

## TW Kambule Award

# Molecular genetics of forest trees for a renewable future

Research and its outputs over the last five to ten years, by an individual

Tamsin Oxford

It was in 1996 that Professor Alexander Myburg was accepted into the forest biotechnology research programme run by Professor Ron Sederoff at North Carolina State University. Heralded as one of the fathers of forest biotechnology, Sederoff inspired Myburg to study the molecular genetics of Eucalyptus trees in an era when the molecular genetics of forest trees was still in its infancy.

"It seemed to be an interesting and challenging research topic. In hindsight, I could not have picked a better field because fast-growing Eucalyptus trees and hybrids have become the premier hardwood plantation crop globally, and a likely source of bio-based materials for the future bioeconomy," says Myburg, now director of the forest molecular genetics programme in the department of genetics at the Forestry and Agricultural Biotechnology Institute, part of the Genomics Research Institute at the University of Pretoria.

Having grown up on a farm in the Eastern Cape, Myburg has always had a predilection for plants and plant breeding and improvement. It led his footsteps towards an undergraduate degree in genetics and botany at the University of the Free State, earned him a Fulbright Scholarship for a PhD study in the US and saw him select his final path under the guidance of Sederoff.

"I graduated in 2001 and joined the department of genetics at the University of Pretoria (UP) as a junior lecturer," says Myburg. "Now I am a professor in genetics at UP and hold an industry-supported Chair in forest Genomics and Biotechnology. I am also the director of the forest molecular genetics (FMG) programme, which is supported by forestry companies like Mondi, Sappi, Hans Merensky, York Timbers and more."

Myburg's primary role is in leading and directing the research in the FMG programme and he has, over the past five years, mentored and added four new young academics to the pro-

gramme. Now the team supervises more than 30 postgraduate students and technical staff.

"I also actively collaborate with forestry industry scientists and a large network of international collaborators, alongside my main activities that include postgraduate student supervision and training," says Myburg.

The context for Myburg's research is to focus on understanding the genetic regulation of growth and wood formation in plantation trees with the aim of improving productivity and sustainability, and to develop trees with novel wood properties for bioprocessing and new bio-based materials.

"All life on Earth is powered by solar energy; even the fossil fuels that form the basis of our current economy are ultimately derived from stored solar energy," says Myburg. "We will eventually use up all available fossil carbon reserves and urgently have to transition to more renewable sources of energy and materials to mitigate the effect of fossil CO<sub>2</sub> on the climate. Fast-growing plantation trees are a likely source of advanced biomaterials and bioenergy. In short, while solar and other renewable sources will provide energy for the future, we

will need renewable sources of materials and biochemicals to make what we will use in everyday life — building materials, cars, plastics and so forth."

Plants are capable of removing CO<sub>2</sub> from the atmosphere and, combined with solar energy, can produce renewable materials such as wood, which is rich in biopolymers and energy. Myburg believes that fast-growing trees will become one of the cornerstones of the future bio-based economy.

"Trees are similar to humans in that they are long-lived and accumulate high amounts of genetic diversity," says Myburg. "They typically have to be grown for at least five years before exhibiting adult traits and do not fit into controlled growth rooms or laboratories. This has made them challenging to study."

It is a challenge that Myburg and his teams have leapt at and they have worked alongside tree breeders to understand the genetics of forest trees and develop experimental populations. These are then analysed, constructed into genetic maps of the genomes and have formed the basis for ultimately deciphering the genome sequence of *Eucalyptus grandis*.

"The genome sequence was pub-



Professor Alexander Myburg.  
Photos: Supplied

lished in June 2014 in the prestigious journal *Nature* with 80 co-authors from over 30 international institutions," says Myburg. "Access to a reference genome for Eucalyptus trees has opened the door to study many features of the unique biology of large woody plants. The successful completion and publication of the Eucalyptus genome was an important milestone, but I think my greatest achievement has been the development of an industry and government-supported research programme aimed at accelerating the genetic improvement of forest trees."



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## Leading SA academics honoured for their excellence in research

### STAFF REPORTER

TOP ACADEMICS, including several from Tshwane, were on Thursday acknowledged at the 17th National Science and Technology Forum (NSTF) Awards Gala Dinner.

The ceremony, held in partnership with South32, celebrated contributions to excellence in science, engineering, technology and innovation.

Awards were presented in scientific research, technological innovation, environmental sustainability/green economy, technology transfer, education and training, capacity building, management, communication and outreach.

The awards ceremony is the flagship project of the NSTF, the most representative multi-stakeholder non-profit forum in South Africa promoting science and technology through collaborative effort.

According to Jansie Niehaus, executive director and spokeswoman for NSTF, the awards are a showcase of the research and development capacity of South Africa through the scientists, engineers and other professionals that the awards recognise and reward.

“Their competitive spirit, appetite for success and vision of excellence are made clear through



Dr Thulani Makhalanyane

the outstanding contributions they make in achieving wealth, health, social upliftment and a better life for all in South Africa,” she said.

The awards were presented by the Science and Technology Minister Naledi Pandor at the event attended by 600 guests at the Emperor’s Palace.

The winners included Dr Thulani Makhalanyane, a lecturer in the department of genetics and research, Centre for Microbial Ecology and Genomics, University of Pretoria, who received an award for exceptional performance and



Professor Helen Rees

contributions as an emerging researcher and specialist in the field of the microbial ecology of hot and cold deserts.

Professor Nigel Bennett, Austin Roberts Chair of Mammology and SARCHi, Mammal Behavioural Ecology and Physiology at the University of Pretoria was rewarded for his outstanding contribution to research in the field of mammalogy, and the students he mentored.

Yet another UP staffer, Professor Zander Myburg, specialist in Forest Genomics and Biotechnology, Department of Genetics and



Professor Zander Myburg

Forestry and Agricultural Biotechnology Institute and Genomics Research Institute, was awarded for research which has uncovered the genomic control of wood formation in fast-growing eucalyptus trees which is significant for fuel production.

Professor Andrew Forbes, formerly chief researcher at the CSIR National Laser Centre and now at Wits School of Physics was awarded for his significant contributions to photonics in South Africa through basic research and innovations that have subsequently

led to commercialisation.

He also landed the Special Photonics Award by an individual in celebration of Unesco’s International Year of Light and Light-based Technologies.

Professor Robert Scholes, research group leader at the CSIR until December last year and a distinguished professor of system ecology at Wits was awarded for his contribution in the realms of environmental science, systems ecology, savannah ecology and global change.

He also enjoys worldwide recognition as an extraordinary scientist.

Professor Helen Rees was recognised for her contributions in HIV prevention, reproductive health and vaccines, where she enjoys global recognition and as a public health strategist with a unique ability to translate research into policy and practice.

She is executive director, Reproductive Health and HIV Institute, Wits University and Unaid Collaborating Centre and Personal Professor, Department of Obstetrics and Gynaecology.

She is also honorary professor, Department of Clinical Research, London School of Hygiene and Tropical Medicine at Wits.