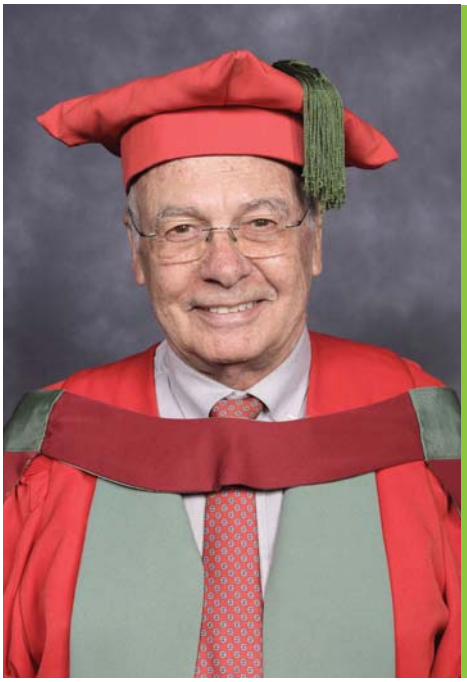
WATER PERSONALITY

After a lifelong commitment to research, a crowning chapter concludes at 80



For most, research, the diligent and systematic enquiry into a subject, is a long-term undertaking. It has been a lifelong journey for Dr Meiring du Plessis, and he realised his most outstanding achievement only recently, just prior to his 80th birthday. This May, du Plessis, an expert in water quality, received his PhD in Soil Science at the University of Pretoria (UP) autumn graduation season for, according to one thesis examiner, a first-of-a-kind, novel decision support system, with which to assess the fitness-for-use of irrigation water. Petro Kotzé spoke to him about this remarkable achievement.

The project took a decade to complete. It resulted in a tool to substantially improve water management in South Africa and an example to inspire a young generation of researchers. Dr Samkelisiwe Hlophe-Ginindza, Assistant Research Manager for the Water Research Commission (WRC), which funded the project, says his journey should inspire South Africa's future problem solvers. According to du Plessis, the first token of advice he can offer them is to train themselves well in the basic science of their choice, in the direction they love and that excites them. Secondly, they should apply their knowledge to practical problems that will improve other people's lives.

His entire career has been a case in point. It started at an extraordinary time for water management in South Africa.

A young researcher steps into water management

Despite the country's social and political turmoil and international isolation, the sixties saw extraordinary economic growth fuelled by gold, wetting the state's appetite for mega water infrastructure projects, including multi-purpose schemes and dams. At the same time, crippling droughts wreaked havoc on the economy and predicted water scarcity threatened to make water supply to agriculture a major political issue. The sector was, by far, the country's primary water user. According to the Commission of Enquiry into Water Matters (reported in 1970), irrigation and stock farming used 70% of available surface water, and 83% of freshwater intake was used for irrigation.

South Africa needed technical experts to help. Du Plessis had just finished his BSc in Chemistry and Geology with a bursary from the then Public Service Commission. He explains that he didn't have many opportunities to further his studies, but the Department of Agriculture announced funding for students who would become the country's necessary agricultural specialists. Focusing on his background in geology, du Plessis secured a bursary and switched direction to agriculture.

The choice set the course for his career, which he started at the Soil and Irrigation Research Institute of the then Department of Agricultural Technical Services. He remembers with a chuckle that his first annual salary as an Assistant Professional Officer in 1965 was a handsome R1 410! He spent years as the head of the water quality section and progressed to become the Deputy Director responsible for soil surveys and irrigation planning. With a focus on research, du Plessis remembers this career stage as "a most interesting and very rewarding period" of his life.

There was plenty to sink his teeth into. For one, the mega Great Fish River Irrigation Scheme was in development. The scheme would be supplied with water from the Orange River diverted from the Gariep Dam on the Eastern Cape and Free State border via an 83 km-long tunnel (the second longest water supply tunnel in the world when constructed). The water was destined for several irrigation schemes and metropolitan areas in the Eastern Cape.

Du Plessis was part of a multidisciplinary team that quantified the potential effect of irrigation water quality on the soil. He explains that the water from the Great Fish River was of relatively poor quality and had a high salinity and sodium content. In contrast, the water from the Orange River was very fresh and was expected to affect the soil's infiltration capacity negatively. Their work resulted in a model to calculate how to mitigate the problem, for example, how much gypsum a farmer would have to apply to the soil to ameliorate negative impacts due to irrigation water quality.

A second memorable project was developing a model to predict the salinisation of rivers due to irrigation return flow. "The salinisation of rivers is a natural, largely unavoidable impact of irrigation," he explains, but the aim is to try to reduce that as far as possible. The resultant model predicted the impact of irrigating with the fresher water from the Orange River, leaching of the salts in the soil from the previous, and more saline water from the Fish River.

His years in research prepared him well for the next chapter in his career when he took up the post of Research Manager at the WRC in 1987. While he mainly worked on water quality for the first part of his career, the scope of water management issues he became involved in grew exponentially as time went on. It further cemented the central theme of his career and development – managing freshwater research in South Africa.

Managing water research

Du Plessis says that the projects under his helm tackled various aspects, like agriculture salinisation and the impact of agricultural nonpoint sources. He was also responsible for most of the mining-related research at the WRC. Later, he managed the domain of water and the economy, an area of research that investigated, for example, economic incentives to reduce industrial pollution and how water and the country's economy interact.

Photo supplied

Prof John Annandale from the UP Department of Plant and Soil Sciences with Dr Meiring du Plessis.

"When I became a research manager at the WRC, I could put myself in the researchers' shoes," du Plessis explains. He understood that undertaking research was not always easy and straightforward. This considerate approach to managing projects earned him the respect of many researchers and colleagues.

When the WRC celebrated its 40th anniversary with a special issue of ***the Water Wheel*** in 2011, du Plessis's name got a honourable mention in several articles. Microbiologist, Prof Eugene Cloete (these days the chief of staff at the Cape Higher Education Consortium), thanked him for "his dedication to making a difference with the research he directed." Dr Ralph Heath (now MD of WSP in Africa) listed du Plessis as one of three people from whom he, and ultimately the South African water industry, gained the most, precisely due to his stoic support of passive minewater treatment. Former WRC Director of water-centred Knowledge, Dr Heidi Snyman, said that of the many people she has worked with who have left an impression, du Plessis was one of the standouts from whom she learned the most.

Prof John Annadale, from the UP Department of Plant and Soil Sciences, worked with du Plessis on a few WRC-funded projects. He remembers du Plessis as being always well prepared and able to quickly get to the crucial issue, despite much debate and diversion from team and reference group members. According to Prof Annandale, Meiring is quiet and unassuming, and when he decides to speak, it is best to listen carefully, or one will miss out. "He is easily one of the best research managers I have dealt with over my four decades of association with the WRC."

For du Plessis, some of his most important contributions during this time were the many students who obtained higher degrees through their involvement with projects he managed. He retired from the WRC in 2009, but, as he puts it, he did not exactly "go to the beach and watch the seagulls". Best described as semi-retirement, du Plessis has participated on ongoing projects at the WRC (as a researcher this time), while serving on the reference groups of others.

A decision support system for assessing fitness-for-use of irrigation water

In 2014, du Plessis became involved with the project that would eventually lead to his PhD. The Department of Water and Sanitation approached the WRC to assist them with revising the 1996 water quality guidelines, one of the most widely used tools in water quality management, but significantly outdated.

These new guidelines would primarily establish water quality requirements for water bodies. They were expected to express the degree of risk involved with using a specific water, consider site-specific conditions, and extend the range of water constituents considered. It was decided to use the irrigation water use sector as the first to develop new water quality guidelines. It fell on Dr Gerhard Backeberg, then the WRC Director of Water Utilisation in Agriculture, to initiate and manage the project.

The WRC's call for project proposals was successfully met

The Orange-Fish tunnel inlet in the Gariep Dam. One of Dr Meiring du Plessis's first tasks at the Soil and Irrigation Research Institute in the 1960s was to quantify the potential effect of Orange River irrigation water quality on the soil in the Fish River catchment, to which it was to be transferred.

by the mentioned Department of Plant Production and Soil Science under the leadership of Prof Annandale. Du Plessis was appointed as the project's principal researcher. He was already 70, and the project seemed almost like a mountain too high to climb, he says. But, Annadale convinced him otherwise. "His decades of practical and academic experience in soil and water chemistry and meticulous attention to detail made him the ideal person to update and improve the 1996 irrigation water quality guidelines, making them much more powerful and user-friendly."

Du Plessis laughs when asked how his participation in the project led to his PhD. "I was bullied into it!" He explains that the WRC strongly advocates for their projects to contribute to post-graduate qualifications, but their high-level project did not allow for much basic research. While aware that there is no need for a PhD to further your career when you retire, his colleagues encouraged him to realise that since he was already doing the research work, he might as well use it to obtain a PhD.

"In the process, Meiring fundamentally changed the question we have always asked" notes Prof Annandale from, "Is this water suitable for irrigation?" to "Are there conditions under which this water can be used for irrigation?".

The design and establishment of the Decision Support System that forms the core of his thesis would be a major undertaking and, as far as could be ascertained, a world first. The user-friendly system provides water resource managers and users with guidance about the risks associated with using water of a particular composition for irrigation under site-specific and generic conditions. The DSS assesses the effect of irrigation water composition on soil quality, crop yield and quality, and irrigation equipment.

The DSS has been designed to cater for two diverging applications. The first, more conventional application assesses the fitness-for-use of a water of known composition (water analysis) by determining its fitness-for-use category. The second application is to determine the threshold water composition for a specific fitness-for-use category. This application, Hlophe-Ginindza explains, is used by water resource managers and users when deliberating on the setting of water quality requirements for a given user of a water resource (river stretch or surface or groundwater body).

In short, Hlophe-Ginindza explains that the DSS allows irrigation farmers or government officials to determine if the water they can access is fit for irrigating the crop they intend to grow in a particular site. If this is not the case, farmers can choose a different crop that may be suitable.

Du Plessis adds that the DSS uses a soil water balance model and long-term site-specific climate data to calculate the water use (and thus irrigation requirement) of a crop as well as the redistribution of water constituents within a soil. The DSS then calculates how soil and crop quality and crop yield can be expected to respond to these conditions, over time. Since simulations are run for periods spanning decades, the DSS provides the user with information about how crop yield and other indicators are predicted to vary over time, as a result of climate variability.

It's the first time water quality in irrigation has been captured as comprehensively as this. Prof Annandale says other countries will undoubtedly carefully examine and emulate his contribution when they decide to update their guidelines. "The DSS he developed is a wonderful legacy he leaves for us, as it neatly and accessibly packages much of what he has learned over his long and illustrious career."

The DSS will be housed at the WRC, which will be the tool's custodian and responsible for ongoing maintenance and future improvements.

Now that his PhD is done, du Plessis is ready to slow down, though he mentions that there are still a couple of students to mentor. For this next generation, he recommends doing their PhDs too, though earlier, to equip themselves for their research careers. "Choose something you enjoy," he says, "because you will spend the rest of your life doing it."

The decision support system, developed as part of Dr du Plessis's PhD, provides water resource managers and users with guidance about the risks associated with using water of a particular composition for irrigation under site-specific and generic conditions.

To read ***Risk-based, site-specific, irrigation water quality guidelines*** visit, https://wrcwebsite.azurewebsites.net/wp-content/uploads/mdocs/TT%20727-17.pdf