Engaging the uMngeni River Basin'. The symposium had several findings, including confirming that the relatively well-watered river basin provides a significant socio-economic advantage to the region; that there is a general decline in social-ecological health of the system, particularly a deterioration in water quality; and that governance and management are fragmented and erratic. Other findings were that:

- There are significant bodies of knowledge and information but much of it is inaccessible
- There are insufficient leadership, management and technical capacity and skills to deal with the issues
- There is insufficient focus on water resource education in schools and amongst adults
- There are significant backlogs in the development of water supply and sanitation infrastructure and services, and inadequate maintenance of what exists
- Financing systems for infrastructure development and payment systems for services are unsustainable
- The price of water is insufficient to sustain re-investment in water resource systems.

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Following the symposium, the uMngeni Ecological Infrastructure Partnership (UEIP) was established. UEIP now compromises 24 state, parastatal, non-governmental, research and private sector organisations and its focus is to promote nature-based solutions to environmental issues facing the river basin. As a parallel process, in September 2013 the International Water Security Network (IWSN) was conceived and commenced its work. Comprising a partnership of the University of the West of England, University of Arizona and Monash South Africa one of its areas of focus was water quality security in the uMngeni system.

The indicators and main source of water insecurity in the uMngeni

Considering first the 400 million m³ of processed water produced annually by Umgeni Water, this provides a theoretical per capita amount of 220 litres per day. By global standards this is a generous amount and, even during severe drought, the river basin should be water secure. But what we observe is increased water insecurity.

"Water brings us together and pulls us apart. How we use it acts as a mirror; reflecting our societies and civilities back to ourselves." Larry A. Swatuk, Professor, University of Waterloo, Canada

Analysing the three major water service authorities in the uMngeni system, non-revenue water (NRW) in eThekwini is 39% of which leaks account for 30%; for Msunduzi non-revenue water is 45% with leaks constituting 20%; and for uMgungundlovu the total loss is 61% of which 30% is leaks. eThekwini is by far the largest user in the system accounting for about 280 million cubic metres annually. So, in volumetric terms it is losing 84 million m³ and financially, at R 6 per cubic metre, it is losing R 650 million annually.

So what conclusions can we draw from this? The obvious – water reticulation infrastructure is not adequately maintained, and metering and revenue collection systems are inefficient (analysis by the national Department of Water and Sanitation indicates that one third of South Africans pay for their water, one third cannot afford to pay and one third can pay but do not because of, amongst other, inadequate metering and revenue collection systems).

What is also apparent is that if, as an urban resident, you are rich (and mainly white or Indian) you are fairly well serviced but if you are poor (and mainly black) you are inadequately serviced.

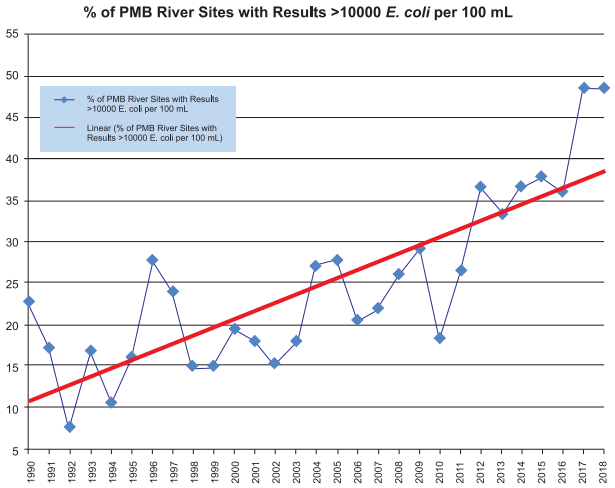

Photo supplied

Up to 20 000 m³ of sewage a day is not reaching Pietermaritzburg's sewage treatment plants, but is rather ending up in the Umgeni River.

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Turning attention from water quantity to water quality and focusing in on the Msunduzi Municipality, the now famous or infamous graph above is self-explanatory. Recent crude calculations indicate that, on a daily basis, 15 000 to 20 000 m^3 of sewage generated in the municipality is not reaching the wastewater treatment plant.

This constitutes nearly 20% of all sewage generated. Most of this sewage is entering our rivers, streams and wetlands which are forced to act as 'treatment plants'. During rainfall events when the stormwater floods the sewerage system the loss of sewage from the system increases dramatically and the functioning of the treatment plant is compromised. The large quantities of nitrates and phosphates associated with this sewage compromises water quality downstream including in Inanda Dam, an important source of water for eThekwini. High pathogen levels compromise recreational use of the river system downstream.

"I believe the biggest risk to South Africa's democracy is the collapse of municipalities." Ralph Mathekga (Fellow at the SARChI Chair: African Diplomacy and Foreign Policy at the University of Johannesburg)

In the uMngeni Municipality both reticulation and wastewater treatment systems cannot cope with the load and raw or partially treated sewage either escapes into Midmar Dam, the main water-supply dam in the system, or is pumped directly into the uMngeni River. Like the situation in the Msunduzi this compromises water quality in Albert Falls Dam, also an important source of water for eThekwini.

Again, we can draw some obvious conclusions. Both sewer and stormwater systems are inadequately maintained and, as the graph indicates, we have a progressively deteriorating situation. Also, regulatory instruments that force municipalities to comply with acceptable levels of performance are clearly not being enforced.

Also, speaking to the political economy of water, middle class and affluent white and Indian residents are well serviced by sanitation infrastructure and responses to problems are quite rapid. Poor urban and peri-urban black residents are poorly serviced.

Water resources are also subject to solid waste pollution. Garbage collection by local municipalities is erratic in certain areas causing residents to dispose of their garbage in water courses where it pollutes or in sewers where it causes blockages. In addition to these factors, run-off from and erosion of agricultural and informally developed peri-urban areas, industrial pollution discharges, infrastructure development of various types and alien invasive plant infestations all contribute to impacting on both water quality and quantity.

The Howick Falls.

So, the main source of water insecurity in the uMngeni River Basin is not the lack of water. Rather, it is the steady decline of local government combined with the decline in regulatory capacity of the national Department of Water and Sanitation (DWS). In short, service delivery, infrastructure maintenance, development planning and revenue collection is compromised, as is regulatory compliance. Even if DWS was in a position to exert regulatory pressure and as we have observed elsewhere in South Africa, it is unlikely that the municipalities could respond adequately.

But why is local government imploding? It is a complex and toxic mix of systemic and legitimised corruption and greed, general criminality, lack of accountability, incompetence, lethargy, political interference, party-political factionalism, cadre deployment and lack of capacity. While we have always been aware of this it is only now that its pervasive extent is coming into full and public view.

How might we respond?

Identifying symptoms and diagnosing causes are relatively simple processes. Establishing cures are more difficult. (I use the language of the medical fraternity quite deliberately as I believe that a pervasive social illness exists.) How might we respond? Here are ten suggestions:

1. Let's take a long-term strategic view, but start acting now. We face a myriad of connected problems and solutions will not happen overnight. We need to be patient, plan carefully but, at the same time we need to start acting now

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in whatever constituency we find ourselves.

2. It is imperative that we raise the importance of water as a critical and indispensable contributor to our development agenda. In an uMngeni River Basin context we should be casting it as the regional economic competitive advantage that it is.
3. We need to bring public pressure to bear on state institutions, particularly local government, to get reliable water and sanitation services to those who are poorly serviced, the urban and peri-urban poor; to maintain existing infrastructure, and to fix billing and revenue collection systems.
4. We need to support those public institutions that are positively influential and functioning properly. Specifically in the context of the uMngeni River Basin the water utility, Umgeni Water, is operating effectively and responsibly and is, arguably, the most influential player in the water resource game in the region. We need to help and encourage Umgeni Water to exert its influence in a meaningful way.
5. We need to continue to lobby for the price of water to more accurately reflect its value. Currently water is so inexpensive at all tiers of the value chain that there is insufficient financial return to re-invest, particularly in nature (ecological infrastructure) to support improved water security.
6. In a research context, a continued focus on exploring nature-based solutions to water security issues has merit. The focus on research that supports improved conservation of our key water source areas might be particularly useful. There is a double-win in doing this as it contributes not only to water security but also to biodiversity conservation. Also, in times of economic down-turn and tight purse-strings, nature-based solutions that are inherently less costly than similar hard infrastructure interventions are likely to be appealing. The time for meaningful greening is now.
7. In the context of research on water resource governance it has become apparent that one of the main drivers of the decline in state functioning in all spheres has been, and remains, systemic fraud and corruption. Some recent news reports have gone as far as to suggest that lack of maintenance of water service infrastructure, particularly our wastewater treatment plants, might be a deliberate act perpetrated to secure emergency funding which can then be looted. What we are observing makes this suggestion a realistic possibility. Research going forward might focus on how we reestablish integrity in public institutions.
8. In the context of advocacy this is directed at scientists. It is our duty not only to equip society to understand the issues; it is our responsibility to lead in bringing about the change we want to see. In a world of institutional failure we need to move increasingly into the realm of advocacy and activism; we need to be toyi-toying in the streets.
9. In the context of capacity development, material improvement in water security is as much about society acting appropriately as it is about the State acting responsibly. We will continue to target society with articles that highlight water security issues, specifically focusing on building the capacity of individuals to understand the issues. What we have learnt from the last five years is that the printed medium is losing ground. We need to target various social media so as to reach a broader and younger audience.
10. Also in the context of capacity development, post-graduate training is essential. We need more young professionally competent PhD graduates to help address the complex water resource management challenges that we are encountering and to become the new leadership in the sector. In addition, we need to address the funding deficit that exists for this training and, finally, bright young MSc graduates are not securing jobs so let them study while employment opportunities are so poor.

Let's get to work.

This research was funded by a combination of the Institute of Natural Resources and the Lloyds Register Foundation through the International Security Network (IWSN).

Inanda Dam is an important source of water to the eThekwini Municipality.

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CAPACITY BUILDING

Building a new generation of ecological infrastructure professionals

The Centre for Water Resources Research (CWRR) at the University of KwaZulu-Natal (UKZN) and partners are nearing the conclusion of a landmark five-year Water Research Commission (WRC) project which has also been supported by the Development Bank of South Africa and Umgeni Water, investigating how healthy ecological infrastructure can be utilised to secure water for the benefit of society and the green economy through research focused on selected landscapes in the uMngeni Catchment.

Dr Catherine Hughes

The project is notable for the breadth and scope of its work, especially in the context of the Sustainable Development Goals and the South African National Water Management and Sanitation Master Plan (NWSMP) call to action. This call features ecological infrastructure as an important strategy for mitigating the impacts of South Africa's water crisis that are felt in water infrastructure, recurrent droughts, inequities in access to water and sanitation, deteriorating water quality, and a lack of skilled water professionals.

Homegrown professionals borne out of partnership

The NWSMP's call to build capacity in the water sector factors into a project that has seen two PhD students, seven Masters students and six Honours students graduate, with many more in the pipeline. Students come from a variety of disciplinary backgrounds, including hydrology, bioresources engineering, microbiology, development studies, geography, ecology and economics. They are no strangers to the study area; all but two of the first crop of graduates were born in the uMngeni catchment.

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This is one of several projects under the WRC's Green Village and Economy Lighthouse, which concentrates research projects that help strengthen policies and generate green jobs. Amongst the Lighthouse's many aims, the positioning of ecological as a core component, and focus on unlocking appropriate economic arguments to aid engagement with ecological infrastructure investment, play into this project.

The Lighthouse focuses on unpacking aspirations of the green economy to finer scales and testing them in selected catchments based on partnerships of committed stakeholders. This involves identifying and closing research gaps, with the aim of contributing to a knowledgeable society in which a healthy ecological infrastructure is maintained, and where sustainable and productive agriculture and renewable energy are commonplace.

This project is characterised by partnerships; it slips into various streams of research and on-the-ground initiatives throughout the uMngeni catchment. The focus area and pilot study site is consolidated through the uMngeni Ecological Infrastructure Partnership (UEIP). In this partnership, more than 30 government departments, academic institutions, private companies and non-governmental organisations have signed a Memorandum of Understanding documenting their commitment to investing in restoring, maintaining and managing ecological infrastructure towards improved water security. The initiative also aims to provide additional benefits such as job creation, agricultural productivity, aesthetics, cultural benefits, flood attenuation and adaptive capacity to climate change impacts, which increase the return on investment.

The WRC project identifies sites in the uMngeni catchment where investment into the protection and/or restoration of ecological infrastructure can produce long-term and sustainable returns in terms of the delivery of water-related ecosystem services. Its interdisciplinary nature provides scope for both biophysical and social scientific research.

Prioritising postdoctoral research

This project includes two postdoctoral researchers, a boon to the high-level research efforts it aims at.

Dr Sheldon Strydom is investigating microclimate trends and variability in the uMngeni catchment and its influences on water resources. Initial findings show no significant changes in rainfall over time, but a clear increase in air temperature. Working on the project has exposed the Agrometeorology graduate to broader issues surrounding water resources.

In turn, Dr Shaeden Gokool is working on identifying hotspots for investment in ecological infrastructure within the uMngeni catchment, and says the project has enabled him to pursue his research interests in GIS and remote sensing as well as present at national and international conferences.

Both postdoctoral researchers, together with other students on the project, recently presented their research at the Fountainhill Estate Symposium in KwaZulu-Natal; their work feeds into a partnership with this estate that enables research that contributes to the health of the uMngeni catchment.

Promoting the value of water and ecosystems

Recent PhD graduate, Dr Catherine Hughes, used validated hydrological modelling to demonstrate that it is possible to derive a more sustainable water supply from a catchment – for humans and ecosystems - if ecological infrastructure is conserved and rehabilitated.

Dr Hughes investigated different forms of human-induced degradation that affect the delivery of ecosystem services in the uMngeni catchment, exploring the potential hydrological benefits of either conservation or rehabilitation of ecological infrastructure. Her thesis also touched on wider issues associated with globalisation and urbanisation in the catchment, and impacts on water delivery. She emphasised the need for stakeholders to work together towards optimal investment decision-making with regard to ecological infrastructure to protect people from water-related risk and help ensure food and water security.

Capacitating Africa

Dr Jean Namugize is from Rwanda where he is now involved in consultancy services as a highly sought-after expert. He completed his PhD on linking land use and land cover changes to water quality in the fast developing uMngeni catchment in 2017. Namugize's research provided him with a wide array of skills, from experimental design to hydrological modelling. He was able to attend short courses and presented his research at several national and international conferences.

'[The knowledge] I gained is needed in Rwanda, where a dense population means land use changes and water quality are major issues,' he said. 'The country is behind in management of its water resources in comparison to South Africa, due to a lack of data or inconsistency of water quality data collection.'

Namugize is about to lead a research project related to management of water resources in one catchment of Rwanda, acknowledging South Africa as a second home and giving credit to the WRC and Umgeni Water for providing funding for his studies.

Rising star investigates diffuse pollution

A Master's candidate who recently submitted her thesis, Nantale Nsibirwa, is earning national and international recognition for work done on this project, winning the prestigious KwaZulu-Natal Premier's Award at the 2017 Symposium of Contemporary Conservation Practice and being shortlisted for the International River Foundation's 2018 Emerging River Professional Award.

Nsibirwa's research concerned identifying the source areas and transport pathways of diffuse pollution in the uMngeni Catchment. This involved developing maps that aid efforts to conserve ecological infrastructure by identifying areas in the catchment with high risk of contributing to the diffuse pollution problem.

In it from the beginning

PhD candidate, Hlengiwe Ndlovu, investigated the effect of the Lions River floodplain on downstream water quality for her Master's, part-time while working with Sappi in 2016. She is now

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working with the World Wildlife Fund on water stewardship within the forestry sector.

Her research examined the ecological integrity of the Lions River floodplain and its impact on downstream water quality, aiming to establish a baseline against which rehabilitation interventions could be assessed. The floodplain is an important wetland system upstream of Midmar Dam on one of the uMngeni's main tributaries. Ndlovu's results influenced the planning and implementation of rehabilitation interventions on the study site, particularly in the management practices of the landowner, Sappi, with practices around alien invasive control and grazing changing. Currently, she is pursuing a PhD examining aspects of water security in productive landscapes, focusing on forestry environments and the importance of ecological infrastructure for water security globally.

Integrated research for water quality solutions

Master's graduate, Ms Jedine Govender, assessed and linked the poor water quality of the Baynespruit River to the health of the Sobantu community exposed to the river through various pathways. This research provided water quality data for the lower reaches of the Baynespruit River, soil and crop data related to heavy metal contamination and recognition of health implications, and potential to conduct a full-scale human health assessment. Govender highlighted the importance of integrated research to derive solutions for water quality issues.

Govender appreciated the interdisciplinary nature of a project that expanded her knowledge and skills in other disciplines and provided networking opportunities for future endeavours.

Long-term pollutant loadings investigation

Mr Sanele Ngubane, another Master's graduate on the project, assessed the changes in pollutant loadings to Midmar Dam over 40 years. Assessing the influx of pollutants into the dam from its five contributing tributary streams and the Umgeni River, he highlighted a significant increase in some nutrients over time, but also an alarming decline in the data needed to manage this problem. This work is important for understanding the looming toxicity crisis that would affect the water supply of more than half of KwaZulu-Natal's population.

Continuing research and investment

In building the capacity of students and researchers in ecological infrastructure, this project emphasises keeping its students in conversation with one another, and has made optimal use of the resources available, highlighting the importance of long term sustained funding for postgraduate, especially PhD, training. Its collaboration with other initiatives is a hallmark of its success, boding well for continued investment in ecological infrastructure solutions.

Drawing on experience gained through this project, the CWRR, with the Institute of Natural Resources and other partners, is developing a PhD programme adopting a "cohort" approach, wherein students from different backgrounds and an interdisciplinary supervisory team work on a set of common, critical water security problems from different perspectives.

Photographs supplied

(From top to bottom) Dr Jean Namugize, Nantale Nsibirwa, Hlengiwe Ndlovu, and Jedine Govender are all post-graduate students that have benefited from the project.

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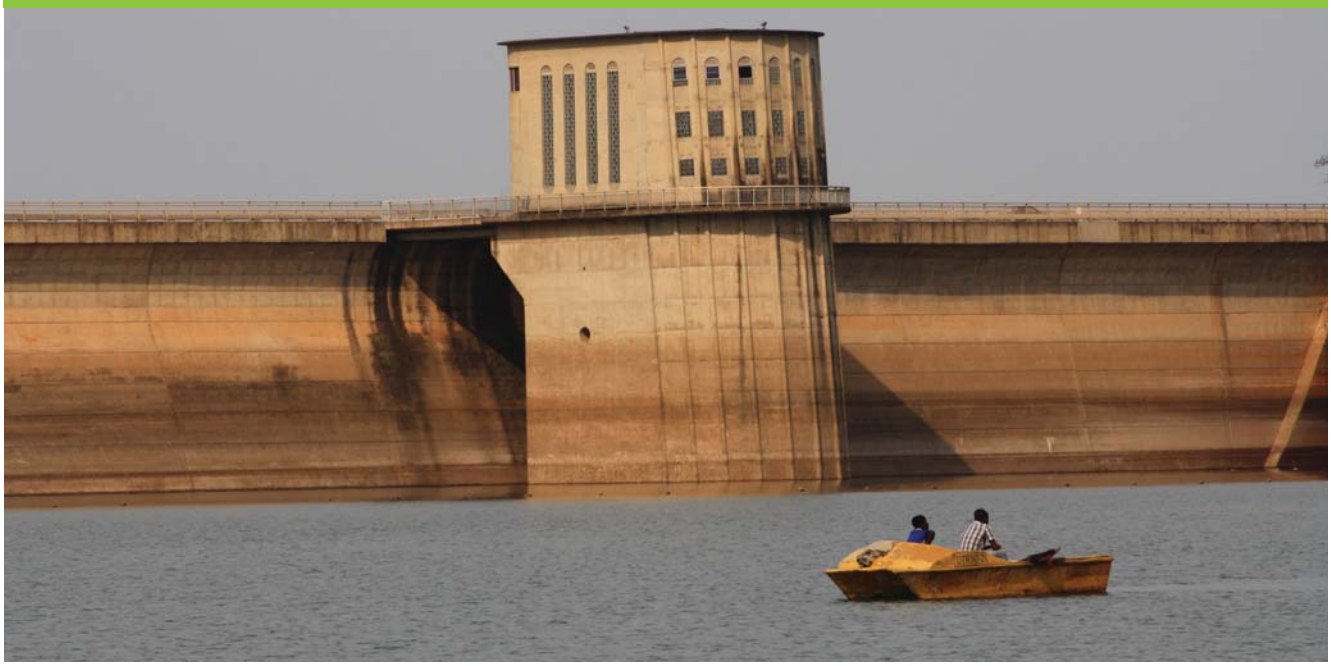
FRESHWATER FISHING

Livelihoods can benefit from artisanal fishing on SA dams

Artificial bodies, such as Pongolapoort Dam in KwaZulu-Natal, offer a small but valuable freshwater fishing industry. A team of researchers from the University of the Western Cape are honing in on the opportunities this sector might offer to women in particular. Article by Leonie Joubert.



Lani van Vuuren

There are only about 15 artisanal fishers making a living from fishing in the waters of the Pongola Dam in northern KwaZulu-Natal, and only three of them currently own their own boats. However, these fishers are part of a small but important industry that boosts food access and livelihoods in surrounding communities.

These skippers usually hire at least one crew-member to go out on the water with them, so that they're safer and they have extra hands to help with the sometimes cumbersome task of bringing in their catch after a night of fishing the dam for mostly tilapia and catfish.

Freshwater fishing on inland bodies of water like this one is a tiny industry in South Africa, and only got established around the Pongola Dam in response to the arrival of Mozambican immigrants in the area who have a long tradition of fishing. While this particular form of artisanal fishing is still largely a man's world, once these fishers haul their catch out at the dam's slipway, women enter the value chain.

Now, on the basis of a new study on the structure of the freshwater fishing value chain on the Pongola Dam, researchers hope to draw up recommendations for policymakers that will support initiatives that may boost women's opportunities in this sector. There is plenty of scope for women to get involved in handling, processing, transporting, and retailing, as well as being avid consumers of the fish.

This is the preliminary finding of a study of the value chain associated with artisanal fishing on the dam, done by a Cape Town-based resource economist, along with researchers at the Institute for Poverty, Land, and Agrarian Studies (PLAAS) at the University of the Western Cape.

"The freshwater artisanal fishing industry at a dam like the

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Pongola is very small, and is quite a recent phenomenon," explains Prof Edwin Muchapondwa, from the University of Cape Town's School of Economics, who is leading the study. "But it's nevertheless an important source of protein and income for communities living around dams like these, not only for the fishermen and their families, but for the many other households that are able to find a source of livelihood along the value chain."

There's a thriving recreational fishing community at the Pongolapoort Dam, where anglers are casting their lines largely as part of a catch-and-release sporting activity.

Meanwhile, the artisanal fishing industry on the dam is much smaller and less formal than the recreational scene, however, the value chain surrounding it is nevertheless a source of business opportunities, income and food for communities surrounding the dam.

"We found four general groups operating in this artisanal value chain. The input suppliers are bringing fuel, fishing gear, and so forth into the value chain," says Prof Muchapondwa. "Then, there are the fishers themselves."

Mostly men, these fishers take to the dam in 3-metre fiberglass boats which they either buy, or collect abandoned ones from places like nearby Lake St Lucia.

"Next in the value chain are the vendors who sell the fish at the informal markets in communities and towns surrounding the dam. Finally, there are the consumers."

The value chain analysis also considers the regulatory framework that influences the behaviour of the actors who are directly involved with moving the physical product along the chain, and also the support services that are available to support the value chain players to comply with the rules and regulations specified by the value chain influencers.

Prof Muchapondwa and his team estimate that these fishermen are landing about 100 fish per person, per trip, and are generally taking their boats out about three or four times a week.

"The size of the fish they're catching ranges between 100 grams and about 1.5 kilos,' says Prof Muchapondwa. 'They're selling these to vendors at around R20 to R30 for the medium-sized fish, and R50 to R60 for the biggest fish. That means the gross revenue for a fisher averages at R3 000 per trip."

The team counted about 27 women who are involved in the fishing trade associated with these freshwater hauls. They mostly secure inputs from local shops, such as fridges, buckets, and ice, and buy the fish directly from the fishers at the slipway.

From here, the women may clean and gut the fish, and then transport them to nearby towns where they'll mostly sell them informally on the roadside or from pavement stalls. Local restaurants don't include this kind of fish on their menus, and therefore don't offer much opportunity for a new market, and the grocery stores tend to sell frozen fish either imported from China or else frozen and canned marine species sourced along the South African and Namibian coast.

"The amount and variation in the kinds of fish that fishermen are landing aren't conducive to meeting the contractual obligations that a local restaurant or shop might have, so this isn't a likely market opportunity for the fishers or the women players in the value chain," explains Prof Muchapondwa.

Although the growing dried fish market might be a lucrative new market, the team speculates.

Many of the important markets for this fish are in the towns surrounding these dams, so the various agents in the value chain need to make sure that the fresh fish that they bring to these markets is of an acceptable quality, notes Prof Muchapondwa. This means they need access to clean processing facilities, refrigerated storage and transport, and a critical mass of fishers targeting to sustainably satisfy demand at all times.

"We're still finalising the study, but by next year we hope to have drawn up some specific recommendations for policymakers about how they can support women in this value chain so they can benefit from the industry more than they currently do," explains Prof Muchapondwa.

The value chain associated with this industry is relatively short, and low-tech, meaning it doesn't need technologically-advanced interventions to make it a more reliable and sustainable livelihood opportunity for those involved in the industry. A critical position which needs clarification is around the use of nets in artisanal fishing, especially in relation to claims of customary rights to fishing on parts of rivers that are now dammed.

"In the context of poverty alleviation, food security and rural development, government policy relating to this industry could play a facilitative role on this front. We hope to be able to make some strong recommendations when we conclude this report."

This study zeros in on the value chains around Pongolapoort Dam in northern KwaZulu Natal, the Voëlvlei Dam about two hours inland from Cape Town, and the Flag Boshielo Dam in the Limpopo Province. It is part of a large empirical assessment of freshwater fish stocks, fisheries potential, market value chains, governance and co-management arrangements. The final report will be published by the Water Research Commission in 2020.

Photo supplied

Women form an important part of the artisanal freshwater fishing value chain.

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FOOD SECURITY

Global hunger continues to rise, UN report says

The latest report on world hunger released by the United Nations (UN) earlier this year indicates that the number of hungry people in the world is increasing. An estimated 821 million people were undernourished in 2017 – one in every nine people.

The report, ***State of Food Security and Nutrition in the World 2018***, was released in September. The publication monitors progress towards the targets of ending both hunger (Sustainable Development Goal Target 2.1) and all forms of malnutrition (SDG Target 2.2), and provides an analysis of the underlying causes and drivers of observed trends.

In addition to the number of undernourished people increasing, limited progress is also being made in addressing the multiple forms of malnutrition, ranging from child stunting to adult obesity, putting the health of hundreds of millions of people at risk. Hunger has been on the rise over the past three years, returning to levels from a decade ago. This reversal in progress sends a clear warning that more must be done, and urgently, if the Sustainable Development Goal of Zero Hunger is to be achieved by 2030. The situation is worsening in South America and most regions of Africa, while the decreasing trend in undernourishment that characterised Asia seems to be slowing down significantly.

The annual report found that climate variability affecting rainfall patterns and agricultural seasons, and climate extremes such as droughts and floods, are among the key drivers behind the rise in hunger, together with conflict and economic slowdowns. "The alarming signs of increasing food insecurity and high levels of different forms of malnutrition are a clear warning that there is considerable work to be done to make sure we "leave no one behind" on the road towards achieving the SDG goals on food security and nutrition," the heads of the UN Food and Agriculture (FAO), the International Fund for Agricultural Development (IFAD), the UN Children's Fund (UNICEF), the World Food Programme (WFP) and the World Health Organisation (WHO) warned in their joint foreword to the report.

"If we are to achieve a world without hunger and malnutrition in all its forms by 2030, it is imperative that we accelerate and scale up actions to strengthen the resilience and adaptive capacity of food systems and people's livelihoods in response to climate variability and extremes," the leaders said.

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The impact of climate variability and extremes on hunger
Changes in climate are already undermining production of major crops such as wheat, rice and maize in tropical and temperate regions and, without building climate resilience, this is expected to worsen as temperatures increase and become more extreme.

Analysis in the report shows that the prevalence and number of undernourished people tend to be higher in countries highly exposed to climate extremes. Undernourishment is higher again when exposure to climate extremes is compounded by a high proportion of the population depending on agricultural systems that are highly sensitive to rainfall and temperature variability.

Temperature anomalies over agricultural cropping areas continued to be higher than the long-term mean throughout 2011-2016, leading to more frequent spells of extreme heat in the last five years. The nature of rainfall seasons is also changing, such as the late or early start of rainy seasons and the unequal distribution of rainfall within a season.

The harm to agricultural production contributes to shortfalls in food availability, with knock-on effects causing food price hikes and income losses that reduce people's access to food.

The report highlights, in particular, the reductions in food availability and price increases in regions affected by the El Niño phenomenon in 2015-2016. This event resulted in large climatic deviations and anomalies compared with historical norms, which were experienced in different ways and to varying degrees of intensity in various part of the world. In some areas, severe drought conditions have resulted from the El Niño phenomenon, particularly in regions where many low- and middle-income countries are situated.

Africa is one region where the influence of climate on production and livelihoods is both strongest and most complex. Much of the vulnerability to climate shocks stems from the dryland farming and pastoral rangeland systems that dominate livelihood systems for 70–80% of the continent's rural population.

A heavy reliance on rainfed agriculture (crops and rangelands) makes rural populations more vulnerable. Furthermore, in arid, semi-arid and dry sub-humid areas, the impacts of human activities aggravate conditions of desertification and drought. This is particularly relevant to Africa as farming practices are extended into agriculture on marginal lands (e.g. arid and semi-arid lands, hilly and mountainous areas and wetlands).

Slow progress on ending all forms of malnutrition
Poor progress has been made in reducing child stunting, the report says, with nearly 151 million children aged under five too short for their age due to malnutrition in 2017, compared to 165 million in 2012. Globally, Africa and Asia accounted for 39% and 55% of all stunted children, respectively.

Prevalence of child wasting remains extremely high in Asia where almost one in 10 children under five has low weight for their height, compared to just one in 100 in Latin America and the Caribbean. The main underlying causes of wasting are poor household food security, inadequate feeding and care practices, and/or poor access to health, water, hygiene and sanitation services.

Suboptimal breastfeeding, poor complementary foods and poor feeding practices can lead to rapid weight loss or growth failure. Lack of knowledge about proper food storage, preparation and consumption by parents and caregivers may be contributing factors. Wasting may be part of a vicious cycle with infection: undernutrition increases the susceptibility to infection, and infection then leads to greater weight loss due to appetite loss and poor intestinal absorption. Diarrhoeal disease, in particular, often leads to rapid weight loss, and poor access to appropriate and timely healthcare slows the recovery from such illnesses.

The report describes as 'shameful' the fact that one in three women of reproductive age globally is affected by anaemia, which has significant health and development consequences for both women and their children. No region has shown a decline in anaemic among women of reproductive age, and the prevalence in Africa and Asia is nearly three times higher than in North America.

Rates of exclusive breastfeeding in Africa and Asia are 1.5 times higher than those in North America where only 26% of infants under six months receive breastmilk exclusively.

The other side of hunger: obesity on the rise
Adult obesity is worsening, and more than one in eight adults in the world is obese. The problem is most significant in North America, but Africa and Asia are also experiencing an upward trend, the report shows.

Undernutrition and obesity coexist in many countries, and can even be seen side by side in the same household. Poor access to nutritious food due to its higher cost, the stress of living with food insecurity, and physiological adaptations to food deprivation to food deprivation help explain why food-insecure families may have a higher risk of overweight and obesity.

Call for action
The report calls for implementing and scaling up interventions aimed at guaranteeing access to nutritious foods and breaking the intergenerational cycle of malnutrition. Policies must pay special attention to groups who are the most vulnerable to the harmful consequences of poor food access; infants, children aged under five, school-aged children, adolescent girls, and women.

At the same time, a sustainable shift must be made towards nutrition-sensitive agriculture and food systems that can provide safe and high-quality food for all.

The report also calls for greater efforts to build climate resilience through policies that promote climate change adaptation and mitigation, and disaster risk reduction.

To access the report, Visit: https://bit.ly/2NLBvIA

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Water KIDZ

Irrigation - helping to grow our food

Centre pivot irrigation is a common sight in South Africa.

In a water scarce country such as South Africa, irrigation plays a crucial role in growing our food. In fact, irrigation for agriculture uses almost two thirds of the country's water.

What is irrigation? Irrigation is the process of watering the ground, or when water is taken from one place and set to where it is needed.

It takes an enormous amount of farmland to grow enough fruits and vegetable crops for us to eat. Although these crops may get rain, sometimes it is not enough to grow the largest and tastiest fruits and vegetables to keep us healthy. Therefore, many farmers use irrigation to supply necessary water to their farms.

About 13% or 14 million hectares of South African land is cultivated. The agricultural sector employs about 7% of the country's workforce. It is estimated that about 1.6 million hectares of farmland is under irrigation.

If you've ever planted a garden you have also used irrigation. Watering plants from a pitcher, bucket or watering can is a simple form of irrigation.

Ancient civilisations in many parts of the world practiced irrigation. In fact, civilisation would probably not be possible without some form of irrigation. The earliest form of irrigation probably involved people carrying buckets of water from wells or rivers to pour on their crops. As better techniques developed, societies in Egypt and Chine built irrigation canals, dams and other water storage facilities. Ancient Rome built structures

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Drip irrigation is gaining popularity as a more efficient form of watering crops.

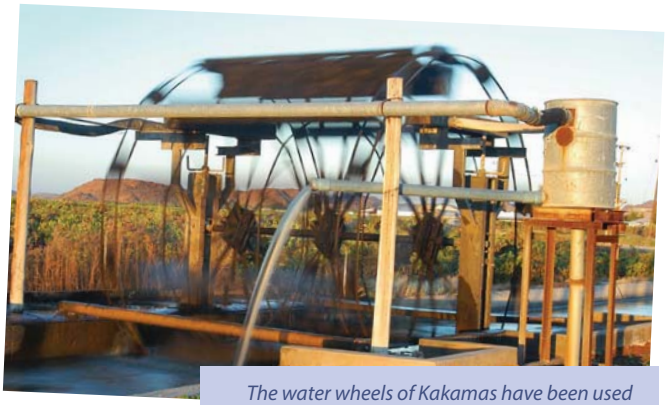
called aqueducts to carry water from snowmelt in the Alps to cities and towns in the valleys below. This water was used for drinking, washing and irrigation.

Modern irrigation systems use dams, tanks and wells to supply water for crops. Water is usually taken from a river, dam or underground source and carried in canals or pipelines to the fields. There are various methods to irrigate crops: flooding an entire field, channelling water between rows of plants, spraying water through large sprinklers, or letting water drop onto plants through holes in pipes.

Overhead or sprinkler irrigation is a traditionally popular method of irrigation in South Africa. In sprinkler irrigation, water is piped to one or more central locations within the field and distributed by overhead high-pressure sprinklers or by low-pressure sprays (think about the kind of sprinklers typically used to water lawns or gold courses). One drawback of overhead irrigation is that much water can be lost because of high winds or evaporation, and irrigating the entire field uniformly can be difficult if the system is not properly designed. Water remaining on plants' leaves may promote fungal and other diseases.

Centre pivot irrigation is a form of overhead irrigation consisting of several segments of pipe joined together and supported by trusses, mounted on wheeled towers with sprinklers positioned along its length. The system moves in a circular pattern and is fed with water the pivot point at the centre of the arc.

Letting water drop onto plant through holes in pipes, known as drip irrigation, is considered one of the most efficient methods of irrigation. Drip irrigation focuses the water onto the plant itself. Other methods can waste water by letting it absorb into the ground where there are no plants. Water can also evaporate into the air when sprayed through sprinklers. On many farms, drip irrigation is often combined with plastic mulch, further reducing evaporation.



The water wheels of Kakamas have been used to irrigate farms for almost a hundred years.

Sources

- https://study.com/academy/lesson/irrigation-lesson-for-kids.html
- https://www.nationalgeographic.org/encyclopedia/irrigation
- https://www.academickids.com/encyclopedia/
- https://en.wikipedia.org/wiki/Irrigation

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CELEBRATING 20 YEARS OF WATER LAW

The year 2018 marked the twentieth anniversary of the National Water Act. Celebrated as one of the most progressive and visionary pieces of water legislation worldwide, the Act has also proven to be more challenging to implement than we ever imagined. The Water Research Commission (WRC) celebrated this 20-year milestone, with a special event in Pretoria on 27 September. The event also culminated in the launch of a new WRC publication, ***the Compendium of the South African Water Law Review Post-1994***. This is both a legal history analysis and an archive of documents relating to the process that led to the National Water Act.

WRC CEO, Dhesigen Naidoo, and WRC Board members, Drs Mosidi Makgae and Ntombifuthi Nala with the Compendium.

Prof Mike Muller, Adjunct Professor, Wits University School of Governance, speaking at the event.

All photographs by Sifiso Mazibuko

Special Technical and Political Advisor to former minister of Water Affairs and Forestry, Kader Asmal, Len Abrams, was one of the keynote speakers at the event.

Executive Director of the Association for Water and Rural Development, Dr Sharon Pollard, discussing water governance.

Chair of the Parliamentary portfolio committee on water and sanitation, Mlungisi Johnson, at the event.

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DEEPLY ROOTED IN SOUTH AFRICA WATER SOCIETY

www.wrc.org.za

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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