NELSON MANDELA
UNIVERSITY

FACULTY OF SCIENCE

NEWSLETTER

» DECEMBER 2024

Foreword

The Semester 2 of 2024 has been an eventful period for the Faculty of Science. This publication reflects on some important activities that took place during the last semester of 2024 as well as some key highlights and achievements from departments and faculty staff.

Prof Muronga, former Executive Dean, also moved on to take up the position of Deputy Vice Chancellor-Research, Innovation and Internationalization during this period. We wish him well in his new position, and we are grateful for his contributions over the past 8 years as the Dean of our faculty. Most notable is the delivery of the new structure and strategy of the Faculty of Science. We are now at the stage of implementation of the 2030 strategic vision of the faculty. At the core of it is the apex priority of a Faculty in the Service of Society in its orientation of Science for Society. The guiding principle for all our activities is the ideal of sustainable futures and this has informed us to promote transdisciplinarity as a key to achieve progress in sustainable development.

In line with this vision, the faculty hosted an inaugural institutional public lecture titled ""Systems Approaches to Fast-track Sustainable Wellbeing" at George Campus. It was delivered by Prof van Jaarsveld (former Director General of the International Institute for Applied Systems Analysis) and responded to by Dr Malgas (Senior lecturer) and Ms Mpapane (PhD Student). The lecture was well received by the community. The faculty also hosted the National Science Week 2024 event at Healdtown Comprehensive High School where our namesake Nelson Mandela completed his matric. We are grateful to the partners who made this event possible as well as exhibitors who took two days to share knowledge and experiences with learners in the Fort Beaufort region of the Amathole West. Other events held by departments include the IK Biotrade Indaba which was organized by Prof van de Venter from the Department of Biochemistry and Microbiology, with the aim of discussing progress in

commercialization of IK in areas of health, agriculture, food, cosmetics and personal care products. The Department of Forestry at George also hosted a Fire Symposium as well as a Silviculture Symposium and we are grateful to Mr pool and Dr Ramantswana for these activities. Our entities are also active, and we are grateful to the Paleolab under the African Centre for Coastal Paleoscience (ACCP) as well as the Govan Mbeki Mathematics Development Centre (GMMDC) for their contributions. Tangible Africa also continues to shine on the national, continental and international stages.

We also acknowledge the achievements of individuals and teams who received awards, won prizes, graduated diplomas and degrees, and those who got selected/elected to important national and international bodies/programmes. We are proud of your outstanding achievements.

Prof Zenixole Tshentu
Faculty of Science: Acting Executive Dean

The Palaeolab team running the registration table at the SASQUA Congress (from left to right: Shabeer Davids, Asithandile Ntsondwa, Marishka Govender, Erin Hilmer, Lynne Quick and Luke Nel)

SASQUA Congress Prize giving event. Awardees Luke Nel (above) (Best Student Oral Presentation) and Monique van Tonder (below) (Best Poster Presentation) with Dr Lynne Quick (Chair of the local organising committee) and the SASQUA President Dr Hayley Cawthra

Updates from the Palaeoecology Lab

Botany Department

The Palaeoecology Laboratory has had an exciting year so far with research efforts focussing on contributing significantly to our understanding of past environments and their impact on early human life. Key highlights of recent activities include hosting and participating in the SASQUA Congress in May and being involved in several interdisciplinary and multinational fieldwork campaigns in June and July.

Mandela Uni students shone brightly at the SASQUA Congress

The Southern African Society for Quaternary Research (SASQUA) aim is to encourage and advance the study of Palaeoscience research in southern Africa. The 24th biennial SASQUA Congress was organised by Dr Lynne Quick (head of the Palaeolab), assisted by her postgraduate students. It was held from the 19th – 24th of May in the Cango Valley (Oudtshoorn, Western Cape) and was themed *Exploring the links between humans, climates, and environments through the Quaternary.*

The congress was a great success with over 100 registrations (nearly double the last congress in 2022) from 10 countries, the majority of which were early career researchers. As the published programme reflects Nelson Mandela University was very well represented.

Mandela Uni students were praised for their excellent presentations and professional conduct throughout the congress, with the best student oral presentation going to the Botany department's Mr Luke Nel and the best student poster presentation was awarded to Ms Monique van Tonder of the Geosciences department.

The post-congress practical workshop: "Botany for Quaternary Scientists" was run by one of the Palaeolab's main collaborators Dr Saúl Manzano (University of León, Spain). The principals of plant identification was taught to non-botanists – emphasising the importance of adhering to fundamental botanical practices.

Collaborative research: Multidisciplinary Fieldwork

The Palaeolab was involved in several fieldwork campaigns over the last few months which strengthened their ties within large multinational, multidisciplinary archaeological research teams. For example, they participated in reconnaissance cave exploration within the Cango Valley, seeking out new fossil finds and hyrax midden sites.

Dr Quick and two of her Master's students (Ms Marishka Govender and Mr Luke Nel) also participated in fieldwork related to a new Australian Research Council funded project based up the west coast entitled: *The evolution of human innovation in an arid biodiversity hotspot.*

These activities all demonstrate that the Palaeolab is at the forefront of palaeoecological research in South Africa and is striving to contribute significantly to research excellence at Nelson Mandela University.

Department of Statistics

NRF Rated Researchers in the Department

Dr Chantelle Clohessy

Head of Department

Dr Chantelle Clohessy started her academic journey at the Nelson Mandela Metropolitan University (NMMU) with a BSc registration in 2006. This was completed with majors in Mathematical Statistics and Physics in 2008. In 2009 she started her Honours degree with her project making use of statistical models to evaluate wind speeds at different sites in the Eastern Cape for potential wind turbine applications. This was a joint project between the Statistics and Physics Departments. The combining of statistics and physics in renewable energy research was a new area for NMMU and this provided an avenue for further collaborative research. In 2010, a master's study with the title "Evaluation of noise levels of micro wind turbines using an experimental design" began. This was supervised by Prof Gary Sharp and Dr Freddie Vorster from the Physics Department. The master's research contributed to the body of knowledge of micro-wind turbine noises in urban, semi-urban and rural areas. The results provided a statistical evaluation of noise at different sites and demonstrated that in an urban environment the noise levels of micro-turbines are indistinguishable from other noises. This research gave her an opportunity for a research visit at a partner university of NMMU, the University of Oldenburg, Germany.

In 2012 she started full time lecturing in the department of statistics and enrolled for a PhD. The emphasis of the doctoral study remained a collaborative work between the Department of Statistics, Department of Physics and the Nelson Mandela University Centre of Energy Research (CER) run by Prof EE van Dyk. The PhD thesis investigated statistical techniques that could be used to improve estimates and methods in feasibility assessments of photovoltaic systems. The use of these techniques was illustrated for a case study of a 1MW photovoltaic system proposed for the Nelson Mandela University South Campus in Port Elizabeth, South Africa. This system is now installed on campus next to main building.

The work covered in her honours, masters and PHD studies formed the basis of Dr Clohessy's research field, Statistical applications in renewable energy studies. This work assisted her in forming her research field. She is currently the statistical expert in South Africa working in this research domain. Dr Clohessy has supervised over 10 MSc students in this field and is currently supervising her first PhD. Herself and Prof Gary Sharp are the first ever rated researchers in the Department of Statistics.

She has also been involved in a variety of research and engagement activities over the past several years, which is not directly related to the research portfolio, however, has had a larger impact towards statistical community in South Africa. She was involved in the South African Statistical Association Education Committee (2015–2017), where she assisted on bursaries and various education outreach projects. She also served as secretary on the executive committee of the South African Statistical Association from 2018 to 2022. This position also meant that she was a part of the executive management committee of the society. In addition, she assisted with the organizing of three South African Statistical Association's conferences with two hosted by the Department of Statistics at Nelson Mandela University and one by the South African Statistical Association executive committee. She also assisted the Department of Physics organise the Southern Africa Sustainability energy Conference (SASEC) in 2023.

Dr Clohessy is currently the Head of the Department of Statistics and is the first woman to hold the position.

Bringing Home the Bronze

In June 2024, Dr Clohessy successfully captained the Eastern Province Country and District (EPCD) hockey team to take a bronze medal at the Country and Districts Tournament held in Gqeberha. Lumka Fani who is a lecturer in Computing Sciences and Dr Carla Phillips (Edworthy), a research fellow for the Institute for Coastal and Marine Research and a lecturer in Zoology, were also part of the team.

"This was totally a coincidence and that is why I jumped at the opportunity to take a photo", said Dr Clohessy, when asked how three staff members from Science ended up in the same team.

"We all play for the Uitenhage hockey club. EPCD was able to enter three teams this year, as it was local, and the girls all played for the first team which was the EPCD elephants.

Other teams at the tournament included Western Province, KZN coastals, KZN northerns, Northern Blues, Mpumalanga Highveld, Mpumalanga Lowveld, Eden (George area), an invitational side and Limpopo.

The Country and Districts Tournament has been around for many years, and is aimed at providing a national tournament for players residing outside the main urban centres. Limpopo won the tournament while the Western Province came in second.

Lumka Fani, Dr Chantelle Clohessy and Dr Carla Phillips

Prof Gary Sharp

Prof Gary Sharp has been an academic in the Statistics Department since mid-1997. Over the many years of service, he has served on various departmental committee's culminating in a seven-year period as HoD. Gary has served the national statistics community in various capacities, including a term as President of the South African Statistical Association (SASA), was an adjudicator for the Oppenheimer Memorial Trust (OMT) scholarship and on a lighter note, for a period, was Chair of Nelson Mandela University's squash club. His research interests are primarily sports analytics, whilst more targeted scholastic research is currently directed towards health analytics. Gary is a C2 NRF rated researcher, is a fellow of the South African Statistical Association and the first academic in the history of the department to achieve these accolades.

Raising awareness about science and its role in society

By Kuyanda Kala

Nelson Mandela University's Faculty of Science partnered with leading institutions to bring science to life on the 3-4 October 2024, during the annual National Science Week (NSW) hosted at Healdtown High School in Fort Beaufort, Eastern Cape.

"National Science Week, to me, means empowering young people to know more about science, to know more about how to develop their country into becoming more advanced, and opening up opportunities for people to live a better life," said Ratiloe Mothlabane, a matriculant at Healdtown.

The two-day knowledge-sharing exchange in Amathole West District garnered close to a dozen schools from the area and surroundings, sparked curiosity and inspired the next generation of scientists. Day 1 was attended by 952 and Day 2 by 741 learners.

Along with witnessing exciting science displays, learners received career guidance, coding demonstrations by Mandela University's Tangible Africa, wellness services from Emthonjeni Student Wellness as well as advice on applying to institutions such as Walter Sisulu University, Fort Hare University, Fort Cox Agriculture and Forestry Training Institute, that had partnered with Mandela University.

"We are looking beyond just bringing learners to science, we also want to bring communities to science because science is all around us. We want to do Science with communities. It does not end with us focusing on empowering learners only," said the Acting Dean of the Faculty of Science, Professor Zenixole Tshentu.

Led by the South African Agency for Science and Technology Advancement (SAASTA), under the Department of Science and Innovation (DSI) to celebrate Science, Technology, Engineering, Mathematics, and Innovation (STEMI). NSW seeks to empower learners, especially those coming from remote rural areas.

The objectives of NSW include:

- To popularise science, engineering, technology and innovation as attractive, relevant and accessible to enhance scientific literacy.
- To attract and retain students in STEMI disciplines along the full length of the educational pipeline.
- To develop a critical public that actively engages and participates in the national discourses of science and technology for the benefit of society.
- To promote science communication that will enhance science engagement in South Africa.

"Government is making strides in aligning the content of the education with the needs of the economy. Therefore, curriculum renewal with an emphasis on maths, science and technology as priority learning areas, demonstrates our commitment in ensuring that education becomes the major tool that we must use to change the world," said Raymond Mhlaba Local Municipality Mayor, Councillor Nomhle Sango.

This year's host school, Healdtown High School, has produced many leaders who played a leading role in the fight against all forms of injustice, including Robert Sobukwe (1946), and the University's namesake, Nelson Mandela (1937).

"As a school that is moving to being a science school, we are honoured to host NSW, not only for our students, but also for us as educators, because we are also eager to learn, as the world is ever-changing," said Healdtown's principal, Sintu Jaxa.

Principal Jaxa has overseen a dramatic turn in the school's academic performance, with Healdtown maintaining a 100% matric pass rate for three consecutive years. This is a commendable feat considering the pass rate was hovering at 40% before he arrived in late 2020.

In the series of public lectures held at Ngumbela Park near the school, the Nelson Mandela University Faculty of Engineering, Built Environment and Technology (EBET) staff (Messrs Chris Allen and Ashvin Manga) and eNtsa staff member (Mr Andrew Young) dealt with the question of climate change from two angles, namely, design of climate smart buildings and designing robotics for monitoring of oceans. Mr Malwande Nkalitshana from SAIMI talked to "Skills development, research and advocacy work in support of the Ocean Economy in South Africa" while Mr Brishan Kaylan from CMR presented on "Algae avengers: biodiversity of our coastal waters" to clarify the issue of algal blooms.

"We are constantly trying to simplify and better our way of living through science" said Faculty of Science Operations Manager, Lubabalo Saba, who used the concept of algorithms to explain to the learners how there is science outside of the Faculty of Science; a preamble to Dr David Waswa's lecture entitled: 'Connected yet concerned: the dual nature of high-tech living,' which explored this further.

Dr Waswa, Director of the Centre for Broadband Communication at Mandela University, addressed the question of whether we should be concerned with living in a high-tech world by explaining that we have two lives – a physical and a digital life.

"The biggest challenge right now is not what technology can do but catching up with the velocity of change driving technology," said Dr Waswa, who added that technology

is for us, and we must be able to move with it by catching up to it.

Answering the question of whether we can move as fast as technology is changing, Dr Waswa utilised 'the Internet of Things (IoT)' which blurs the boundaries between the physical and the virtual.

He uses the example of how Chat GPT can be used positively as a voice-over tool, to help people in villages understand things communicated in their mother tongue.

In the same vein, Dr Waswa outlined some of the dangers of high tech, which include:

1. Digital divide – limited access to technology
2. Privacy risk – risk of identity theft
3. Job displacement – automation threatens traditional employment
4. Environmental impact – questions around sustainability
5. Health concerns – public worries about EMF exposure and its long-term risks

He said this can be mitigated through digital literacy, raising public awareness by having technology workshops in rural areas, and the usage of cybersecurity tools.

"My first experience of NSW has been informative, I have learnt many things, and how we should go for careers that are in demand, which will require us to think out of the box," said top-performing Healdtown grade 11 learner, Sinazo Hlohla.

The fruits of National Science Week were aptly captured by EC Department of Education representative, and Mandela University PhD candidate, Chief Director Mbulelo Mpupu.

"For education to find full expression, we must be able to see a transformed society, and that can only come through you as the generation that constitutes the future of our country," he said.

Faculty of Science First Institutional Public Lecture

A holistic, transdisciplinary approach to sustainable wellbeing is needed to fast-track the achievement of the Sustainable Development Goals (SDGs). This was the consensus of speakers at the inaugural Faculty of Science Institutional Public Lecture hosted at Nelson Mandela University's George Campus on the 25 September 2024

The public lecture, titled "Systems Approaches to Fast-track Sustainable Wellbeing and streamed live on the University's YouTube channel, attracted hundreds of viewers and participants from across the world, offering insightful perspectives on sustainability from renowned and emerging academics.

The keynote address was delivered by Professor Albert van Jaarsveld, an expert in biodiversity and systems thinking, with thought-provoking responses from Nelsiwe Mpapane, a community development leader and doctoral student at the University, and Dr Rhoda Malgas, a specialist in agroecology and community-based conservation and lecturer at the institution.

In his keynote address, Prof Van Jaarsveld highlighted how the world was still far from achieving the SDGs as envisaged by 2030, stressing the urgency of adopting systems-based approaches to fast-track sustainable development.

Drawing on his extensive experience in leading organisations like the International Institute for Applied Systems Analysis (IIASA) and his academic research, Prof Van Jaarsveld highlighted how traditional, linear models of addressing sustainability challenges have been insufficient in the face of interconnected global issues.

"Linear thinking often leads to siloed solutions, but sustainability is a complex, multi-dimensional challenge that requires a shift in how we understand and respond to crises," he said.

He emphasised the importance of integrating environmental, social and economic factors in sustainability frameworks, arguing that failing to do so risks perpetuating inequality and environmental degradation.

Prof Van Jaarsveld also spoke to the power of data and technological innovation to support systems approaches, touching on the advances made in climate modelling, artificial intelligence and data analytics and how these have made it possible to simulate complex scenarios that predict the impact of various interventions on ecosystems and communities.

"These tools allow us to see the ripple effects of decisions made at different levels, whether by governments, corporations or local communities," he said. "This capacity to anticipate outcomes and respond proactively is essential if we want to achieve sustainable wellbeing."

Prof Van Jaarsveld's address included examples from real-world projects, including IIASA's collaborations with the United Nations and other international bodies to

Dr Albert van Jaarsveld

Nelsiwe Mpapane

Dr Rhoda Malgas

develop strategies that link climate adaptation, biodiversity conservation and poverty alleviation.

"The good news is that we have the knowledge and the tools to implement these systems-based approaches. What we need now is the political will and collective action to make it happen," he said, optimistically.

Ms Mpapane, a respected figure in community development and grassroots activism, provided a thought-provoking response that located the global perspectives within local realities. She began by affirming the need for systems thinking, particularly in South Africa's rural and urban communities, where poverty, food insecurity and climate vulnerability interconnect.

"Prof Van Jaarsveld is right in highlighting the need for a holistic approach but for many people in my community, sustainability is not an abstract concept — it is about survival. It is about ensuring that there is enough food on the table and clean water to drink," she said.

Mpapane, whose doctoral studies explore innovative approaches that promote inclusivity in conservation management, relational values and transformative change within conservation science, stressed that solutions must not only be scientifically sound but also socially just, inclusive and rooted in local knowledge systems.

She spoke passionately about the role of women in advancing sustainable wellbeing, particularly in rural areas where they are often the primary caregivers and food producers.

"Women are the backbone of our communities, and their voices must be at the centre of any conversation about sustainability," she said. "They understand the environment in ways that textbooks cannot teach, and they have the wisdom to offer practical solutions that work at the grassroots level."

In her closing remarks, Mpapane urged institutions like Mandela University to strengthen their engagement with local communities.

"Academics have a wealth of knowledge, but so do the people on the ground. If we can bridge the gap between science and the lived experience, we will be much better equipped to fast-track sustainable wellbeing for all."

Dr Malgas, a leading voice in agroecology and conservation science, offered additional perspectives in her response. Building on Prof Van Jaarsveld's systems thinking and Mpapane's focus on community engagement, Malgas highlighted the role of biodiversity in achieving sustainable wellbeing.

"Biodiversity is the foundation of any sustainable system; from the food we eat to the air we breathe, our well-being is intricately linked to the health of ecosystems," she said.

Dr Malgas argued that while technological advancements are important, they must be balanced with efforts to conserve biodiversity and promote regenerative practices in agriculture and land management.

She also spoke about the need for interdisciplinary research that cuts across natural sciences, social sciences and humanities.

"Sustainability is not just a scientific problem; it is also a cultural and ethical one. We need to ask ourselves not only what we can do to protect our planet, but also why it matters and how we can inspire others to care," she said.

She encouraged young scientists to take an active role in the sustainability movement, urging them to think beyond academic research and engage with policymakers, farmers and civil society organisations.

"We have an opportunity to reshape the future, but it requires collaboration, creativity and a commitment to justice."

The respondents' contributions on the importance of socially just approaches to sustainable wellbeing and bridging the gap between the natural and social sciences and humanities, are in true alignment with the University's scholarly objectives and overall strategy.

In the subsequent discussions and closing remarks, the message was clear: fast-tracking sustainable wellbeing requires not only scientific innovation but also empathy, inclusion and a deep respect for the natural world.

Dr Ogunlaja selected for Future Professors Programme

Senior lecturer and Chemistry Department Head Dr Adeniyi Ogunlaja has been selected for the Future Professors Programme (FPP), an initiative by the Department of Higher Education and Training (DHET).

The programme connects with academic excellence, research and leadership by enhancing academic skills through mentorship, funding, and interdisciplinary collaboration. It aims to cultivate new generation professors dedicated to research, teaching, and community engagement.

Highly selective, it identifies promising candidates for academic leadership roles. Producing skilled academics to lead research and mentor others, the programme strengthens higher education in South Africa and key elements include networking, research development and capacity building.

The programme over two years includes training sessions, workshops, and collaborative projects and is expected to start in January 2025.

Dr Ogunlaja's research focuses on the development of advanced functional catalysts for application in fuel desulfurisation and carbon dioxide (CO_2) utilisation.

Fuel desulfurisation removes sulfur compounds from fuels like gasoline, diesel, and natural gas. These compounds contribute to air pollution when burned, producing harmful gases such as sulfur dioxide (SO_2), which can cause acid rain and respiratory issues in humans.

Carbon dioxide utilisation involves converting (CO_2) into useful products, such as methanol, to create sustainable energy solutions and address climate change. This technology is vital for South Africa's economy as it shifts towards green hydrogen and a low-carbon economy.

Both research areas contribute significantly to society by improving environmental conditions, fostering economic growth through innovation and job creation, enhancing energy security while promoting sustainability practices.

Dr Ogunlaja believes the programme will help him build academic networks, facilitate interdisciplinary exchange, and promote teaching excellence while sharing resources with visiting scholars.

He hopes to gain enhanced research capabilities, valuable mentorship, and meaningful community engagement experiences. He also wants to develop personally and contribute to creating a more representative academic environment.

Dr Ogunlaja is a C2-rated NRF researcher and has published several articles and book chapters, and Google Scholar H-index 20. He is a recipient of several awards and research grants and a member of the South African Chemical Institute (SACI), Royal Society of Chemistry (RSC), UK and American Chemical Society

Reasons to be Proud

Student Academic Achievers' Awards and VC's Excellence Awards

The Vice-Chancellor Awards were presented to the top achievers in the Faculty of Science:

VC's Awards

- **Troy Palframan:** Best First Degree – BSc in Computer Science
- **Kade Tissink:** Best postgraduate award in Science, Engineering and Technology – MSc in Computer Science and Information Systems (Science)

First Diploma Awards

- **Tayla van Heerden:** Diploma in Nature Conservation. Faculty of Science

With an average of 92% for her Diploma in Nature Conservation Tayla's dream job is to be a researcher and publish scientific articles. She is currently studying for her Advanced Diploma at George Campus and hopes to study up to her doctorate, focusing on fungi and more specifically, ecosystem functions and services. She also works as a laboratory assistant. While she was completing her work-integrated learnership year, she was appointed as environmental monitor manager for AfriCarbon. The company restores degraded thicket through planting spekboom and uplifts local communities through job creation.

- **Troy Palframan:** BSc. Faculty of Science

"I am still exploring my options, but I want to apply my skills and passion in a role that embraces variety, critical thinking and problem solving", says Troy, who scored an average of 97% for Mathematics and an overall 93% for his first year BSc in Computer Science. He also obtained seven distinctions in matric and received the Grade 12 Advanced Programme Mathematics Award. Troy wants to continue learning, whether through formal studies or on his own, and likes to always pursue new challenges and knowledge.

First Degree Award

- **Tamaryn Wagner-Welsh:** BSc Honours in Computer Science and Information Systems

Tamaryn wants to be a high school educator to help teenagers to achieve their dreams and to give back to the community. She is presently studying for her BSc Honours in Computer Science and Information Systems and plans to obtain her PGCE to qualify as a high school educator. Her dream job is to be a librarian and working in education. Tamaryn also received the best First-Year Degree Award in 2022, and her top mark in her degree studies was 87%. She excelled in Advanced English and creative writing at school.

Honours Degree Awards

- **Reece Tuck:** BSc Honours in Chemistry. Category: Science, Engineering and Technology

"Synthetic chemistry is harder than it looks, and it doesn't look easy", says Reece, who plans to lecture and research the development of new medicinal therapies. He obtained an average of 91% for his BSc Honours in Chemistry and wants to change the world for the better by teaching further generations about the magic of chemistry. Reece dreams of studying at one of the top three universities in the world, such as Harvard. Currently, he is studying for his master's in chemistry at Stellenbosch University, working on the in silico (using computer simulation) design, synthesis, and testing of new antimalarial drugs. As malaria develops resistance to existing treatments, and new strains emerge, new solutions are urgent to prevent uncontrolled pandemics.

Master's Degree Award

- **Kade Tissink:** Master's Degree by Dissertation: Science, Engineering and Technology

"My passion for AI drives me to contribute to innovative research and development that can transform industries and improve lives", Kade says. His dream job is to be an artificial intelligence researcher and to advance the frontiers of machine learning and artificial intelligence, as well as expanding into image and video generation. Kade obtained 95% for his master's research in computer science and information systems, focusing on leveraging machine learning to automate the translation of English sentences into first-order logic. This enables information retrieval and question answering through natural language communication with machines. Modern language models can perform similar tasks, but their outputs are not logically derived, which can result in inaccuracies, Kade says. His research has already been published in conference proceedings.

Engagement Excellence Awards

- **Zikhona Tywabi-Ngeva and The Grade 12 Physical Science Education Project**

Zikhona's ongoing project focuses on enhancing Grade 12 Physical Science education in the Eastern Cape through hands-on engagement activities, in collaboration with the Dr ZTN Foundation NPC and Uchumo Lwesizwe Foundation. It provides tutoring sessions to help students grasp challenging concepts, supplemented by practical

experiments that bring theory to life and deepen understanding of scientific principles. This initiative addresses the difficulties faced by students in rural high schools, where mastering physical science is crucial for future STEM careers but often challenging due to complex concepts. By offering additional support, through tutoring and hands-on experiments, the project seeks to improve comprehension, boost confidence, and enhance academic performance, while making science more accessible and relatable, particularly for those in under-resourced schools.

- **Gletwyn Rubidge And The Science Literacy Project**

Gletwyn has developed a series of innovative activities to enhance science literacy among school learners, aligning with the University's vision for community engagement and scientific understanding. Key initiatives include hands-on science shows where learners participate in practical experiments designed to demystify complex chemical concepts through interactive learning. He conducts some 15 chemistry shows annually, presenting at a variety of schools, including Alexander Road, Mzondolelo, Walmer and Despatch high schools. Gletwyn also offers teacher training in chemistry demonstrations and actively participates in science fairs, such as the Eskom Science Expo and National Science Week, promoting creativity and collaboration. He complements these efforts with outreach programmes for underprivileged schools, bridging educational gaps. Through these activities, Gletwyn inspires future scientists and engages non-scientists.

Innovation Awards

- **James Jena and the Fibre Optics Research Group**

The group has developed an early warning device that detects potential collapses of tailings dams, structures, and land, significantly enhances population safety, while minimising costly repairs and disruptions to businesses and livelihoods. This optic fibre sensor device detects subtle ground vibrations and instabilities before failures occur, helping mitigate risks associated with bursting tailings dams and geo-hazards like landslides, sinkholes and earthquakes. By analysing part of the light transmitted through the fibre,

the device monitors environmental vibrations, detecting certain frequencies indicating structural instability. "The impact of optics on society, ensuring safety and sustainability for future generations and smart environments, is what drives innovation in our work at the Centre for Broadband Communication, says James. The other team members are Gaathier Mahed, Victor Chike, David Waswa, Francois Swanepoel, Sisipho Dlakiya, and Vela Shumane.

Faculty Emerging Researcher Awards

- **Neliswa Mama:** Chemistry

"Our research group started few years ago with the aim of developing simple organic materials that can detect toxic ionic impurities onsite during water treatment processes," says Neliswa, a senior lecturer in chemistry. Several compounds have been synthesised and successfully used in the selective recognition of metal ions from water samples collected from various dams in the Gqeberha area. By using computational programs, the group has gained valuable insights into how these compounds interact with analytes, which assists in understanding their selective interactions.

Faculty Researchers of the Year Awards

- **Mandy Lombard**

"Healthy oceans underpin healthy societies, but we are pushing the boundaries of human influences and extractive activities further and further into the ocean. We take food and minerals out of the ocean, and we dump our pollution and global warming heat into the ocean", says Mandy, professor and the SA Research Chair in Marine Spatial Planning. We overdo all of this. We need to act fast, and together, as a global community, to reverse the negative trends of these activities. We need to think ahead and make decisions that will deliver a functioning world for future humans, she says. Mandy's research aims to provide decision makers with the support they need to make difficult decisions, and she trains students and young researchers from many different disciplines to collaborate in projects that tackle the complex and wicked problems that are impacting our oceans today.

Research Excellence Awards

- **Adeniyi Ogunlaja:** Chemistry

"My research combines advanced chemistry with environmental science to develop technologies that can improve fuel quality while also addressing global warming through innovative CO2 reduction methods", says Adeniyi, senior lecturer in chemistry. Together, his research efforts aim to develop new, more efficient catalysts that work better and last longer, making fuel hydrotreatment processes, which help to remove impurities, like sulfur, from fossil fuels more sustainable. developing special materials, called photocatalysts, are also developed that use sunlight to drive the conversion of carbon dioxide (CO2) into beneficial products, such as methane or methanol, which can be used as fuels or raw materials for various industries.

- **Rao Appadu:** Applied Mathematics

Predator prey pursuit and evasion and the pattern formation in coral reefs in science, as well as biofilm formation in engineering, are among the applications that benefit from the quantitative, qualitative and numerical analysis of these models in Rao's research. "My research focuses on mathematical modelling, (fractional) partial differential equations and numerical methods. Rao, an associate professor in mathematics, mainly works with standard, composite, multisymplectic and nonstandard finite difference methods, as well as the analysis of numerical dispersion and dissipation in finite difference methods.

Best Beer Label

Nelson Mandela University's Biochemistry and Microbiology postgraduate student team won the "Best Beer label Design" category and R 10 000 at the recent annual national Intervarsity Brewing and Tasting Challenge.

The winning label was for their beer named Tide Rider and their company, the "Tides Brewing company".

The competition was hosted by the Central University of Technology, Bloemfontein, for university students from various STEM disciplines.

It serves as a platform for academic networking and to connect graduates interested in pursuing a career in brewing with industry partners, such as SAB, Heineken and the craft brewing community.

"We are extremely proud of their achievement!', said Dr Sharlene Govender, senior lecturer in Microbiology

From left, Microbiology laboratory technician Dr Sharon Pelo, who led the team with Bridget Ferreira (MSc), and Finn Harris, Kate Weddell and Nicholas Gregoriou, all honours students.

Neuroscientist elected to world's leading brain body

By Heather Dugmore

"Understanding how the brain and nervous system function and recognizing the risks to brain health is a rarity among the general public. This is why the neuroscience community plays a vital advocacy role," explained Dr Duyilemi Chris Ajonijebu, a behavioral neuroscientist in the Department of Human Physiology at Nelson Mandela University, South Africa.

Dr Ajonijebu was recently elected to the International Brain Research Organization (IBRO) Africa Regional Committee (ARC) by IBRO's Governing Council in Chicago. His term will begin in January 2025. IBRO, the world's premier association of neuroscience societies, operates through five regional committees—Africa, Asia Pacific, Pan-Europe, Latin America, and US-Canada—to advance neuroscience research and education globally. Its efforts emphasize the study of the brain and nervous system, including their development, functions, and disorders, supported by educational programs, research initiatives, and community outreach.

Dr Duyilemi Chris Ajonijebu

Addressing Africa's Need for Brain Research

"The brain, a highly intricate organ, connects to every bodily system," noted Dr Ajonijebu, who established the Neuroscience Research Team at Nelson Mandela University in 2019. His team organizes virtual seminars featuring leading neuroscientists worldwide, raises awareness about brain health, and provides platforms for postgraduate students and early-career researchers to share findings and ideas.

Africa faces a pressing need for more research on the brain and neurocognitive disorders. Dr Ajonijebu aims to enhance therapeutic outcomes for affected individuals by studying how diseases impact the brain. His research primarily addresses two significant challenges: drug abuse and Human African Trypanosomiasis (HAT), a blood-and-brain disease caused by the *Trypanosoma brucei* parasite, transmitted by tsetse flies and prevalent in Sub-Saharan Africa.

HAT research often focuses on the blood, but Dr Ajonijebu highlights the importance of understanding its effects on brain function. Symptoms such as memory impairment and anxiety emerge when the parasite crosses the blood-brain barrier. Current treatments are expensive, have serious side effects, and face challenges like drug resistance and relapse. Dr Ajonijebu's team collaborates with Nigerian institutions to explore whether an affordable anti-inflammatory prostacyclin can reverse the cognitive damage caused by HAT.

Investigating Drug Abuse and Cognitive Impact

Dr Ajonijebu is also examining how prolonged cannabis and other drug use impair the brain's dopamine reward system, compelling users to consume more to achieve a "high." In collaboration with Professor William Daniels at Wits University and PhD student Musa Aminu, his research delves into the neurobiological mechanisms of Cannabis Use Disorder and co-occurring psychiatric conditions. Their work explores the roles of microRNAs and potential therapeutic treatments.

Advocacy and Regional Leadership

Beyond research, Dr Ajonijebu is dedicated to raising awareness about brain health and actively participates in Southern Africa's neuroscience community. He helped organize a regional neuroscience symposium in Umhlanga, South Africa, in July 2024, hosted by the Southern African Neuroscience Society (SANS). Recognizing his leadership, SANS nominated him to represent the SADC region on the IBRO-ARC committee, a role that empowers him to advocate for policies supporting brain research and increased investment in African neuroscience.

"I am committed to saving lives, alleviating the strain on healthcare systems, and promoting brain health," he said.

Educating and training for effective wildfire management

Mandela University's George Campus, in partnership with key industry stakeholders, hosted the 14th International Fire Management Symposium focusing on "Educating and Training for Effective Wildfire Management" at the Halliwell Country Inn, Karkloof region in KwaZulu Natal from 6 to 8 November.

This symposium, took place amidst the backdrop of recent destructive veld fires in KwaZulu-Natal, which aimed to address the pressing need for integrated and collaborative wildfire management strategies.

Various professionals involved in wildfire management, including natural resource managers, engineers, fire managers, educators, and scientists gathered to attend.

With the rising frequency and intensity of wildfires globally, the symposium emphasises the urgent need for better integration between research findings, technological advancements, and on-the-ground fire management practices.

Experts and authorities from diverse sectors, such as nature conservation, agriculture, disaster management, forestry, and local authorities attended.

Beyond sharing advancements in fire management technology, a key goal was to highlight and address the ecosystems are affected by wildfire hazards. Various insights and experiences of the frontline of wildfire management were brought together with researchers and developers working on cutting-edge solutions.

This collaboration would contribute to a clearer understanding of each other's needs, successes, and challenges, among stakeholders, contributing to a more resilient fire management framework.

A variety of informative presentations showcased the latest developments in wildfire prevention and suppression and networking opportunities will strengthen alliances across different land uses and disciplines, reinforcing a collective approach to wildfire management.

Panel discussions and workshops explored questions around training and education to enhance wildfire management, who will provide this training, who would benefit most, as well as how these initiatives would be funded.

Tangible Africa's Engagement Highlights

Tangible Africa had a remarkable Semester 2, 2024, with impactful local and international activities aimed at promoting coding literacy and empowering communities. The #Coding4Mandela initiative was a major milestone, engaging 32,000 learners across 600 schools in 85 sites spanning two continents. This initiative was complemented by the showcasing of the innovative Grand Prix app at the British Grand Prix and a visit to Seattle, where workshops were conducted at Amazon Web Services (AWS).

In South Africa, Tangible Africa focused on teacher training, equipping over 500 SADTU teachers with unplugged coding skills and assessment tools, extending the reach to 14,000 additional educators. Rural and underserved communities also benefited, with coding workshops hosted in Limpopo, Butterworth, Kwaggafontein, and the Karoo. Special initiatives included sessions for learners with hearing impairments, autism, and visual impairments, as well as coding workshops for senior citizens and home-based care members.

Globally, Tangible Africa extended its influence to countries such as Malawi, Lesotho, Indonesia, Croatia, Kenya, Korea, Ireland, and Madagascar, introducing unplugged coding tools to learners, teachers, and communities. These efforts included participation in the EU Code Cup, international coding tournaments, and the launch of coding initiatives at prominent events like the National Space Conference and AWS Girls' Tech Day.

Domestically, notable activities included coding tournaments in the OR Tambo Coastal District, Limpopo, and Johannesburg, as well as an all-girls coding camp in Butterworth. The team also introduced coding tools to the Minister of Basic Education and empowered educators and learners at various conferences and summits.

Through these diverse engagements, Tangible Africa has continued to break barriers, foster inclusivity, and bridge the digital divide, demonstrating its unwavering commitment to creating a digitally empowered generation.

Related Links:

- https://is.gd/sWPHaj
- Roux Joubert from AWS reflects on Mandela Day
- Herald
- Engineering News
- Good Things Guy
- Herald
- Daily Dispatch
- Herald
- TedX Talk – The Tangible Africa Story

Master's Graduates
Summer Graduation 2024

The Faculty of Science had a successful summer graduation, especially on graduation of postgraduate students. Fourteen Masters candidates and ten PhD candidates completed their qualifications and were awarded in December 2024. Few undergraduate students were awarded including one candidate for the Diploma in Agricultural management, once candidate for the Diploma in Chemical Process Technology and five candidates for the Bachelor of Science. One Advanced Diploma in Agricultural Management student, one Advanced Diploma in Analytical Chemistry student and one candidate for the Bachelor of Commerce Honours (Computer Science and Information Systems) also graduated.

The following Master of Science (Research) students graduated, and their dissertation titles are included:

De Waal, Gysbert Nicolaas – Cum Laude (Applied Mathematics)
Title of Dissertation: Solution of Some Cross-Diffusion Equations in Biosciences Using Finite Difference Methods and Artificial Neural Networks

Dube, Tafara Alfred (Chemistry)
Title of Dissertation: Investigation of Potential in Situ Polymeriza Tion Reactions for Use in Lithium-Ion Batteries

Hoekstra, Shaun Pierre – Cum Laude (Zoology)
Title of Dissertation: Portfolio Effect and Bet Hedging Adaptions in Sea Turtles

Jacob, Siphosethu (Chemistry)
Title of Dissertation: Enhancement of Carbon Black Recovered From Waste Tyres for Industrial Rubber Applications

Klaver, Michael – Cum Laude (Nature Conservation)
Title of Dissertation: Collaborative Conservation Governance in Multifunctional Landscapes: A Contextual Analysis of Two South African Biosphere Reserves in the Boland

Koza, Norma Nondumiso (Chemistry)
Title of Dissertation: Formulation of Fish Feed for Aquaculture Using Olive Pomace Extract as An Antioxidant

Mcfarlane, Duncan William – Cum Laude (Chemistry)
Title of Dissertation: Supramolecular Chemistry Consideration of Fluorenyl-Derived Host Compounds

O'connell, Tristin Wade – Cum Laude (Geology)
Title of Dissertation: Ground- and Marine Water Inputs into Supratidal Microbialite Systems Along the Nelson Mandela Bay Coastline

Qomfo, Vuyiseka (Chemistry)
Title of Dissertation: Synthesis, X-Ray Characterization, Spectroscopic and Hirschfield Surface Analysis of Dimeric Metal Centers Featuring Phenacyl-Esters

Recchia, Daniella Loridana – Cum Laude (Chemistry)
Title of Dissertation: Synthesis of Two Tartaric Acid-Derived Host Compounds and their Behaviour in Mixed Pyridines and Mixed Heterocyclic Guest Compounds

Swart, Nicolas (Agriculture)
Title of Dissertation: Studies on Soil Acidity Management Strategies for Sustainable Agriculture

Van Der Merwe, Vicky (Biochemistry)
Title of Dissertation: Screening Drug Candidates for Sars-Cov-2 Spike Protein Variants Within the Sancdb (South African Natural Compounds Database) and Drugbank

Viljoen, Zenobia (Biochemistry)
Title of Dissertation: The Inhibitory Effects of Cannabinoids From Cannabis Sativa on the Enzymes Dipeptidyl Peptidase-Iv, Sucrase and Maltase as a New Therapeutic Treatment for Type 2 Diabetes

Mulovhedzi, Rolivhuwa – Cum Laude (Nanoscience)
Title of Dissertation: Graphene@Microalgae-Based Nanohybrid Structures as Adsorbents for Removal of Cr(Vi) Ions in Aqueous Solutions

PhD Graduates

Summer Graduation 2024

The following PhD candidates graduated, and their doctoral thesis titles are included:

Amy Lynne De La Harpe, Doctor of Philosophy (Biochemistry)
Title of Thesis: Characterization of the Molecular Mechanism(s) of Cannabinoid-Induced Paraptosis in Breast Cancer Cells

Jenske Didloff, Doctor of Philosophy (Microbiology)
Title of Thesis: Gymnopilus Junonius and Rhodofomitopsis Lilacinogilva: In Vitro Evaluation of Antimycobacterial Activity, Safety Assessment and Isolation of Active Compounds

Ullrich Hechter, Doctor of Philosophy (Nature Conservation)
Title of Thesis: The Optimisation of Eucalyptus Regeneration Practices for Improved Survival, Growth and Uniformity in South African Pulp-Wood Plantations

Terry-Lee Honiball, Doctor of Philosophy (Nature Conservation)
Title of Thesis: Social Dynamics of Spotted Hyaenas (Crocuta Crocuta) in Fenced Protected Areas: Implications for Conservation Management of a Socially Intelligent Species

Lulama Patrick Kepe, Doctor of Philosophy (Mathematical Statistics)
Title of Thesis: Development of Density-Dependent and Density-Independent Competition Models to Understand Single Tree Growth Responses in Eucalyptus Stands

Dumani Tau Kunjuzwa, Doctor of Philosophy (Computer Science)
Title of Thesis: A Framework for Designing a Gamified System That Promotes Knowledge of Water Sustainability

Briswell Mabuto, Doctor of Philosophy (Chemistry)
Title of Thesis: Toughened Wood Plastic Composites for Low Technology and Advanced Manufacturing Applications

Steven Mc Gregor, Doctor of Philosophy (Zoology)
Title of Thesis: Associations Between Patterns of Wild Ungulate Patch Use, Soil Carbon and Albedo in Montane Grasslands

Kwakhanya Mkwakwi, Doctor of Philosophy (Chemistry)
Title of Thesis: A Multistep Synthesis of Zidovudine in Continuous Flow Systems

Mellisa Brenda Sagandira, Doctor of Philosophy (Chemistry)
Title of Thesis: Exploiting Continuous Flow Technology to Develop Synthetic Processes for Active Pharmaceutical Ingredients: Prilocaine and Betrixaban

GMMDC-AIDC EC STEM Skills Development Project

The annual implementation of the GMMDC-AIDC EC STEM Skills Development Project in two under-resourced urban schools in Nelson Mandela Bay and one in East London concluded successfully in November 2024, delivering remarkable outcomes in fostering critical STEM skills among learners.

At the heart of this initiative was the Integrated Technology-assisted Support Project (ITSP), which focused on equipping both educators and learners with essential skills for the future workplace. Using innovative, techno-blended models and resources developed by GMMDC, the project incorporated:

A structured Tablet-assisted TAPS Mathematics incubation programme for Grade 11 and 12 learners:

Sixty selected Grade 11 and 12 learners successfully completed a rigorous 20-session after-school Mathematics incubation programme over nine months, facilitated by a trained teacher-facilitator. The learner participation rate exceeded 95%, reflecting strong engagement and commitment. A post-programme impact survey revealed significant academic and inspirational growth among the learners, underscoring the programme's effectiveness. (see Project Impact Summary) .

Accredited professional development programme for Mathematics teachers:

This programme aimed to enhance teaching methodologies that integrates technology, pedagogy and content knowledge for active learning. Educators were also well-equipped to deliver high-quality STEM education in classrooms.

Support for mobile GammaTutor Mathematics and Science resource centres deployed to schools:

These centres provided convenient access to interactive and self-directed offline learning tools, ensuring Mathematics learners of all grades had access to valuable resources regardless of internet connectivity.

In addition to these core activities, after-school STEAM workshops were offered to promote critical thinking and creative problem-solving. Sessions also included information about STEM careers to raise awareness about the evolving skills demands of the Fourth Industrial Revolution (4IR).

Recognition and Testimonial

Ms. Rose de Doncker, the principal of Paterson High School and a Mathematics educator who is a longtime collaborator of the Centre, expressed deep appreciation for the project's impact on STEM learners. "The GMMDC-AIDC initiative has significantly enhanced STEM education in our schools, empowering both teachers and learners to excel in a technology-driven future," she remarked. Ms. de Doncker's contributions to education were further recognized nationally when she received the prestigious National Excellence in Secondary School Award in October 2024.

Looking Ahead

The GMMDC-AIDC EC STEM Skills Development Project has proven to be a game-changer for in-service Mathematics educators and learners aspiring to pursue STEM careers. By equipping participants with the skills and confidence needed to thrive in a technology-driven future, the initiative has demonstrated its value and potential for continued growth.

As we look to the future, the ITSP project and partnership with AIDC EC aims to expand its reach, refine its curated resources, and further innovate its educational approaches. With a focus on inspiring both STEM teachers and learners in schools across the Eastern Cape Province, the project is committed to fostering a new generation of critical thinkers and problem-solvers ready to meet the challenges of the 21st century.

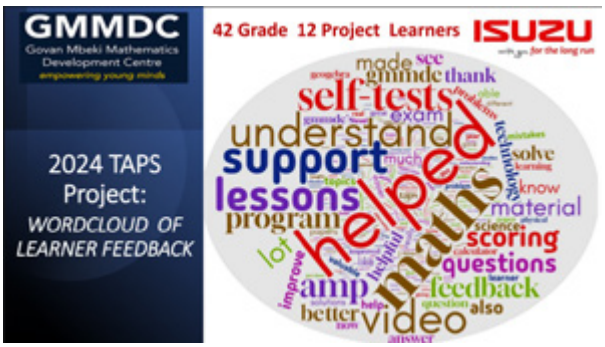
ISUZU Mathematics & STEAM Project Takes Off Strongly in 2024

The Mathematics Incubation and Techno-Blended STEAM Support Programme (MITS), launched in 2024, is a groundbreaking three-year initiative of the GMMDC implemented in three prominent township public schools in Nelson Mandela Bay: KwaZakhele High School, Sophakama High School, and Newell High School. Sponsored by ISUZU in partnership with Mandela University and the GMMDC, the project is part of a shared mission to advance quality STEAM education and foster a culture of science and innovation in society.

Key components of the MITS programme included the Tablet-Assisted Mathematics Incubation (TAPS) of 45 Grade 12 learners, Mathematics Teacher Development, and STEAM Skills Development. Through GMMDC's innovative techno-blended support model, a variety of digital resources for Mathematics and Physical Science were distributed to teachers, enabling improved classroom teaching and a 7-month TAPS support programme. This approach provided learners with facilitated support sessions and offline access to self-directed learning tools, ensuring inclusivity despite internet limitations.

In the second semester of 2024, the programme also hosted engaging STEAM workshops that encouraged critical thinking and real-world problem-solving. These included activities such as geometric design challenges and playful coding sessions, which emphasized the connection between Mathematics and Art, as well as the importance of critical thinking for future STEM careers.

Feedback from participating teachers and Grade 12 learners has been overwhelmingly positive. Teachers highlighted the value of customized tools and training in using offline technologies effectively in the classroom. Learners also expressed appreciation for the innovative digital resources, which empowered them to explore Mathematics and Physical Science in new and meaningful ways. The success of this programme reflects its significant role in transforming STEAM education in underserved communities and to create pathways for learners with potential to successfully access post-school STEM study programmes (see Project Feedback for more details).



Modern Silviculture Symposium

Background

The Modern Silviculture event has been hosted as a webinar (virtually) by Nelson Mandela University since 2020. The focus has always been to encourage knowledge sharing about modern silviculture technologies in nurseries and silviculture operations. For the first time, the Nelson Mandela University (Forestry Department) in collaboration with Ellepot hosted the first modern silviculture symposium physically to encourage interaction, and networking around this important topic. The theme was titled Silviculture 4.0 "Smart technology from nursery to field". The event took place in the picturesque town of Howick, located in the KwaZulu-Natal Province of South Africa from 15th to 17th October 2024. About 200 delegates predominantly from South Africa and other countries like, Eswatini, Kenya, Tanzania, Brazil, Uruguay, New Zealand, and Finland attended the symposium both physically and virtually.

The Silviculture 4.0 Symposium, organized by Nelson Mandela University and Ellepot, focused on the application of smart technology in forestry, covering both nursery and field operations. Over two days, stakeholders explored innovations such as automation, robotics, and big data. Key discussions highlighted the role of mechanized nursery operations, AI-driven tools, and digital technologies like drones for pest management. Sustainability was a major theme, with presentations on biodegradable materials, water conservation, and advanced irrigation practices. The symposium emphasized the importance of mechanization in improving productivity while balancing labor retention, especially in regions like South Africa, where forestry relies on manual labor. Demonstrations included robotic planting systems, AI-powered nursery technologies, and precision forestry operations for pest control and weed management. Technologies like drones and satellite sensors were shown to enhance monitoring and early issue detection. Sustainable practices, such as mulching and the use of biodegradable paper pots, were explored for improving soil health, seedling survival, and water retention. The shift towards containerized stock and mechanized planting techniques was also underscored, particularly for steep terrains. Additionally, the symposium stressed the need for training and skill development to enable rural communities to effectively adopt new technologies. In conclusion, the symposium reinforced that the future of silviculture lies in integrating cutting-edge technology with sustainability to maximize productivity and minimize environmental impact. Collaboration between industry and academia, along with careful management of socioeconomic impacts, is vital for the success of modern silviculture.

To access the presentation, please visit: Modern Silviculture Symposium