SANORD Conference Schedule - Panel 3: Building a resilient and functional future for nature and people

WEDNESDAY, 13:00–17:00

Sub-theme: Climate Stress, Drought, and Local Resilience

The nexus between climate finance and climate-resilient agriculture in rural South Africa

Basetsana Mokwite, Phineas Khazamula Chauke, & Mpho Tshikororo – University of Venda

Climate change threatens farmers' livelihoods in developing countries despite implementing Climate-Smart Agricultural Practices (CSAP). Given socio-economic constraints, climate finance emerged as a funding mechanism to overcome financial barriers and enable adaptation to climate change, as CSA technologies and Practices s are costly to implement. However, despite the continuous investment of these funds, previous research argues that farmers remain vulnerable to climate change, and the impact of the financial resources remains unclear. The review aims to draw lessons from cases of financing from various sources of CSA practices technologies and provide insight into the role of climate finance in financing their adoption. To accomplish this goal, this literature review provided insights into climate-smart agriculture (CSA) technologies and practices and an overview of various climate finance mechanisms for funding them. This review shortlisted and identified developing countries within Sub-Saharan Africa (SSA) and searched using journals and programme documents. The literature synthesis highlighted best practices and lessons learned where climate finance had been effectively used to support technological innovations and practices in agriculture to understand how climate finance influenced the adoption of CSA technologies and practices. The findings reveal regional disparities in CSA adoption across the continent despite the availability of financial resources. The review also discovered positive outcomes, including improved productivity, food security, and income as a co-benefit CSAP adoption funded by climate finance. However, the review highlighted some policy barriers and challenges, including unequal access and inadequate funding. This review recommends scaling up funding and ensuring climate finance reaches marginalized groups.

Women's Experiences of Drought as a Hyperobject in the Global South

Mistancia Kanengoni – University of Cape Town

This study examines the lived experiences of women in the rural region of Madziva, Zimbabwe, as they confront the problems presented by drought, conceptualized as a hyperobject, substantial and unavoidable occurrence that impacts their lives both immediately and in the long term. Drought intensifies the vulnerability of women's livelihoods due to their dependence on natural resources for household sustenance and the gender-based disparities in access to land, information, and decision-making authority. Climate-induced stressors, such as drought, are inherently connected to bigger concerns like the Just Energy Transition (JET), which prioritizes equitable access to renewable energy

and sustainable development. This change poses distinct issues for rural women in Zimbabwe, whose marginalization intensifies as environmental resources diminish and renewable energy options remain inaccessible. The study utilizes the notion of hyperobjects to illustrate the intersection of women's experiences with drought and the pursuit of climate resilience, especially in a situation where access to clean energy is essential for both gender equity and environmental sustainability.

Vulnerability Assessment of Households Maize Growers in Limpopo Province

Koketso Machete & Mmapatla Senyolo – University of Limpopo

Climate change threatens economic sectors including wetlands, forestry, and agriculture, thereby risking these industries' production, profitability, and sustainability. Warmer temperatures and erratic rainfall impede agricultural development and increase the risks of pests and diseases which reduces crop yields. Current methods employed in maize farming makes the crop vulnerable to climate change, notably severe heat, and unpredictable rainfall. The study examined the vulnerability of maize household maize growers towards risks of climate change. It was carried out in three district local municipalities of Limpopo Province, selected for their specific agro-ecological zones. A multipurpose research design was used to gather data, and multistage random sampling was used to choose study areas and subjects. Subsequently, 209 purposively selected household maize growers were interviewed face-to-face using structured questionnaires, focus discussion groups, and vulnerability index assessment. The results in Ga-Makanye showed that household maize growers' vulnerability ranged from 0.22 to 0.91, while in Giyani and Gabaza 0.19 to 0.91, and 0.12 to 1. In Ga-Makanye, Gabaza, and Giyani 38.46%, 40.23%, 27.08% maize growers were highly vulnerable, respectively. Additionally, 11.54%, 12.64 %, 22.92%, were very highly vulnerable in Ga- Makanye, Gabaza and Giyani, respectively. The study recommends that maize growers should be supported by relevant stakeholders such the Department of Agriculture and Rural Development in collaboration with research institutions, universities and private companies explore practicing crop rotation and crop diversification to minimize the loss, use integrated pest management, and to adopt drought-tolerant maize seeds to address climate change related risks that they are exposed to.

Sub-theme: Ecosystem Management and Biodiversity Conservation

Ecosystem management under emerging novel biosphere conditions

Jens-Christian Svenning – Aarhus University

Human-induced global changes, including anthropogenic climate change, biotic globalization, trophic downgrading, and pervasive land use, are transforming Earth's biosphere, placing biodiversity and ecosystems at the forefront of unprecedented challenges. Arguably the current situation represents a new geological epoch, the Anthropocene, underscoring the dominant influence of humans in the Earth system and calls for a critical reassessment of our interactions with the biosphere. Addressing the pressing climate and biodiversity crises requires transformative changes toward effective planetary stewardship. In this talk, I will explore the socio-ecological dynamics leading to our current situation, examine biodiversity dynamics within novel ecosystems, discuss the growing significance of biosphere

novelty for human societies, and consider strategies for steering ecological dynamics toward positive outcomes under increasingly novel conditions. A central conclusion is that achieving planetary stewardship in the Anthropocene will necessitate collaboration across different scales and the integration of ecological knowledge with societal needs, through scalable solutions and cultural innovations tailored to these new ecological realities.

Enhancing Biodiversity Conservation through Indigenous Knowledge

Muthoni Masinde – Central University of Technology, Free State

Biodiversity conservation is increasingly critical in the face of climate change, habitat degradation, and unsustainable agricultural practices, especially in sub-Saharan Africa. Small-scale farmers, who manage a significant portion of the land, are pivotal to both biodiversity conservation and the resilience of local ecosystems. However, their role in global conservation efforts remains insufficiently acknowledged. This study addresses this gap by adapting the 100 Questions for the Conservation of Global Biological Diversity framework to the realities of small-scale farmers in Limpopo, South Africa. The research investigates how Indigenous Knowledge (IK) can be integrated with emerging technologies like Artificial Intelligence (AI) and the Internet of Things (IoT) to improve biodiversity conservation and strengthen ecological resilience. Through surveys with 138 farmers, the study reveals a strong awareness of biodiversity loss and climate change, yet highlights significant gaps in accessing locally relevant weather information. The research proposes incorporating traditional ecological indicators—such as seasonal changes and animal migration—into AI-driven tools for real-time biodiversity monitoring. By adapting global conservation frameworks to local contexts and integrating new questions that reflect these synergies, this study contributes to building a resilient future where technology and Indigenous Knowledge work together to address biodiversity loss, support sustainable agricultural practices, and enhance the resilience of ecosystems and farming communities.

Tiger recovery amidst people and poverty

Ninad Avinash Mungi, Yadvendradev V. Jhala, Rajesh Gopal, Qamar Qureshi – Aarhus University

Recovery of large yet ecologically important carnivores poses a formidable global challenge. Tiger (Panthera tigris) recovery in India, the world's most populated region, offers a distinct opportunity to evaluate the socio-ecological drivers of megafauna recovery. Tiger occupancy increased by 30% (at 2929 square kilometers per year) over the past two decades, leading to the largest global population occupying ~138,200 square kilometers. Tigers persistently occupied human-free, prey-rich protected areas (35,255 square kilometers) but also colonized proximal connected habitats that were shared with ~60 million people. Tiger absence and extinction were characterized by armed conflict, poverty, and extensive land-use changes. Sparing land for tigers enabled land sharing, provided that socioeconomic prosperity and political stability prevailed. India's tiger recovery offers cautious optimism for megafauna recovery, particularly in the Global South. This study not only provides a "roadmap" for large predator (and biodiversity) recovery and maintenance, but also suggests that what

is good for tigers and ecosystems—lifting human populations out of poverty, and away from deadly conflict—is also good for people.

The Importance of Long-Term Studies in Human-used Forests for Developing Sustainable Management Strategies

Fornavn? Chequin – Aarhus University

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le Roux – Aarhus University?
TBD

Conserving wild grazers for resilient African savannas

Celesté Maré, Elizabeth le Roux, Jens-Christian Svenning – Aarhus University

Over the past century, the density and distribution of wildlife species have shifted dramatically worldwide. Regions that once supported diverse communities of wild animals are now dominated by a single domestic grazer, while elsewhere wildlife are being moved to new areas as part of restoration or conservation efforts. Yet, what this means for the resilience of both established and emerging ecosystems remains largely unknown. Unravelling the mechanisms that drive important ecological processes is therefore crucial for predicting how such changes will impact the functioning of natural systems. My PhD research aimed to understand how wildlife grazing influenced the roots of African savanna grasses, and the consequences for carbon storage during seasonal fires. Savannas cover about 46% of the land area across southern Africa, and account for a large portion of the annual global burnt area. Grasses are a key component of savanna systems and play an important role in mediating carbon input to savanna soils through their root systems. Although grazing impacts on the aboveground biomass of savanna vegetation have been well documented, how this affects belowground plant biomass has been largely overlooked. To address this gap, I used experimental manipulation to isolate the effects of wildlife grazing on the roots of individual grasses and combined this with field-based surveys to understand what this means at the landscape scale. My findings challenge assumptions that large herbivores necessarily reduce ecosystem carbon stocks and instead highlights the role of grazing in shaping carbon pathways. In fire-prone systems, like savannas, this has potential implications for the local carbon balance and ecosystem resilience.

Sub-theme: Sustainable Agriculture and Local Innovations

Building a Resilient and Sustainable Agripreneurship Ecosystem in Africa

Nonceba Ntoyanto-Tyatyantsi & Wellington Chakuzira – University of South Africa

Integrating circular economy principles with advanced technologies in agripreneurship presents an innovative approach toward sustainability and resilience in agricultural practices. This paper synthesises the confluence of circular economy practices, technological advancement and their implications for agripreneurship while addressing pressing ecological and socioeconomic concerns and resource limitations. Adopting a circular economy strategy enhances resource efficiencies and waste minimisation across food systems, which are essential in achieving sustainable agriculture. Furthermore, this review highlights the role of technology in enhancing recycling, reusing, repurposing, rethinking, reducing, refurbishing and remanufacturing strategies crucial for mitigating the adverse impacts of traditional linear agricultural models. The integration of advanced technologies such as IoT and big data analytics also improves the efficiencies in operations and enhances real-time monitoring and adaptive resource management. The systematic review draws on a range of scientific studies published between 2010 and 2024 from Google Scholar, Scopus and Web of Science databases focusing on circularity and technology adoption and its impact on the sustainability of agripreneurship. The review is conducted based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. Drawing from the findings, the paper proposes strategies for policymakers and agripreneurs to effectively respond to the adoption of circular economy principles and technological innovations. These strategies will promote food systems that align with ecological integrity and economic stability, positioning agripreneurship as an essential element in achieving sustainable goals.

THURSDAY, 10:30–12:30, 13:30–16:00

Indigenous Crops Conquest on Native Soils, an Agritech Experience

Qinisani Qwabe & Sussy Munialo – Nelson Mandela University

Indigenous crops in African soils have played a significant role for centuries and have been a source of sustenance for individual households, communities, and nations. However, through the invent of the green revolution which prioritized exotic crops like maize, brassicas and other non-native crops for production, indigenous crops have been under threat and under constant decline. Exotic crops have taken over arable landscapes in South Africa and replaced indigenous produce, shaking the resilience for nature, biodiversity and people. There is need to re-introduce indigenous crops as a conquest on native soils, and as a step towards enhancing biodiversity and South African food systems. Using stakeholder engagement discussions across nine South African Provinces, the researchers engaged with various stakeholders including government, non-government, non-profit organisations (NPOs), civil society, and farmers. The discussions were followed by a vigorous multi-stage thematic exercise. While the findings indicate the critical role that is played by exotic crops in the market industry, they pose numerous threats to the resilience of their indigenous crop counterparts. The production of exotic crops promotes the practice of monocropping on vast amounts of lands, not allowing for an agroecological approach to farming, threatening agrobiodiversity, the environment, and food security. We argue for a redesign of the farming model in South Africa supported by policy, research, extension/advocacy, carefully scrutinising what should be produced in native soils and what foods should be included as part of the national food system.

Improving Collaborations to Mitigate Non-economic Loss and Damage

Tsogolo Angel Itaye – University of Malawi

Background Malawi encountered Tropical Cyclone Freddy in 2023 and El- Niño induced climate variability in 2024, leading to damaged school infrastructure and disruptions to learning. Food insecurity worsened among primary school children reliant on School Feeding Programs [SFPs], including Mary's Meals, which serves over one million children everyday. Climate disasters may be contributing to child malnutrition, negatively impacting children's cognitive and physical development, school attendance and educational quality. This study analyses policies and collaborations that can mitigate these effects. Methods A mixed method approach was used, combing primary data from interviews with teachers, learners and Mary's Meals. Secondary data was obtained from government reports, academic literature and national policies, including Social Support Programme [MNSSP II] and the School Health and Nutrition Policy. Results Preliminary findings indicate a 35% decline in school attendance in cyclone affected areas, linked to damaged infrastructure and disrupted feeding programs. Nutritional deficiencies, including stunting and wasting affected 45% of surveyed children, while cognitive development sores decline by 25% in affected regions. Teachers reported a 40% drop in classroom participation due to hunger and trauma. Conclusion Climate disasters threaten literacy rates by increasing dropouts and hindering cognitive development. Strengthened collaborations between development partners, public and private sectors and the government are needed to integrate disaster management into SFPs. Further, climate adaptation strategies should be embedded in food security and education frameworks to protect learners' developmental and educational outcomes.

Sub-theme: Climate Modelling, Nature-Based Solutions and Governance

Prediction of Long-term and Short-scale Wind Power Potential in Mozambique

Fernando V. Mucomole, Carlos S. A. Silva, & Lourenço L. Magaia - Eduardo Mondlane University

In recent years there has been a strong call for the adoption of clean and sustainable energy sources capable of leveraging and accelerating the achievement of sustainable development goals by the end of 2050. Wind energy is an alternative and efficient source, as it uses the available wind speed resource and can be used autonomously as well as injected into the grid, thus being able to reach a large and beneficial population. Hence the objective of predicting the availability of wind energy in the long term and on a short-term measurement scale in the southern region of Mozambique, with around 60% of rural regions without access to electricity. The parametric model was used, which consists of, in the estimate, considering all atmospheric and physical parameters that influence the availability of the wind as well as its direction, among others. Wind speed and direction data were collected along the northern region of Mozambique at 6 stations, with measurement intervals of 10 minutes, during the years 2012 to 2014. The statistical evaluation reveals results of high resource availability in the order of 0.86. However, solar transmittance due to uniformly mixed gases influences at a rate of about 0.96 followed by ozone layer absorption at a rate of about 0.86, which causes small- and large-scale

atmospheric wind circulations. It can be concluded that there is a high correlation of wind energy between the measurement stations in the order of 0.81.

Evaluating and Comparing Machine Learning Algorithms for Forest Cover Mapping

Thendo Mugwena, Inos Dhau, Solomon Newete, & Khaled Abutaleb – University of Limpopo

Invasive alien species, such as Tamarix, pose significant ecological and economic threats in South Africa. Remote sensing techniques, combined with machine learning algorithms, can potentially improve the accuracy and efficiency of detecting and mapping these species over large areas. This study aimed to evaluate and compare the performance of several machine learning algorithms in detecting and mapping Tamarix species using Sentinel-2 satellite imagery, focusing on improving land cover classification accuracy for invasive species management. The study compared five machine learning algorithms—Support Vector Machine (SVM), Random Forest (RF), C.50 Decision Trees, Neural Network (CNN), and Majority Voting—chosen for their diverse approaches to classification. Sentinel-2 imagery was used, and field data were collected to train and validate the models. The Majority Voting ensemble achieved the highest accuracy of 96.77%, followed by Random Forest (90%) and C5.0 Decision Tree (87%). SVM achieved 83%, while Neural Networks had the lowest accuracy at 63%. These results suggest that combining models through Majority Voting may improve accuracy, and Random Forest and C5.0 Decision Tree perform well for this specific classification task. This study demonstrates the potential of machine learning algorithms, especially Random Forest, C5.0 Decision Tree, and Majority Voting, in accurately mapping Tamarix using Sentinel-2 imagery. These methods can be valuable tools for monitoring and managing invasive species, offering a scalable solution for environmental management efforts.

An Appraisal of the Relationship Between Climate Change and Biodiversity Conservation

Pearl Mnisi & T. M. Ramoroka – University of Limpopo

Climate change and Sustainable Development are believed to be interlinked across the globe. Climate change results mostly from human activities such as deforestation, burning of fossil fuels among others. As a result, such occurrences are aggravating the existing socio-economic vulnerabilities. This appraisal aimed at evaluating how climate change interacts with the country's pursuit of a sustainable development. This is a theoretical paper which was conducted through a desktop study. Scholarly articles and eBooks were used to source out information for the study. Content analysis was employed to analyse the data used in this paper. Climate change influences natural and human living settings together with the basis for social and economic development, making it difficult to achieve sustainable development. This paper concluded that, there is a robust relationship characterized by both challenges and opportunities between climate change and sustainable development. Climate change poses a challenge to the country's environmental, social and economic system, leaving most communities vulnerable. On the other hand, sustainable development seeks to address those glitches and improve quality of life. Therefore, the study recommends a need for sustainable development to put more focus on enhancing resilience to climate change.

From Contaminated Soils to Self-Sustaining Ecosystems: Nature-Based Solutions for Ecosystem Restoration

Ujala Ejaz & Jens-Christian Svenning – Aarhus University

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The in(ex)clusive potentiality of science, innovation and knowledge for policy

Sijekula Mbanga – Nelson Mandela University

The present world is confronted with several social and environmental challenges such as wealth inequality, climate change, population growth, rapid urbanisation, conflict and wars, and depletion of resources. Climate change is already having significant impacts globally. These impacts are experienced most acutely in developing countries where infrastructure and population are often more vulnerable, and resource and capacity for adaptation are limited. The potentiality of science, innovations and technologies in human settlement, urban, rural development and management to reduce the effects of climate change and advance socio-economic resilience in a Global North-South cooperation warrants attention. As we have witnessed how digital divide put to spotlight deep spatial inequalities between the developed and developing economies at the onset of the global pandemic, the Coronavirus, wherein certain segments and sectors of society watched others progressing with life leveraging on advanced digital technologies, it becomes imperative to examine the ex(in)clusive nature of built environment technologies, which cities are beginning to embrace in the provision of basic services, infrastructure and economic development. Anchored in a critical interpretivism knowledge paradigm, employing qualitative methods of data collection and analyses, extracting data from research engines such as Google Scholar, Web of Science, ResearchGate, Academia, this paper examines the global development challenges that militate against attainment of the 2030 Sustainable Development Goals. Second, the paper discusses both the developmental and 'discriminatory' potential of science, technologies, and innovations in response to the latter global mega-trends. Third, the paper unmasks the constraints and shortcomings of the innovation policies and systems in less-developed countries. From hereon, the paper assesses the potentiality of Transformative Innovation Policy (TIP) lens to improving the innovation systems of different countries. The paper concludes by proffering the Green Village Model as a fresh approach to mainstreaming of science, technology and innovations in human settlement and urban development for attainment of socio-economic development and economic prosperity.

Variation in Soil Element Dynamics Under Different Land Uses

Zibanani Seletlo, Bakari Mtili, Elizabeth le Roux, & Richard Fynn – Aarhus University

Sustainable rangeland management hinges on understanding how cattle influence soil nutrient dynamics. However, little is known about the stoichiometric environments shaped by different grazing systems. This study examines soil elemental variations between two contrasting cattle management

systems: Holistic Planned Grazing (HPG) with short-duration kraaling (SDOK) and continuous grazing. Specifically, it evaluates: (i) the influence of cattle kraaling on soil elemental composition and the resultant stoichiometric differences from surrounding areas, (ii) the temporal changes in these stoichiometric states, and (iii) the distinct elemental profiles created by the different cattle management strategies. We used portable X-ray fluorescence spectroscopy (pXRF) to analyse all elements heavier than Sodium (Na) in Shangani Holistic Ranch, Zimbabwe (HPG-SDOC management), and adjacent village grazing lands (Sabelo, Mohlotshane, and Hamilton), where continuous grazing is practised. Preliminary findings indicate that kraaled areas exhibit distinct nutrient patterns that contrast sharply with surrounding lands and persist over extended periods of time. Moreover, the different cattle management strategies appear to produce markedly distinct elemental profiles with notably lower soil fertility and more homogeneous nutrient distributions in continuously grazed areas. By contributing to our understanding of how management decisions impact soil health this research provides insights into sustainable rangeland management practices that enhance ecosystem resilience while supporting livelihoods. This work aims to add to the scientific basis for optimising rangeland management that supports climate adaptation, biodiversity conservation and people within a "One Health" framework.

Managing African rangelands for nature and people

Buitenwerf – Aarhus University

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Online Presentations

A Future for Nature: Conservation for the Age of Climate Breakdown

Adam Welz – University?

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