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National Science and Technology Forum (NSTF)

media release

International Day of Forests, 21 March 2024

Collaboration to tackle invasive tree pests and pathogens – award-winning scientist, Prof Bernard Slippers calls for international collaboration

Forests are crucial for global food security and nutrition, supporting millions of families with essential foods like fruits, seeds, roots, and wild meat. They provide vital resources such as wood for cooking, aid in agriculture through pollination and soil enrichment, and they regulate the climate, and conserve biodiversity. However, deforestation and fires threaten forest ecosystems, with 10 million hectares lost yearly. Add to that, a plethora of pests and pathogens that spread like wildfire, and you can see why an International Day of Forests is important. Protecting and restoring forests is essential for the planet's future well-being.

The National Science and Technology Forum (NSTF) takes this opportunity to put the spotlight on the award-winning work of **Prof Bernard Slippers,** who is a Professor of Genetics at the University of Pretoria (UP), where he leads the Tree Protection Co-operative Programme and the Centre of Excellence in Tree Health Biotechnology at the Forestry and Agricultural Biotechnology Institute (FABI). Prof Slippers was awarded the prestigious Management Award at the 2024 NSTF-South32 Awards, known as the 'Science Oscars' of South Africa (SA), on 11 July 2024.

The International Day of Forests: The United Nations General Assembly (UNGA) proclaimed 21 March the International Day of Forests (IDF) in 2012. The day celebrates and raises awareness of the importance of all types of forests. Countries are encouraged to undertake local, national and international efforts to organise activities involving forests and trees, such as tree planting campaigns. The 2025 theme, "Forests and Food", recognises the fundamental role of forests in food provision. This is particularly appropriate as 21 March is also SA's National Human Rights Day.

Forests not only provide food, fuel, income and jobs, but also soil fertility, and are home to a variety of animal species among which are important pollinators. The Day is a call to action to harness technological innovations for our forests to address the growing threat of deforestation, habitat degradation and climate change.

The vital role of SA's forests and plantations: SA's forests and woodlands cover about 500,000 hectares, or 0.4% of the land, yet play a crucial role in biodiversity conservation, soil preservation, and water purification. These ecosystems provide sanctuary to both wildlife and humans.

Forested watersheds also supply freshwater to over 85% of major cities in the world. In crises, forests are a key economic and food lifeline, contributing up to 20% of rural family income.

Timber plantations, though less biodiverse, serve as vital carbon sinks, absorbing carbon dioxide (CO_2) and supporting industries. Covering over 1.2 million hectares, they are key to sustainable forestry practices, especially in regions like KwaZulu-Natal and Mpumalanga. Dominated by pine, eucalyptus, and wattle trees, these plantations balance economic growth with environmental care.

SA's forests also boast an impressive variety of plant life, with over 649 woody and 636 herbaceous indigenous species, including rare and endemic plants. Key forests include:

- **Knysna Forest**: A lush, biodiverse forest in the Garden Route region of the Western Cape Province.
- **Tsitsikamma Forest**: Adjacent to Tsitsikamma National Park, known for its ancient trees, deep gorges and numerous hiking trails.
- **Knysna-Amatole Montane Forests**: Spanning both the Western and Eastern Cape, renowned for its rich biodiversity and unique montane forest ecosystems.
- **Mistbelt Forests**: Located in KwaZulu-Natal's Drakensberg foothills, known for misty conditions and diverse plant and animal species.

Forest threats and protection: The country's forests are primarily managed as conservation areas, protected by the National Forest Act (1998) to preserve forests on private, communal, and state-owned land. However, the forests face threats from wood harvesting for fuel and building materials, as well as bark harvesting for medicinal purposes, which can kill trees if done excessively. SA's mangrove forests are classified as critically endangered due to habitat loss from harbour development, and riparian (associated with rivers) gallery forests in Mpumalanga are under threat from water extraction.

Figure 1: Minister Blade Nzimande, Prof Slippers and Dr Maria Mushaathoni, Acting Head: Department of Journalism and Integrated Communication, Tshwane University of Technology (TUT)

About Prof Bernard Slippers: Bernard Slippers is a Professor of Genetics at UP, where he leads the Tree Protection Co-operative Programme and the Centre of Excellence in Tree Health Biotechnology at FABI, a world-renowned institute for plant biotechnology, which runs two of the largest tree health research initiatives globally. His research focuses on the molecular ecology and evolution of insects and microorganisms affecting tree health, particularly influenced by human activity.

Prof Slippers has published over 200 papers in prestigious journals and has supervised numerous PhD and MSc students. He has received numerous awards, including recognition from the International Union of Forestry Research Organizations (IUFRO) and a President's Award from the National Research Foundation (NRF). He is an active participant in international scientific meetings, and supervises graduate students. He also advises global organisations on tree protection.

Prof Slippers was awarded the NSTF-South32 Management Award for his leadership and participation in several substantive research programmes and his role in the foundation of the Future Africa Institute, the Africa Science Leadership Programme and Innovation Africa at UP, as well as the Global Young Academy (GYA) movement and South African Young Academy of Science (SAYAS).

> "Science and innovation are not the result of a brilliant moment and a brilliant person; it is always an emergent property of an ecosystem in which people work."

His pivotal role in the development and spearheading of SAYAS, GYA and more recently, the Future Africa Institute at UP – aimed at developing excellence in transdisciplinary science leadership for innovation in Africa, is a testament to his impeccable leadership prowess. It is underscored by his ethos of great teamwork and strategic collaboration, which has defined his entire career.

> "Collaboration is two athletes running 100m next to each other. Teamwork is like competing for the World Cup and relies on different skills; everyone depends on one another to do their unique part."

For over 25 years, FABI has maintained global competitiveness in SA's challenging scientific environment, under Prof Slippers' expert guidance. The institute collaborates with various parties in the private and public sector to bridge the gap between academic research and real-world applications, particularly in forestry and agriculture. Prof Slippers also emphasises the importance of leadership development, encouraging young scientists to hone soft skills like teamwork, communication, problem-solving, emotional intelligence, and collective leadership.

> "While expecting scientists to help build our organisations and change our world, we are not intentional enough in developing key skills beyond technical work." ... "Social skills are as important — or perhaps even more important — as our discoveries don't happen in isolation."

He feels fortunate to be able to play the role that he does, and credits the Management Award win to the collective effort of the FABI team. He emphasises that their success is due to the ecosystem they've built, where collaboration and shared excellence thrive to contribute to a better world.

> "FABI's focus is very much on the common ground and we look to develop programmes and platforms that speak to the common interest that exists between government, industry, and university needs. I think we have been successful in providing a bridge that connects these sectors successfully over the years."

Forest pest management: Prof Slippers' research mainly focuses on the molecular ecology and evolution of fungal communities, tree pathogens, insect pests, and their interactions with trees, especially in the context of anthropogenic impacts (which are impacts caused by humanity). His research spans invasive and native pests expanding their host ranges, and uses a variety of tools like genomics, barcoding, phylogenetics, and chemical ecology.

He has a particular interest in Botryosphaeriaceae fungi as latent pathogens and Sirex woodwasps and their symbionts. His work also delves into pest management, particularly for forestry and agriculture, involving species like macadamia and maize.

Prof Slippers emphasises the need for more investment in pest identification, particularly in poorer countries where many pests go undetected. DNA technologies can reveal cryptic species, enhancing disease diagnosis (e.g. distinguishing different fungi affecting Eucalyptus trees). Accurate identification of pathogens is critical for managing forest and agricultural health, and emerging technologies like genome sequencing are playing a key role. The discovery of Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) has shown much potential to be implemented for gene editing in insect pests, for a genetic pest management approach.

Prof Slipper posits that although Semiochemicals and biological control methods show great promise, they are difficult to apply at a broad scale. Emerging pests, such as those adapted from host shifts or hybridisation, pose new risks to both forestry and native ecosystems. Climate variation also plays a role in this shift, changing plant and pathogen interaction, and either extending or shortening the pest/pathogen lifecycle. There is a need for continuous research into multidisciplinary pest management strategies that integrate approaches from various fields and professionals around the world.

> "There is no way we can deal with this global threat alone — neither as individual companies, nor as a country. It is essential that we build not only the national networks amongst sectors such as academia, government, and industry, but also the international networks that will allow us to do that."

About the Awards. The NSTF Awards recognise, honour, reward, celebrate, profile and promote outstanding contributions to science, engineering and technology (SET) and innovation in South Africa (SA)

About the NSTF: NSTF is an independent non-profit stakeholder body and network – a civil-society forum of over 140 organisations involved in science, engineering, technology (SET) and innovation in SA.

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