THE 2ND FIVE UNIVERSITY CONSORTIUM SCIENTIFIC CONFERENCE

CONFERENCE THEME

"Beyond Survival: Building Inclusive and Climate-Resilient Societies"

BOOK OF ABSTRACTS

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For more information, please contact
Professor Japhet Kashaigili, Sokoine University of Agriculture
Chairperson, Organizing Committee,
Mob: +255 754 2075 117
Email: jkashaigili@sua.ac.tz; second5UCC@sua.ac.tz

The Five University Consortium

The Five University Consortium (5UC), comprising of Sokoine University of Agriculture, University of Dar es Salaam, Aga Khan University, Nelson Mandela African Institution of Science and Technology, and Simon Fraser University (Canada), is pleased to announce the 2nd Scientific Conference, to be held at the Cate Convention Centre in Morogoro, Tanzania. This multidisciplinary conference brings together researchers, scholars, and professionals from partner universities to share insights, innovations, and findings addressing today's critical challenges on health, food security, environment and climate change.

Conference Theme

Beyond Survival: Building Inclusive and Climate-Resilient Societies

Sub-Themes:

Health Systems: Focuses on the following key issues: how public and eco-health systems can strengthen response and resilience against infectious diseases and emerging pandemics, non-communicable diseases, and access to affordable quality healthcare.

Sustainable Agriculture and Food Systems: Focuses on resilient farming practices, agroecology, water-efficient irrigation, food and nutrition, post-harvest management, and inclusive value chains; locally driven innovations and policies that enhance food security, empower smallholder farmers, and safeguard natural resources.

Environmental Integrity and Climate Change Resilience: Addresses strategies for protecting natural ecosystems while adapting to climate change. Key issues include sustainable land use, healthy wetlands and sustainable water resources, climate-smart agriculture and urban planning, green infrastructure, efficient waste management, circular economy, indigenous ecological knowledge, clean energy, low carbon solutions, carbon trading, climate financing, and biodiversity conservation as foundations for sustainable development.

Inclusivity and Community Resilience: Explores social protection, civic engagement, and equity in access to education, livelihoods, decision-making, gender equity, youth participation, disability inclusion, indigenous rights, and locally anchored approaches to building social resilience.

Governance, Policies and Institutions: Focuses on the role of policies and institutions in driving sustainable development. Topics can include participatory governance, data-driven policies, decentralization, and cross-sectoral coordination for effective implementation of national strategies.

Technology and Innovation: Explores how emerging technologies AI, IoT, mobile platforms, and digital public infrastructure can be leveraged to address development challenges. Sessions may focus on tech innovation, digital inclusion, ethical AI, and local tech ecosystems that prioritize equity and accessibility.

Conference Theme 1

Health Systems

KEYNOTE SPEAKER

Adaptive Policies & Practices in Building Responsive & Resilient Public Health Systems Against Emerging & Re-emerging Diseases, NCDs and Health Access Inequities: A case of Tanzania

Prof. Pascal Ruggajo (AKU)

Influenza A Viral RNA Sequence Visually Detected by A Paper Strip Sensor

Al-Hashim Tiffere, Paul C. H. Li
Email: paulli@sfu.ca

Chemistry Department, Simon Fraser University, Burnaby, Canada

Introduction: Influenza A is a highly contagious RNA virus that continues to pose a major threat to global public health. RNA variants such as H1N1, H2N2, H3N2, and the avian H5N1 have led to significant outbreaks. The avian influenza A subtype H5N1 poses a high mortality rate in humans but with low occurrence. Addressing any potential pandemic requires considering new subtypes and developing rapid diagnostic tools for new RNA variants. While rapid antigen-based tests are commonly used in clinical settings, their low sensitivity often leads to false-negative results. Molecular methods like RT-qPCR offer higher accuracy but require the use of multiple enzymes, precise thermal cycling equipment, and extended processing times, making these methods unsuitable for point-of-care use in many parts of the world. Method: To address these challenges, this project aims to develop an accessible, low-cost, and instrument-free sensor strip for influenza A detection. The proposed method utilizes the ligase enzyme for cDNA formation and lesion-induced DNA amplification (LIDA), an isothermal technique, in combination with gold nanoparticles (nanogold) that allows for visible detection with unaided eyes. Results: The nucleic acid amplification test has been developed to detect RNA sequence related to the H1 and H5 influenza A on a paper strip made of the nitrocellulose membrane. The instrument-free and isothermal amplification technique (LIDA), coupled with the formation of cDNA by ligation using T4 DNA ligase, made it possible to detect influenza viral RNA sequence on the test strip sensor. There is no need for a visualizing instrument, as visual observation with the naked eye was possible using 20 nm AuNP. Conclusion: This sensor strip could be used in point-of-care diagnoses to produce fast and accurate results of influenza A since the genetic material, rather than protein, of the virus is used as the sample.

Keywords: nucleic acid, influenza A, viral RNA, ligase, cDNA ligation, in-situ DNA amplification, gold nanoparticle

Molecular Detection and Characterization of Rotavirus from Wastewater Treatment Plants in Morogoro, Tanzania

Alice Syomiti Kilonzi, Augustino Chengula and Gerald Misinzo
Email: kilonzialice@gmail.com

Department of Microbiology, Parasitology and Biotechnology, Sokoine University of Agriculture, Tanzania

Background and Objectives: Rotavirus A (RVA) is the leading cause of acute gastroenteritis in children under five years. Despite vaccination efforts, its persistence in the environment through wastewater remains a significant public health concern. This study aimed to detect and molecularly characterize RVA in wastewater treatment plants (WWTPs) in Morogoro, Tanzania, to provide insights into environmental circulation and implications for community health. Methodology Between November 2024 and February 2025, a total of 93 pooled wastewater samples were collected from three WWTPs. Samples were concentrated by ultracentrifugation, RNA was extracted, and RVA detection was performed using RT-PCR targeting VP4 and VP7 genes. Positive amplicons were sequenced and analyzed phylogenetically using MEGA X. Key Results Overall, 8.6% (8/93) of samples tested positive for RVA. Detection varied across sites, with Mafisa WWTP showing the highest positivity (16.1%), followed by Mzumbe (9.7%), while no RVA was detected at Magadu WWTP. Sequencing revealed high nucleotide identity with previously reported human RVA isolates, including Rotavirus A/Tanzania/2022 (99.29% VP7) and Rotavirus A/Kenya/2014 (99.32% VP4). Phylogenetic analysis confirmed close clustering with East African strains, indicating ongoing circulation and potential cross-border transmission. Conclusion and Implications The detection of RVA in Morogoro wastewater confirms ongoing community circulation and reinforces the value of wastewater surveillance as an early warning system for diarrhea disease outbreaks. Beyond technical findings, this study highlights the urgent need for policy frameworks that integrate environmental surveillance into national health systems. Strengthening wastewater management and sanitation infrastructure should be prioritized within climate-resilient development strategies. Regional collaboration on genomic surveillance is equally critical to address cross-border viral transmission. Embedding wastewater monitoring in routine public health practice can guide evidence-based policies, improve outbreak preparedness, and support Tanzania's progress toward universal health coverage and sustainable development goals.

Keywords: Rotavirus A; Wastewater; Molecular detection; Phylogenetic analysis; Tanzania

Early Childhood Development in changing times: lessons from Monduli, Tanzania on resilience and coping with environmental and climatic changes

Fortidas Bakuza
Email: fortidas.bakuza@aku.edu

Institute for Education Development East Africa, Aga Khan University, Dar es Salaam, Tanzania

Early Childhood Development is a period of rapid growth physically, socially, and emotionally. It is the period between conception to the first eight years of human development. The new-borns coming to the world during this time should be welcome in the conducive environment that provide conducive care, protection, and adequate nutrition. However, there are environmental factors that often interfere with parenting and their influence tend to affect early childhood development in all spheres of life. Population growth, draught, environment degradations, poverty and social mobility are some of the factors that are changing the traditional ways of raising children. Parents, and communities in general are forced to adjust to the new ways of life to be able to support their families especially the young children. The changes happening will have impact in the ways growing children will experience their early life and obviously their mental, physical development and early stimulation will be affected. The rural communities in East Africa are experiencing the changing in the traditional ways of life. Traditional farming and animal grazing are affected by change in seasons that have significantly disrupted the ways of living. In turn family economic income is disrupted and the impact is the weakened family income to provide quality care. The Institute for Human Development in collaboration with the Institute for Education Development East Africa at the Aga Khan University conducted a situational analysis to map out the existing ECD services and programmes, identify challenges faced by the target populations e.g., access, implementation barriers and contextual factors in the pastoralist communities in Monduli, Arusha, Tanzania. This study sought to understand the life circumstances of individual families and the broader socio-economic context which influences nurturing care practices and children's development. The main aim of the study was to qualitatively document the community perceptions on ECD challenges and sources of risk and resilience for children living in Monduli District, Arusha The qualitative field notes have indicated some promising findings such as strong and resilient family child rearing practices, adaptability to the climatic and environment changes, parallel leadership (traditional and local government) which are working together smoothly and openness of pastoralist communities to share and learn from others. In this presentation, parents, local leaders, and other stakeholders have shared some good lessons which should be well understood. The climatic change, population growth and urbanization are likely to interfere with traditional child rearing practices. Adapting to new situation is possible without losing the common practices that defines the families and communities. Contextually relevant interventions are important and they should be informed by data both quantitative and qualitative. Engage the communities in local solutions.
Keywords: Early Childhood Development, Climate change, environmental change, resilience.

Determinants of Knowledge in Hypertension and Type 2 Diabetes among PLWHIV: A Cross-sectional Study

Biiru, Levitas and Kereth, Gudila A
Email: biirulevitas@gmail.com

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Tanzania

Introduction: Advert of Antiretroviral Therapy (ART) has significantly increased the life expectancy of People Living with HIV (PLWHIV). Improved health allows PLWHIV engage in social and economic activities, boosting their resilience. However, ART has been associated with higher risk of developing Type 2 diabetes and Hypertension. Managing HIV, hypertension and diabetes complicates care, leading to financial and psychological stress. Without integrated care this burden can cause poor disease control, increased morbidity and mortality, and ultimately threaten the sustainable livelihoods of PLWHIV. This study examined gender differences in knowledge concerning hypertension and diabetes among PLWHIV in Kagera, Tanzania. Methodology A cross-sectional study was conducted among PLHIV (≥18 years) on ART ≥6 months in Kagera. Data were collected using structured questionnaire to examine knowledge on hypertension and diabetes among PLWHIV, with results disaggregated by gender. Findings The findings revealed that 43.3% of women had good knowledge in hypertension and 31.7% of men had good knowledge in diabetes. Determinants of knowledge in hypertension among male were time on ART (AOR 1.114;95% Cl 1.114-1.224 p=0 025) and age (AOR=1.070 95%Cl1.012-1.132 p=0.017) and to female being obese (AOR=3.877 95%% Cl 1.28-11.72 p=0.016). Determinants of knowledge in diabetes among male were family history of diabetes (AOR=5.179; 95% CI:1.922–13.9; p=0.001) good practices (AOR=0.172; 95% CI:0.054-0.546 p=0.003). Among female, obese (AOR=4.115;95% Cl 1.012-6.736 p=0.048) and family history in diabetes (AOR=4.57;95% Cl1.268-16.50 p=0.020. Conclusion and Implications: The gaps identified in the study compromise the health outcome and reduce resilience emphasizing the need for targeted gender sensitive interventions, which help PLWHIV improve their health by reducing preventable complications such as hypertension and diabetes hence actively participate in social and developmental activities and ensuring that no one is left behind.

Keywords: Knowledge, Diabetes/hypertension, ART, PLWHIV

Building Inclusive and Resilient Health Systems: Patient Knowledge of Radiation Risks in Southern Tanzania

Theresia Estomih Nkya, Bakari Rashid Taifa
Email: theresia.nkya@gmail.com

Department of Parasitology and Entomology, University of Dar es Salaam-Mbeya College of Health and Allied Sciences, Mbeya, Tanzania

Background: Medical imaging is critical for diagnosing and managing health conditions, but ionizing radiation carries potential health risks. Patient awareness of these risks is essential for informed decision-making and building resilient, inclusive healthcare systems. Understanding community knowledge and perceptions can guide interventions to enhance patient safety and engagement. Objective: To evaluate adult patients' knowledge, attitudes, and perceptions regarding ionizing radiation exposure during medical imaging in Southern Tanzania, and identify gaps to support inclusive and community-centred interventions. Methods: A cross-sectional study was conducted from April to June 2024 at the radiology unit of Mbeya Zonal Referral Hospital. A total of 384 adult patients awaiting imaging procedures were selected. Data on socio-demographics, knowledge, attitudes, and perceptions of ionizing radiation were collected using a structured questionnaire and analyzed descriptively. Results: Only 5% of participants demonstrated excellent knowledge of ionizing radiation, while 70% had a moderate understanding, and 25% had poor knowledge. Despite 72% acknowledging potential health risks, 83% indicated willingness to proceed with imaging if necessary, and 56% expressed no concern. Approximately 40% reported feeling anxious during procedures, highlighting gaps between awareness, perception, and emotional response. Conclusions and Implications: Limited patient knowledge of radiation risks may compromise informed decision-making and patient safety. Public health strategies should focus on inclusive education, risk communication, and patient engagement to strengthen community resilience and safe use of medical imaging services. Findings can guide health policy on patient-centred radiology practices.

Keywords: Ionizing radiation, patient knowledge, inclusivity, community resilience, medical imaging, Tanzania

Dietary Intake and Physical Activity in the Management of Type 2 Diabetes Mellitus Patients: A Cross-Sectional Analysis

Brenda B. Temba, Happiness. Muhimbula and Akwilina.W. Mwanri
Email: brendabtemba@gmail.com

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Morogoro, Tanzania

Background and objectives: Type 2 diabetes mellitus(T2DM) is growing public health concern in Tanzania. Effective management relies on pharmacological treatment complemented by lifestyle modification, specifically die and physical activity. This study assessed dietary intake, dietary quality, and physical activity patterns among T2DM patients in Morogoro, Tanzania.

Methodology: A cross-sectional study was conducted involving 155 T2DM patients, aged 18 years and older and diagnosed with T2DM for at least six months, from two public health facilities in Morogoro. Dietary intake was assessed using the Prime Dietary Quality Score (PDQS), while physical activity was measured using the Global Physical Activity Questionnaire (GPAQ). Fasting blood glucose (FBG) was recorded from patient file. Binary logistic regression was used identified determinants of elevated FBG (≥7.0 mmol/L).

Key findings: Healthy food intake was high, with 90.3% consuming high intake of green leafy vegetables and whole grains. High diet quality scores (AOR=0.804, 95% CI: 0.674-0.958, p=0.015), higher BMI (AOR=0.87, 95% CI: 0.772-0.982, p=0.024) and family history of diabetes (AOR=0.073, 95% CI: 0.008-0.685, p=0.022) were significantly associated with lower odds of elevated blood glucose. Self-employment, longer duration of diabetes and the absence of comorbidities predicted higher physical activity.

Conclusion and implication: The study emphasized the significant role of dietary quality and physical activity in the management of T2DM.The findings highlight the need for personalized dietary strategies and tailored lifestyle interventions that consider genetic predispositions and socioeconomic factors.

Keywords: Diet quality, physical activity, Type 2 diabetes, glycemic control, Tanzania

Disability and Livelihoods: Lessons from Local Government Interest-Free loan scheme in Tanzania

Gamariel Mboya
Email: gamariel.mboya@aku.edu

Aga Khan University

Access to sustainable livelihoods has remained a persistent challenge for persons with disabilities (PWDs) worldwide, especially in the global south. PWDs face difficulties in financing new start-ups due to limited access to financial resources in many low- and middle-income countries, despite the emergence of progressive legal and policy frameworks that affirm their rights to economic empowerment to improve their livelihoods. In Tanzania, local government authorities must allocate 10% of their own-source revenue as interest-free loans targeting women, youth, and persons with disabilities. This study explores how this scheme, as an instrument for improving livelihoods and fostering inclusion, is implemented for PWDs, drawing lessons for strengthening community resilience. This study was guided by social capital theory and policy implementation theory. It used a mixed-method case study across four local government authorities in Tanzania. Data was collected through a structured questionnaire administered to PWD loan applicants and beneficiaries, complemented by key informant interviews with local government officials. A documentary review of relevant policy instruments was conducted to provide additional context. The study findings indicated that while Tanzania has a robust legal framework that is disability inclusive, translating these provisions into practice remains uneven. PWDs often encounter procedural barriers, limited awareness, and weak monitoring mechanisms. Nevertheless, where access is facilitated, loans have catalyzed small-scale entrepreneurship, improved household income, and enhanced social participation, demonstrating the potential of inclusive financing models to build resilience among marginalized groups. The study concludes that if effectively implemented, disability-centered financing schemes can serve as machinery for inclusive livelihoods and community resilience. However, to fully realize this potential, LGAs should strengthen outreach, ease procedures, and integrate disabled organizations into decision-making processes. These lessons have broader implications for advancing equity, social protection, and inclusive development in Tanzania and similar contexts.

Keywords: Disability, livelihoods, interest-free loans, and LGAs

Inclusivity and Community Resilience in Cardiovascular Disease Decision-Making in the Southern Highlands of Tanzania: Prevalence, Risk Factors, and Knowledge Gaps

Riziki Iddi Mwangu and Hortensia Gaspar Nondoli
Email: hnondoli@gmail.com

University of Dar es Salaam-Mbeya College of Health and Allied Sciences, Mbeya, Tanzania

Background: Cardiovascular diseases (CVDs) are the leading cause of non-communicable disease mortality globally, with a growing burden in sub-Saharan Africa. Limited community-level data exist on awareness, behaviors, and decision-making for CVD prevention in Tanzania, particularly in the Southern Highlands. Understanding community knowledge and engagement is critical for inclusive and resilient health interventions.
Objective: To assess CVD prevalence, risk factors, and knowledge gaps among adults in Mbeya and explore implications for community-informed decision-making and resilience.
Methods: A hospital-based cross-sectional study was conducted from April to June 2025 at Mbeya Zonal Referral Hospital. A total of 360 patients aged 30–70 years were selected via systematic random sampling. Data on socio-demographics, medical history, behaviors, and CVD knowledge were collected using a structured, interviewer-administered questionnaire adapted from the WHO tool. Descriptive statistics, chi-square tests, and multivariate logistic regression were performed using STATA 17.
Results: CVD prevalence was 66%, with hypertensive heart disease accounting for 82.8% of diagnoses. While 75.8% of participants were aware of CVDs, only 27.1% demonstrated good knowledge. Knowledge significantly correlated with healthy behaviors: non-smoking ($p<0.001$), physical activity ($p<0.001$), and fruit/vegetable intake ($p=0.0006$). Female gender, age >60, and diabetes were strong predictors of CVD. About 31% had a history of CVD-related hospitalization, mostly due to hypertensive crises.
Conclusions and Implications: High prevalence of modifiable CVDs and significant knowledge gaps were observed among adults in Mbeya. Public health strategies should prioritize awareness campaigns, lifestyle interventions, and early screening at the primary care level. Findings can guide inclusive health programs and community-based interventions to reduce CVD burden, enhance decision-making, and improve population resilience.

Keywords: cardiovascular diseases, community resilience, knowledge, hypertension, risk factors

Dietary risk assessment of organophosphorous pesticides in tomatoes from Morogoro: A case study of Mlali and Doma divisions in Mvomero

Alex Wenaty, Beatha Mkojera and Hekima Mliga
Email: beatha.mkojera@sua.ac.tz

Department of Food Science and Agro-processing, School of Engineering and Technology, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Background: The widespread use of pesticides in tomato production raises concerns about dietary exposure and associated health risks. This study assessed the presence and health implications of organophosphorous pesticide residues in tomatoes from farms and markets in Mlali and Doma divisions, Morogoro.
Methodology: Farmer practices, awareness, and knowledge of pesticide usage were evaluated through questionnaires. Tomato samples were collected from farms and markets, and pesticide residues were analysed using validated residue-detection methods. Dietary risk assessment was conducted by calculating hazard indices (HI) and estimating cancer risks for adults and children.
Key Findings: Six organophosphorous pesticides were detected at low concentrations, with pirimiphos methyl being most prevalent, followed by diazinon, fenitrothion, dimethoate, profenofos, and chlorpyrifos. Cancer risks ranged from very low to low across age groups and sample sources, while non-cancer hazard indices (HI) were all well below 1.0, indicating no significant health concerns. The cancer risks from detected organophosphorous pesticides in tomatoes ranged from 2.53E-07 to 5.81E-05 for adults and 6.10E-07 to 1.98E-04 for children in Mlali, and from 9.71E-07 to 3.95E-05 for adults and 2.34E-07 to 9.54E-05 for children in Doma, with pirimiphos methyl posing the highest risk and profenofos or chlorpyrifos the lowest.
However, risks were slightly higher in market samples than farm samples, suggesting potential post-harvest misuse or illegal pesticide applications. The cancer risks from market tomatoes ranged from 6.02E-07 (chlorpyrifos) to 5.75E-05 (pirimiphos methyl) for adults and 1.45E-06 to 1.39E-04 for children in Mlali, and from 2.62E-07 to 5.27E-05 for adults and 6.33E-07 to 1.24E-04 for children in Doma.
Conclusion: The study concludes that tomatoes from Mlali and Doma are generally safe for consumption with respect to organophosphorous pesticide residues, posing negligible cancer and non-cancer risks. Nonetheless, continuous monitoring of pesticide residues is recommended to prevent pesticide accumulation in the food chain and to address potential misuse in market chains.

Keywords: organophosphorous pesticides, dietary risk assessment, tomatoes, Morogoro, food safety

Harnessing Artificial Intelligence for Malaria Vector Control in High Malaria-Burden Sub-Saharan African Countries

Theresia Estomih Nkya
Email: theresia.nkya@gmail.com

Department of Parasitology and Entomology, University of Dar es Salaam-Mbeya College of Health and Allied Sciences, Mbeya, Tanzania

Background: Malaria remains a leading cause of morbidity and mortality globally, with Sub-Saharan Africa bearing the highest burden. Despite advances in vector control, challenges including insecticide resistance and changing mosquito behaviour threaten progress. Artificial intelligence (AI) offers approaches to enhance vector control through improved surveillance, environmental risk mapping, and intervention optimization. Understanding applications, barriers, and research gaps is crucial for data-driven policy and system-level decisions. Objective: To map AI applications in malaria vector control in the top 10 malaria-endemic countries in Sub-Saharan Africa, highlighting opportunities, implementation barriers, and policy implications. Methods: A scoping review followed PRISMA-ScR guidelines. Systematic searches of PubMed and Google Scholar were conducted in June 2025 using AI and malaria-related keywords combined with the top 10 endemic countries. Eligible studies included primary research in English reporting AI applications in vector control. Data were extracted using a standardized form and synthesized narratively, focusing on AI techniques, vector control aspects, benefits, challenges, and research gaps. Results: AI applications included mosquito surveillance (age-grading, species identification, blood meal analysis), environmental risk mapping, and genetic population studies. Machine learning, deep learning, and hybrid AI approaches were common. Benefits included improved accuracy, cost-effectiveness, scalability, and enhanced decision-making. Barriers included limited field validation, ecological variability, data and infrastructure constraints, and ethical considerations. Gaps were noted in operational integration, cross-country studies, and longitudinal evaluations. Conclusions and Implications: AI can transform malaria vector control in Sub-Saharan Africa by enabling data-driven, context-specific interventions. Policymakers should prioritize validation, capacity building, infrastructure development, and ethical governance to ensure equitable deployment. Integrating AI tools into national strategies can enhance surveillance, optimize interventions, and support evidence-based decisions, contributing to malaria elimination and resilient health systems.

Keywords: Malaria vector control, Artificial intelligence, Machine learning, Deep learning, Mosquito surveillance, Environmental risk mapping, Sub-Saharan Africa, Predictive modelling.

From survival to safety: Assessing the potential for integrating Manual Emptying in Citywide Sanitation Systems

Fides J. Izdori, Theckla B. Ngewe, Prisca A. Mlangwa, Gloria Mbise and Vanessa M. Saimon

Email: eng.fides@yahoo.com

Department of Water Resources Engineering, University of Dar es Salaam

Rapid urbanization in Sub-Saharan Africa has intensified sanitation challenges in informal settlements, where high population density, poor infrastructure, and climate-related flooding undermine safe faecal sludge management (FSM). In Dar es Salaam, Tanzania, on-site sanitation is widely used, yet physical access constraints and high groundwater levels often hinders mechanized desludging. Manual pit emptying performed by workers using basic tools or semi-mechanized devices, remains a vital but largely informal service operating outside regulatory frameworks and exposing both workers and communities to health risks. This scoping review and policy analysis examines how manual pit emptying can be integrated into Citywide Inclusive Sanitation (CWIS) strategies, with a focus on Tandale Ward, a high-density, flood-prone settlement. Peer-reviewed and grey literature, as well as Tanzanian policy documents for the period between 2010 and 2025 were systematically searched, screened, and coded against the CWIS framework components: equity, safety, sustainability, responsibility, accountability, and resource management. Findings reveal persistent misalignment between national sanitation policies and the operational realities of informal settlements. While Tanzania's guidelines acknowledge on-site FSM, they lack actionable provisions for formalizing manual emptying, ensuring occupational safety, and embedding climate resilience. Evidence indicates that integrating context-appropriate technologies (e.g., MAPET and gulper pumps) with decentralized treatment, flood-adapted service protocols, and inclusive governance mechanisms can significantly reduce environmental contamination and service inequities. The results of this study offer a replicable analytical method for other urban contexts and contribute actionable recommendations to shift manual emptying from an informal survival mechanism toward a safe, regulated, and climate-resilient sanitation service.

Keywords: City Wide Inclusive Sanitation, manual pit emptying, informal settlements, faecal sludge management, climate resilience

Exploring Quality of life among rheumatic heart disease patients at Jakaya Kikwete Cardiac Institute

Magreth Justine
Email: magreth.justine@scholar.aku.edu

Aga khan university, Dar es salaam, United Republic of Tanzania

Rheumatic Heart Disease (RHD) continues to be a leading cause of cardiovascular morbidity and mortality, particularly in low- and middle-income countries such as Tanzania, where the prevalence is estimated at approximately 9% among the general population. This study aimed to explore the lived experiences and perceptions of Quality of Life among postoperative RHD patients at JKCI, focusing on the physical, psychological, social, and economic dimensions. This qualitative descriptive study employed an exploratory design to gain insight into postoperative QoL among RHD patients. Purposive sampling was used to recruit eight adult patients who had undergone valve surgery at JKCI at least one month prior to data collection. Data was collected through in-depth, semi-structured interviews which were audio-recorded, transcribed and analyzed using thematic analysis to identify recurring themes and patterns relevant to patients' lived experiences .Thematic analysis revealed four central themes characterizing postoperative QoL in RHD patients: Physical Relief and Burdens, Patients expressed profound gratitude for life-saving surgery, reporting significant improvements in symptoms like shortness of breath and fatigue. Psychological Distress and Fear of the Future, Participants described living with persistent anxiety, fear of re-operation, sudden complications, and death. Financial Hardship, this was expressed by most participants, since post-operative care requires lifetime medication, for some of the RHD patients post mitral valve replacement. Barriers to Continuity of Care, Distances to JKCI and limited access to essential medications and INR testing. Cardiac surgery for RHD offers essential physical relief but marks the start of a lifelong, complex journey for patients. Their quality of life is deeply affected by psychological distress, financial burdens, and systemic barriers to follow-up care. To enhance long-term QoL, an integrated care model cannot be overemphasized, combining psychological, financial support, and accessibility to postoperative services for RHD patients.

Keywords: quality of life, surviving surgery

Bridging the Knowledge–Practice Gap: Improving Cervical Cancer Screening Uptake in the Southern Highlands of Tanzania, for Stronger and More Inclusive Health Systems

Luis Adayo Jumbe, Hortensia Nondoli
Email: hnondoli@gmail.com

Mbeya College of Health and Allied Sciences, University of Dar es Salaam, Mbeya, Tanzania

Background and Objectives: Cervical cancer is a leading cause of cancer-related deaths among women in Tanzania, despite being largely preventable. Persistent gaps in knowledge, negative attitudes, and limited screening uptake hinder early detection, especially in low-resource settings. This study aimed to assess knowledge, attitudes, and practices (KAP) regarding cervical cancer screening among women of reproductive age in Mbeya Municipal to inform strategies for strengthening inclusive, resilient, and preventive health systems.
Methodology: A descriptive cross-sectional study was conducted from April to June 2024 among 279 women aged 15–49 years, selected through simple random sampling. Data were collected using a pre-tested structured questionnaire covering socio-demographics, knowledge, attitudes, and screening practices. Descriptive statistics were computed, and knowledge was scored using a 12-point scale, with ≥9 points indicating good knowledge.
Results: Most participants (81.6%) had heard of cervical cancer screening, yet only 44.6% identified Pap smear and 36.8% VIA as correct methods, while 14.8% believed pregnancy tests were screening tools. Although 91.6% demonstrated good overall knowledge, awareness of recommended screening intervals (35.6%) and the HPV cause (14.5%) was low. Attitudes were generally positive, with 86% recognizing cervical cancer as serious and 75.3% supporting regular screening. However, only 18.4% had ever been screened, predominantly via VIA (57.6%). Common barriers included cost (55.6%), fear of pain (46.6%), and embarrassment (41.2%).
Conclusion and Implications: Despite favorable attitudes and high general awareness, critical knowledge gaps and low screening uptake persist, reflecting a substantial knowledge–practice gap. Integrating cervical cancer screening into routine reproductive health services, coupled with targeted, culturally sensitive health education, could improve early detection and build more inclusive, climate-resilient health systems that address non-communicable disease prevention in Tanzania.

Building Climate Resilient Health Infrastructure: The Tanzanian Societies under Survival Siege

Prof. Samwel Manyele and Honest Anicetus
Email: sammanyele@gmail.com / hanicetus@gmail.com

Department of Chemical and Process Engineering, University of Dar es Salaam, United Republic of Tanzania

Introduction: Tanzania's healthcare system is increasingly exposed to the impacts of climate change, including floods, droughts, extreme heat, and the spread of climate-sensitive diseases. These hazards threaten healthcare facilities (HCFs), disrupting service delivery and weakening the nation's capacity to safeguard public health. Building climate-resilient infrastructure has therefore become a pressing survival necessity for Tanzanian societies. Methodology: The study employed a mixed-methods approach combining surveys of healthcare facilities, field assessments, and secondary data from national and global climate-health reports. RED forms, ARIS records, and infrastructural audits were reviewed to identify vulnerabilities. Cost-benefit analysis was used to compare retrofitting versus rebuilding, while policy analysis examined gaps in governance, financing, and enforcement of resilience standards. Results: Findings show that many HCFs remain structurally fragile, with inadequate WASH systems, unreliable energy supply, poor drainage, and weak building designs. These gaps have led to frequent service disruptions during climate-related events. Retrofitting initiatives—such as elevating foundations, improving ventilation, flood-proofing, and integrating renewable energy—reduced climate-induced service interruptions by 50–80%. Cost-benefit analysis confirmed that retrofitting is up to 60% more cost-effective than rebuilding. However, adoption remains limited due to financial constraints, weak institutional capacity, and restricted access to climate finance. Conclusion: Tanzanian societies face compounded risks: escalating health burdens, infrastructure breakdowns, and widening inequalities between rural and urban populations. Addressing these challenges requires enforceable climate-resilient building standards, sustainable financing instruments such as climate bonds, integration of renewable energy and water conservation technologies, and capacity-building for health workers. Multi-stakeholder partnerships—government, donors, and communities—are vital. Strengthening climate-resilient health infrastructure will reduce vulnerability, protect lives, and advance progress toward SDG 3 (Health) and SDG 13 (Climate Action).

Keywords: Climate-resilient healthcare, Tanzanian societies, health infrastructure, retrofitting, WASH, renewable energy, climate adaptation, resilience governance.

People, Water, and Health in the Era of Climate Change

Emmanuel Sulle, Bashir Adelodun, Askwar Hilonga, Happiness Moshi, Grite Nelson and Mussa Dida
Email: emmanuel.sulle@aku.edu

Arusha Climate & Environmental Research Centre, The Aga Khan University, Arusha, United Republic of Tanzania

Climate change, in interaction with societal and environmental factors, is exerting profound negative effects on human health, particularly in low- and middle-income countries where both physical and economic water scarcity persist. In Tanzania, the growing challenge lies in climate shift and human-induced environmental pressures, undermining access to safe water, adequate sanitation, and proper hygiene, the key determinants of human health outcomes. This study investigates the state of water availability and quality, sanitation, hygiene, and related health risks in the Arusha and Manyara regions of northern Tanzania. Employing a mixed-methods approach, the research combined (i) household surveys, focus group discussions, and key informant interviews, (ii) systematic sampling and laboratory testing of water samples, and (iii) evaluation of existing technological solutions in the market for improving water security and safety. Findings reveal alarming water quality challenges: fluoride concentrations as high as 12 mg/L—far exceeding the World Health Organization guideline of 1.5 mg/L—were recorded in Monduli and Arusha districts. In addition, water sources in Mbulu Town, Mbulu Rural, Arusha, and Monduli districts were found to be contaminated with high levels of E. coli, faecal coliforms, and salinity. These conditions present significant public health risks, particularly for vulnerable populations. Drawing on primary data and an intensive review of existing literature, the paper argues that climate change—compounded by population growth, land use changes, disproportionate water, sanitation, and hygiene services between rural and urban settings, pollution and inadequate infrastructure and erosion of Indigenous and local knowledge systems—is fundamentally altering water availability and quality. These interlinked pressures threaten both human and ecosystem health, underscoring the urgent need for context-specific, transdisciplinary studies and sustainable interventions.

Keywords: **Climate** change, water, human health, sanitation, land use change, ecosystem health

Untapped Nutritional Gems: Nutrient and Micronutrient Profiles of Two Indigenous Tanzanian Fruits

Hadijah A. Mbwana, Victoria F. Gowele and Raphael T. Chibunda
Email: hadija27@yahoo.com

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Introduction Micronutrient deficiencies remain a significant contributor to malnutrition in Tanzania, particularly in rural areas where dietary diversity is limited. Indigenous fruits such as prickly pear (Opuntia ficus-indica) and white sapote (Casimiroa edulis) are underutilized despite their potential nutritional value. Limited compositional data constrains their promotion in nutrition interventions. This study analyzed their nutrient composition and compared them to commonly consumed fruits in Tanzania. Objective To determine the macronutrient, micronutrient, and antioxidant profiles of prickly pear and white sapote, and compare them with popular fruits in Tanzania. Methods Ripe fruits were purchased from markets in Singida, Tanzania. Proximate, mineral, and vitamin analyses were conducted using standard AOAC methods. Antioxidant activity was assessed via DPPH radical scavenging assays. Nutrient values were compared with mangoes, papayas, bananas, pineapples, watermelons, and oranges using Tanzania Food Composition Tables. Results Prickly pear had higher crude protein (0.91%), fiber (4.15%), carbohydrates (12.35%), and calcium (15.7 mg/100g) than white sapote (0.24%, 2.58%, 10.24%, and 7.9 mg/100g, respectively). White sapote had higher vitamin A (124.6 μg RE/100g), vitamin C (4.13 mg/100g), magnesium (6.71 mg/100g), iron (0.45 mg/100g), and total phenols (26.68 mg GAE/100g), while prickly pear showed greater antioxidant activity (34.01%). Compared to common fruits, prickly pear's fiber content exceeded that of mangoes, papayas, bananas, and watermelons, and its calcium content was higher than mangoes, bananas, and watermelons. Both fruits offered higher iron content than most common fruits. Conclusion Prickly pear and white sapote possess unique nutrient profiles that complement commonly consumed fruits, with potential to improve dietary diversity, address micronutrient deficiencies, and enhance nutrition security in Tanzania. Promoting their consumption and exploring value addition could reduce post-harvest losses and boost rural livelihoods.

Keywords: Prickly pear, white sapote, indigenous fruits, nutrient composition, antioxidant activity, Tanzania, micronutrient deficiencies

Association Between Food Security and Dietary Practices in Urban Settings in the Era of Climate Change: A Cross-Sectional Study in Mbeya Urban

Zawadi Yusuph Kaniugu, Titus P Leonard, Tumsifu Daudi Msigwa, Valentina G Rwegasira, William Adimilabilis Vitus, Wilson Nicholous Jackson, Yudith Yakobo Mdete, Zaituni Nanana Mpimbi, Zephrine Joseph Pembe, Christopher Hariri Mbotwa

Email: cmbotwa@udsm.ac.tz

Mbeya College of Health and Allied Sciences, University of Dar es Salaam, Mbeya, United Republic of Tanzania

Introduction: Despite the availability of food through home production and local markets, individuals' daily dietary practices may not necessarily reflect the consumption of food resources accessible within their communities. Climate change is a key driver of food insecurity, which in turn influences diet quality and diversity. In sub-Saharan Africa, there is limited evidence on the relationship between food security and dietary practices in urban settings. Objective: To determine the association between food security and dietary practices among adults in Mbeya, Tanzania. Methodology: This ongoing cross-sectional study is part of a medical students' public health project. We are recruiting 400 adults aged ≥18 years residing in Mbeya City Council through multi-stage cluster sampling. Dietary practices are assessed using a Food Frequency Questionnaire (FFQ), while food security is measured using the Household Food Insecurity Access Scale (HFIAS). All analyses will be implemented in STATA version 14. Preliminary Findings: Data cleaning is in progress. Preliminary analysis indicates that 71% of participants experience some level of food insecurity. Conclusion: High prevalence of food insecurity among urban residents highlights the need for interventions that address both climate-related food system challenges. Strengthening inclusive, climate-resilient food policies could improve food accessibility in urban areas.

Keywords: Dietary practice, food security, nutrition, food accesibility, food insecurity, climate change

Fuzzy logic-based AI model for breast cancer classification and risk prediction in Tanzanian women: toward interpretable decision support in low-resource oncology settings

Linus Paul Rweyemamu, Gokce Akan, Niyazi Senturk, Meliz Yuvali, Nazima Dharsee, and Fatmahan Atalar
Email: linuspaul88@gmail.com

Department of Molecular Biology and Biotechnology, University of Dar es Salaam, United Republic of Tanzania

Background and Objectives Breast cancer (BC) remains a major public health challenge in sub-Saharan Africa (SSA), where late-stage diagnosis and limited access to diagnostic services drive high mortality rates. In Tanzania, nearly half of women diagnosed with BC die from the disease, underscoring the urgent need for affordable and scalable diagnostic solutions. This study aimed to develop and evaluate the first fuzzy logic-based artificial intelligence (AI) model tailored to the Tanzanian oncology context to support early BC detection and clinical decision-making. Methodology A Mamdani-type fuzzy inference system was developed using clinicopathological and demographic data from 250 Tanzanian BC patients and validated on an independent cohort of 20 patients. Sixteen routinely collected risk factors, including reproductive history, hormonal status, and lifestyle variables were used to predict four outputs: TNM pathological stage, histological subtype, tumor laterality, and immunohistochemical (IHC) classification. Model performance was assessed using predictive accuracy and mean absolute error (MAE). Statistical consistency across outputs was examined using the Friedman test and Wilcoxon signed-rank post hoc analysis. Key Results and Findings The model demonstrated high predictive accuracy: TNM stage (91.18%, MAE=8.8%), histological subtype (92.49%, MAE=7.5%), tumor laterality (90.74%, MAE=9.3%), and IHC classification (92.93%, MAE=7.1%). Output scores differed significantly (χ^2=16.23, p=0.001), but no pairwise inconsistencies were observed (p>0.05), indicating internal reliability. The fuzzy logic approach was selected for its transparency, interpretability, and low data requirements: features that enhance feasibility in resource-limited settings. Conclusion and Implications This context-specific fuzzy logic AI model shows strong potential to enable early-stage diagnosis, facilitate subtype-specific classification, and support personalized treatment planning in Tanzania. By reducing diagnostic delays, it aligns with national cancer control priorities and offers a scalable digital health strategy for other low-resource settings in SSA.

Keywords: Artificial intelligence, Breast cancer, Clinical decision-support, Early diagnosis, Fuzzy logic, Reproductive risk factors.

Conference Theme 2

Inclusivity and Community Resilience

KEYNOTE SPEAKER

Decolonizing Food System Planning for Inclusivity and Community Resilience: A Photovoice Food Asset Map with Kitselas Nation

Dr. Tammara Soma (SFU)

Empowering Students for a Sustainable Future: Integrating Climate Education into Tanzania's Learning Systems

Simon Peter Ngalomba & Agnes Gisbert Kapinga
Email: ngalombasimon@gmail.com

Educational Foundations, Management and Lifelong Learning, University of Dar es Salaam, United Republic of Tanzania

The accelerating climate crisis poses profound challenges to Tanzania's social, economic and ecological systems, demanding urgent action to build resilience among its population-particularly the youth who will inherit these challenges. This study presents the systematic integration of climate education into Tanzania's formal and informal learning systems as a strategic pathway to empower the next generation with the knowledge, skills and values required for climate action. Drawing on qualitative insights from teachers, policy experts, environmental NGOs and student leaders as well as a review of national education policies and climate strategies, the study identifies gaps and opportunities in current climate education practices. Findings reveal that while environmental topics are included in science and geography secondary curricula, climate change is often treated superficially, with limited emphasis on local realities, indigenous knowledge or actionable solutions. Teachers reported insufficient training and resources, while students expressed a desire for more practical, project-based learning experiences linked to their communities. Successful case examples such as school-led tree-planting campaigns, school-based climate clubs and community water conservation initiatives demonstrate the potential of experiential learning in fostering climate literacy and civic responsibility. The study argues for a national framework to mainstream climate education across all education levels, supported by teacher capacity-building, climate-focused extracurricular activities and partnerships between schools, universities and local communities. Special attention is given to integrating resilience-building concepts, such as disaster preparedness, sustainable agriculture and renewable energy awareness, into both rural and urban learning contexts. By equipping Tanzania's youth with comprehensive climate knowledge and practical skills, the country can cultivate a generation capable of innovating, adapting, and leading in the face of environmental change. This call to action emphasizes that climate education is not optional-it is a critical investment in Tanzania's sustainable future and global climate leadership.

Keywords: indigenous knowledge, capacity building, climate strategies, school curricula, sustainable agriculture

Sustainable approaches to disease management on vegetable crops

Zamir K. Punja
Email: punja@sfu.ca

Department of Biological Sciences, Simon Fraser University, Burnaby, Canada

Vegetable crop production is subjected to various biotic stresses, among which fungal pathogen infection can cause significant economic losses. Sustainable management options for these diseases are required to allow farmers to reduce fungicide inputs and reduce environmental impact. In our research, we have evaluated the effects of application of formulated extracts from seaweeds, as well as formulated products containing Bacillus species, to manage fungal pathogens affecting carrot, cucumber and tomato plants. The pathogens evaluated for response to treatments included Alternaria, Botrytis, Didymella, Podosphaeria and Fusarium species. Seaweed extracts from Ascophyllum nodosum when applied prior to pathogen inoculation on carrot and cucumber plants showed significant reductions in disease severity at 10 and 25 days after treatment. In treated leaf tissues, the activity of certain defence-related enzymes, including peroxidase (PO), polyphenoloxidase (PPO), phenylalanine ammonia lyase (PAL), chitinase and B-1,3-glucanase were significantly increased within 12 h following treatment. The treated plants also had higher gene transcript levels of pathogenesis-related protein I (PR-1), chitinase, lipid transfer protein, phenylalanine ammonia lyase, chalcone synthase, non-expressing pathogenesis-related protein (NPR-1) and pathogenesis-related protein 5 (PR-5) genes compared to control plants. These results indicate that seaweed extracts can enhance fungal disease resistance in carrot and cucumber plants, likely through induction of defence genes and/or proteins. Tomato and cucumber plants treated with Bacillus spp. prior to pathogen inoculation showed reduced development of Fusarium and Pythium species causing root rot and of powdery mildew affecting the foliage. Post-harvest fruit rots of tomato caused by Penicillium and Botrytis species were also reduced. The mechanism of action was likely through the production of antimicrobial compounds that inhibited pathogen growth. These results demonstrate that sustainable disease management through the application of seaweed extracts and formulations of Bacillus spp. can provide significant reductions of fungal pathogens on carrot, cucumber and tomato plants with reduced environmental impact.

Keywords: biological control, induced resistance, fungal pathogens, root pathogens

The Afterlife Projects' Maintenance Dilemma in Tanzania

Suma Fahamu Kibonde
Email: Kibonde.suma@udsm.ac.tz

University of Dar es Salaam, United Republic of Tanzania

Various social welfare and economic challenges in Tanzania have stimulated the establishment of multiple development projects aimed at addressing them. However, the sustainability of most infrastructure projects post-implementation remains a critical challenge, often undermining their intended socio-economic and environmental benefits. This study examines the maintenance dilemma with a specific focus on the Mpirani sanitary landfill in Tanga City, Tanzania, a government-led initiative under the Tanzania Cities Transforming Infrastructure and Competitiveness program, designed to enhance urban sanitation and waste management. Employing a qualitative research design, the study assesses the landfill's current operational condition and maintenance practices through purposive sampling of stakeholders, including waste pickers (11), residents (6), waste transporters (2), the city's environmental officer (1), and the landfill manager (1). Data were collected via focus group discussions, in-depth interviews, key informant interviews, and field observations, and analysed using content thematic analysis. The findings demonstrate the Mpirani sanitary landfill's vital contribution to improved waste management and local livelihoods through recyclable collection. However, persistent operational challenges such as uncompacted and exposed waste, malfunctioning equipment, and inadequate budget allocations for maintenance and procurement undermine its efficacy. Compounding these issues, the incomplete and delayed remittance of the mandated 10% city revenue for upkeep intensifies equipment downtime. At the same time, the reported escalating odour problems reflect declining waste management efficiency since the landfill's establishment in 2020. These findings underscore the urgent need for proactive maintenance strategies to ensure the sustainability of urban infrastructure projects in resource-constrained contexts. To address these challenges, the study advocates for the implementation of a robust monitoring and evaluation framework to systematically track waste compaction, equipment performance, and odour levels; the allocation and timely disbursement of realistic operational budgets; and the promotion of accountability and ethical conduct among staff to safeguard the long-term environmental and public health benefits of such initiatives.

Keywords: sanitary landfill, maintenance challenges, waste management, project sustainability

Gender patterns in vegetable wholesale markets: experiences, constraints and opportunities

Victoria F. Gowele
Email: vgowele@sua.ac.tz

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Vegetables have received considerable attention in Tanzania due to their high market potential and substantial contribution to household income and nutrition. In 2024, the "Research Supporting African MSMEs to Provide Safe and Nutritious Food" (RSM2SNF) project conducted a survey of wholesale markets for tomato and green leafy vegetables (GLV) in 8 cities in Tanzania. The survey covered 45 markets and captured information on the various ways that women and men participate in tomato and green leafy vegetables wholesale market activities. The representation among wholesalers showed that across markets, an average of 47% of tomato wholesalers are women whereas 76% of green leafy vegetables wholesalers are women. Additionally, the representation of women among vegetable wholesalers varied across regions. Majority (67%) of female tomato wholesalers were from the markets in southern highlands regions (Iringa, Njombe and Mbeya) compared to Dar es Salaam (13%). Representation of vegetable wholesalers in leadership positions was mostly dominated by men as 71% of the market chairpersons were men. The dominance was also observed in other positions such as chairperson of market committee, deputy chairperson and secretary with proportions of 100%, 84% and 87% respectively. Female vegetable wholesale traders mostly (69%) dominated the treasurer position. Changes in vegetable wholesale business over the past decade revealed that 63% of tomato markets report that the share of female traders has increased whereas 53% of green leafy vegetables markets report that the share of female traders has increased. Overall, findings from this study revealed that women are under-represented among tomato wholesalers and there is a need to improve women's representation in wholesale market leadership positions.

Keywords: Gender, markets, wholesale, tomato, green leafy vegetable

Investigation of the Suitability of Waltheria indica L. (Sleepy Morning Plant) Root Extracts as Pathogen Removal Agent from Drinking Water

Josephat Ilunde, Nelson Mpumi, Mwema Felix Mwema, Revocatus Machunda
Email: mwema.felix@nm-aist.ac.tz

School of Materials, Energy, Water and Environmental Sciences, The Nelson Mandela African Institution of Science and Technology, Arusha, United Republic of Tanzania

Access to safe drinking water is essential for health, yet remains a challenge due to climate change, resource competition, and contamination. Only about 10% of global freshwater is accessible at the surface, with 1.5 to 3 billion people, especially in developing regions, relying on groundwater from wells. These conventional water sources are highly susceptible to contamination by coliforms and E. coli, affecting nearly 50% of Africa's population and hindering progress toward Sustainable Development Goal number 6 on clean water and sanitation. Waterborne diseases not only impact public health but also burden economies and healthcare systems. While various water treatment methods exist, many are expensive and require technical expertise, making them less practical in low-resource settings. Plant extracts have demonstrated potential to reduce water turbidity, but their efficacy against microbes is not well documented. This study investigated the effectiveness of Waltheria indica root extracts - selected for their accessibility and traditional use - in removing pathogens from drinking water sourced from shallow wells in Tanzania. The study evaluated three types of Waltheria indica root extracts: powdered, soaked, and boiled using standard water analysis protocol. Results indicated that all extract forms successfully eliminated E. coli and total coliforms within 12 hours. The effectiveness ranked highest for the soaked extract, followed by the boiled extract, and finally powdered extract. Although the extracts introduced some coloration and odor to the treated water, these effects were mitigated through the application of biochar. In conclusion, Waltheria indica root extracts show promise as a sustainable, plant-based alternative for water purification. Further research is recommended to optimize extraction methods and to assess long-term performance in diverse environmental conditions.

Keywords: Escherichia coli; Pathogen removal; Root extracts; Waltheria indica; Water purification.

Effects of Climate Change on Indigenous Based Strategies that Improve Food Security in Serengeti District, Tanzania

Donald Anthony Mwiturubani
Email: dmwiturubani@udsm.ac.tz

Department of Geography, University of Dar es Salaam, United Republic of Tanzania

Livelihoods of smallholder farmers in Serengeti district depend mainly on rain-fed agriculture. Local people, through interaction with the environment and practicing agricultural activities, develop, adopt and use indigenous based food production strategies to improve food security. However, in the past three decades or so, climate change is said to have potentially affected these indigenous strategies. We conducted a study in two villages in Serengeti district to determine the effects of climate change on indigenous based strategies for improving food security. Mixed methods were used to collect data including household survey covering 112 households, 2 focus group discussion sessions and 5 key informant interviews. The findings suggest that there are indigenous food production strategies that smallholder farmers develop, adopt and use to improve food security. They include planting drought tolerant crops; change of planting techniques, change of planting dates, change of crop types, use of wild edible fruits and vegetables, and post-harvest food storage strategies. The strategies are also based on indigenous knowledge on weather forecasting such as prediction of rainfall onset and end that allow efficient use of available moisture. Climate change-based constraints that affect indigenous strategies include change of rainfall patterns; change/disappearance of indigenous based indicators of onset and cessation of rainfall; disappearance of edible wild fruits and vegetables; increase of pests and insects on crops; and emergence of invasive plant species. The findings form the basis for concrete recommendations to non-governmental organizations and the government to design strategies and formulate policies to backup indigenous based strategies to enhance agricultural productivity and increase food security in Tanzania and beyond.

Keywords: climate change, indigenous strategies, food security

A Systematic Review of Digital Technologies and Innovations for Enhancing Inclusive Development in Tanzania

Nyinondi, P.S., and M.E. Sospeter

Department of Informatics and Information Technology, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Digital technologies and innovations have become the center of development in this century, with people accessing various services, such as digital financial transactions and remote access to agricultural extension and advisory services through mobile apps like M-Kilimo, E-learning systems, health advisory and services, and information access. However, there are limited comprehensive studies on digital technologies and innovations for inclusive development in Tanzania. This study conducts a systematic review to investigate the depth of digital technologies and innovations for enhancing inclusive development in Tanzania, covering the period from January 1, 2005, to December 31, 2024. A thorough search strategy was devised, incorporating key terms such as "Digital innovations," "Technologies," "technology AND Development," and "ICTs and Development," resulting in the inclusion of 31 relevant articles. The study found various emerging digital technologies already in use, such as Artificial Intelligence (AI), Internet of Things (IoT), E-government system, E-learning, mobile applications, and platforms, very useful in inclusive development efforts. The technologies and innovations have improved access to information and advisory services, enhanced good governance, and access to public services. Furthermore, the study found underutilization of agricultural advisory applications. Effective use of digital innovations and technologies is limited by the digital divide, digital literacy skills, and internet connectivity, especially in rural areas. Study concludes that digital technologies and innovation have the potential to foster inclusive development. It recommends strengthening local technology and innovation ecosystems and providing reliable internet connections, provision of training and capacity building to rural people on the use of digital technologies and innovations.

Keywords: Digital technology, Innovations, ICTs, Development, Tanzania

Enhancing Groundwater Management for Climate Resilience and Sustainable Water Supply in the Drylands of Tanzania

Kashaigili, J.J., Taylor, R.G., Kangile, J.R., Mosha, D.B. and Sanga, H.
Email: jkashaigili@sua.ac.tz

Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Groundwater is a critical resource for sustaining livelihoods, ecosystems, and agricultural productivity, especially in the dryland regions of Tanzania, where surface water availability is frequently inconsistent and unreliable. As the impacts of climate change become more pronounced — evident from rising temperatures, more erratic rainfall, intensified floods, and prolonged droughts — dependence on groundwater for water security is rapidly increasing. However, groundwater resources in these regions face growing pressure due to over extraction, inadequate management, and limited natural recharge. This presentation explores strategic approaches for enhancing groundwater management to strengthen climate resilience and promote sustainable water supplies in Tanzania's drylands. Drawing on ongoing and past research, case studies, and policy analyses, it explains key challenges affecting groundwater systems, which are declining water tables, deteriorating water quality, and governance challenges. An integrated management framework is proposed, emphasizing improved monitoring and data systems, adoption of water-efficient technologies, participatory governance that includes, for example, the protection of groundwater recharge zones through sustainable land use practices. This framework would also include the potential roles of managed aquifer recharge (MAR) and climate-smart agricultural practices in sustaining groundwater levels. Drawing from recent experience under the CLARITY project in the Dodoma Region, this presentation highlights the necessity of strengthening policy coherence, investing in local capacity development, and fostering multi-stakeholder collaboration for effective groundwater governance. It also recognizes explicitly the socio-economic importance of groundwater as a climate-resilient water supply for smallholder farmers and rural communities, who are most vulnerable to climate-induced water stress. By advancing sustainable groundwater management, Tanzania can enhance the adaptive capacity of its dryland populations, support national climate resilience and water security objectives, and protect vital water resources for future generations.

Keywords: Groundwater, climate resilience, water supply, dryland, adaptation

Impacts of Climate Change on Agricultural Water Scarcity Risk and the Effectiveness of Adaptation Strategies in the Kagera Sub-Basin

Nickson Tibangayukaa, Deogratias M. M. Mulungua, and Fides Izdoria
Email: nicktib@outlook.com

Department of Water Resources Engineering, University of Dar es Salaam, United Republic of Tanzania

Climate change is one of the major threats to agricultural water availability in many regions around the world. This study assessed agricultural water scarcity risk and prioritized adaptive management options in two catchments (Ngono and Mwisa) of the Kagera sub-basin. The agricultural water reliability scores were used to evaluate scarcity risk, while a multi-criteria decision analysis was used to rank adaptation options. In this study, 9 adaptation options, in addition to the baseline rainfed practice, were evaluated. Results show that current rainfed systems are highly vulnerable to future climate change impacts, with baseline resilience scores of 0.51 in Ngono and 0.42 in Mwisa projected to decline by up to 9.52% and 21.33%, respectively. In Ngono, the combination of adjusting the planting calendar and introducing supplemental irrigation could increase resilience by up to 68.13%, followed by a combination of mulching, planting date adjustment, and supplemental irrigation with a potential increase of 66.67%. In Mwisa, adjusting the planting calendar alone could improve resilience by up to 37.41%, while combining mulching with calendar adjustment could increase resilience by up to 38.18%. These findings are valuable for stakeholders and decision-makers in planning and implementing strategies to ensure adequate agricultural water supply, thereby supporting sustained agricultural productivity under the impacts of climate change. The insights from this study will also guide adaptation planning and policy development and provide a base for similar assessments within the region.

Keywords: climate change, agricultural water, adaptive management, Kagera sub-basin

Factors influencing the adoption of agricultural innovations Among smallholder farmers in Morogoro, Tanzania

Jackline M. Martine, Camilius A. Sanga and Philbert S. Nyinondi
Email: martinejackline12@gmail.com

Department of Informatics and Information Technology, Sokoine University of Agriculture, United Republic of Tanzania

The adaptation of agricultural innovations among smallholder farmers is important for enhancing productivity, sustainability, and resilience in face of solving agriculture challenges. Study adopts the Technology Acceptance Model (TAM) it helps to analyses how farmers perceive the introduced innovation and what aspects of these innovation influence their willingness to adopt them. This study examines the factors influencing the adoption of agricultural innovations to smallholder farmers in Morogoro, Tanzania. The study employed quantitative research design through structured questionnaires with 402 smallholder farmers from nine (9) wards in three districts in Morogoro. Result was collected through questionnaire and respondent selected purposively. The result show that perceived usefulness, perceive ease of use, and social capital significantly impact farmers wiliness to adopt innovations, while most farmers identify the benefits of new innovation in Improving crop yield and income but there are barriers such as inadequate extension services, financial constraints and digital illiteracy hinder widespread adoption of agriculture innovation. The study recommends to strengthen institutional supports, enhancing famers training programs and fostering collaboration between research institutions and farmers to facilitate adoption of agriculture innovations which contributing to sustainable agriculture development in the region.

Keywords: Agriculture innovation, adoption of technology, Sokoine University of Agriculture, smallholder farmer's adoption factors, Morogoro

Strengthening Large-Scale Food Fortification (LSFF) Data Ecosystems in Kilifi County Kenya

Denis Owiti, Dr. Isabella Iseme
Email: omondi.owiti@aku.edu

Population Health, Aga Khan University, Nairobi, Kenya

Introduction: Micronutrient deficiencies remain a major contributor to malnutrition in Kenya, with Kilifi County experiencing some of the highest rates of stunting (37%) and anemia (54%) nationally. Despite Kenya's mandatory food fortification policies, monitoring systems at the county level are fragmented, with siloed datasets, irregular reporting cycles, and limited capacity for enforcement. This project aims to design and implement a centralized, AI-enabled Large-Scale Food Fortification (LSFF) data ecosystem to strengthen real-time monitoring, regulatory oversight, and evidence-based decision-making in Kilifi County. Materials and Methods: This initiative is a phased, three-year systems project that will begin with mapping existing data workflows, stakeholder analysis, and digital infrastructure assessment. Findings will inform the development of a cloud-based platform integrating fortification compliance audits, laboratory assay results, production and supply-chain data, and household consumption survey.

Keywords: Large-Scale Food Fortification, Micronutrient Deficiency, Data Ecosystem, Kilifi County, AI Analytics.

What is it Like to Be a Single Parent and How Does it Impact Children? A Case in Kibaha Town, Tanzania

Ambi Juma Chogo and Emilia Halton-Hernandez
Email: ambi.chogo@sua.ac.tz

Department of Human Nutrition and Consumer science, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Considering the notion of emotional, social, economic, and psychological stresses that affect a family's well-being, single mothers make up the most disadvantaged population. Single mothers are especially susceptible to the negative consequences of numerous responsibilities within and outside their households. Therefore, this study examines the emotional, psychological, social, and economic impacts of children raised in single-mother' households. Phenomenological research techniques were employed qualitatively to investigate the real-life experiences of single mothers in two designated wards in Kibaha Town, Tanzania: Mailimoja and Pangani. By analyzing the participants' perspectives of their circumstances, the phenomenological research approach was employed to gain a deeper understanding of the participants' experiences. The sample of eight (08) single mother participants with children below eighteen (18) years old was selected using snowball sampling. The data was collected using a semi-structured interview followed by open-ended questions that allowed respondents to speak freely and allowed me to probe further into their first responses to obtain a more thorough response on a particular subject. Thematic analysis was used to analyse data, and responses were classified according to themes and patterns found in the data. The results of this study showed that most single mothers encountered significant challenges, including financial and social stigma, and both mothers and children suffered emotionally and psychologically. Despite some positive personal growth, they often lack professional and government support, particularly when seeking emotional help. These findings intend to inform policymakers, educators, service providers, psychologists, other researchers, and the government, encouraging them to provide better support for single mother and their families.

Keywords: Single mothers, Children, Households, and Government.

Gendered Dynamics in Land Use Decision-Making: Insights from Rural Tanzania for Sustainable Food Systems

Victoria Kariathi, Eward Mushi, Hadijah Mbwana, and Constance Rybak
Email: vkariathi@gmail.com

Department of Human Nutrition and Consumer science, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Introduction: Achieving minimum dietary diversity is challenging for rural Tanzanian households. The demand for commercial products pushes farmers to shift from diverse subsistence farming to cash crops, reducing food availability and diet variety, which worsens food insecurity and malnutrition. Although crop diversity is vital for food security, little research explores how gender roles influence diversification efforts. Objective: This study investigates how gender dynamics in land use decision-making affect crop diversity, aiming to support more inclusive, nutrition-focused policies. Methodology: This cross-sectional study included 348 rural households from two wards in Mkuranga District, Pwani region, Tanzania. The participants were household heads or other adults responsible for land resource decisions. Information on workload distribution, decision-making power, and land resource benefits was collected using the Harvard Gender Analytical Framework. Social and demographic data were gathered through a semi-structured questionnaire to explore perspectives on gender roles and land use. Data analysis was performed using Stata software version 15. Linear regression analysis examined the relationship between gender roles in agricultural practices and crop diversity. Results: The findings showed that shared access to land resources between males and females has a negative and significant impact (β = -1.28, p = 0.006) on crop diversity. In contrast, joint decision-making power over land resources significantly increased (β = 1.176, p = 0.005), leading to higher crop diversity. Both males (β= 1.232, p=0.005) and females (β= 1.091, p=0.038) individually benefiting from agricultural land resources significantly boost crop diversity. Additionally, crop diversity notably improves (β= 0.895, p=0.051) when females have control over land resources. Conclusion: These results emphasize the role of gender in influencing crop diversity to improve food security. Tackling gender disparities in agriculture and land use decision-making could increase crop diversity and boost household dietary variety in rural areas.

Keywords: Crop diversity, food security, gender dynamics, land use, rural, Tanzania

Assessment of Cedrela Odorata Seeds Dispersal Patterns in Kimboza Nature Forest Reserve

Hyasinta Shirima, Diana Tesha and Charles Kilawe
Email: diana.tesha@sua.ac.tz

Department of Ecosystems and Conservation, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Invasive species including Cedrela odorata are characterized with the rapid and substantial spatial coverage. The mechanism of the dispersal and spread of this species remain untold, therefore this study investigates the seed dispersal patterns of the invasive tree species Cedrela odorata within Kimboza Nature Forest Reserve (KNFR), Tanzania. C. odorata is known for its aggressive spread primarily through wind dispersal which threatens native biodiversity and forest structure. The research employed a purposive sampling approach with a total of 6 mother trees selected randomly where for all 6 mother trees, seed and seedling densities were recorded at various distances (10–50 meters) and 8 cardinal directions. Results showed that seed dispersal and seedling density varied significantly with both distance and direction. While the number of seeds increased with distance up to 50 meters, seedling density followed a different trend, decreasing from 10m to 30m but rising again at 40m and 50m, likely influenced by microhabitat conditions and nearby seed sources. Dispersal patterns were strongly affected by wind direction, slope, and forest canopy structure. The findings highlight C. odorata high dispersal efficiency and its dominance across disturbed forest areas, especially post-disturbance sites such as those affected by fires and logging. These dynamics pose serious ecological challenges, as the species competes with and displaces native vegetation, including critical habitats like Pandanus kirkii groves which are essential for endemic species. The study underscores the need for urgent management interventions including fire control, seedling removal, and enrichment planting with native species. By revealing the species' dispersal behavior, the study provides a foundation for targeted conservation strategies to control its spread and preserve the ecological integrity of KNFR.

Keywords: Invasive species, Seed dispersal

Conference Theme 3

Technological Innovation, Environmental Integrity and Climate Change

KEYNOTE SPEAKER

Community-Centered AI Tool for Environmental Surveillance: Battling Mosquito Breeding in the Face of Climate Change

Dr. Devotha Nyambo (NM-AIST)

Predicting tree species distribution using MaxEnt model. A case study of Mazumbai Forest Reserve, Tanzania

Sarafina Masanja, Japhet Safiel and Deo Shirima
Email: sarafina.masanja@sua.ac.tz

Department of Ecosystems and Conservation, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Tropical montane rainforests are globally significant biodiversity reservoirs, yet climate change, habitat fragmentation, and human pressures increasingly threaten their ecological integrity. The Mazumbai Forest Reserve, part of Tanzania's Eastern Arc Mountains is recognized as a biodiversity hotspot hosting high levels of endemism, but the relative roles of climatic, topographic and edaphic factors in shaping species distribution remain poorly understood. This study pioneers a high-resolution, plot-based approach to model the distribution of the five most dominant tree species (Ocotea usambarensis, Syzygium guineense, Parinari excelsa, Newtonia buchananii, and Dicranolepis usambarica) by integrating extensive field inventory data with climate, topography and soil variables using the Maximum Entropy (MaxEnt) algorithm. Beyond assessing current distributions, the study identified priority environmental drivers, quantify species-specific niche sensitivities and highlight potential conservation zones under climate-sensitive conditions. Results showed that climatic factors especially annual mean temperature and precipitation dominate distribution patterns (>50% contribution), with topography providing secondary influence. The high predictive performance (AUC = 0.78–0.92) and species-specific response curves revealed contrasting niche breadths, indicating differential vulnerability to climate change. This research provides the first species–environment modelling baseline for Mazumbai Forest Reserve and offers a transferable framework for conservation planning in other tropical montane systems. Future application of this approach to climate change scenarios could inform adaptive management, forest zoning and biodiversity offset strategies across the Eastern Arc range.

Keywords: Species Distribution Modelling, Conservation Prioritization

Transformative Agritech through AI and Sensor-Driven Innovations

Woo Soo Kim
Email: woosook@sfu.ca

School of Mechatronic Systems Engineering, Simon Fraser University, Surrey, Canada

This talk will discuss cutting-edge innovations in agritech, highlighting 3D printed sensing systems with physical AI that are set to revolutionize the agricultural landscape. We will explore the R&D outcomes from SFU's Additive Manufacturing Lab, where agritech technologies serve as critical elements for transformative change. Discover the potential of technologies such as 3D-printed environmental sensors, designed to optimize agricultural resource allocation using AI algorithms. Also, we will cover the topic of drone-based image analysis algorithm to extract plant information, supporting sustainable resource management. The discussion will also include weed managing robotics, which are ushering in a new era of precision agriculture and innovative crop protection techniques. We discuss Canadian agritech innovations where sensors and robotics propel agriculture into a more sustainable, productive, and secure future.

Keywords: Physical AI, sensor, robot, drone, deep learning

From Shelf to Impact: Enhancing Postgraduate Research Utilization through the NMU Innovation Hub

Mussa Ally Dida
Email: mussa.ally@nm-aist.ac.tz

School of Computational and Communication Science and Engineering, Nelson Mandela African Institution of Science and Technology, Arusha, Tanzania

A significant proportion of postgraduate research and innovations often remain underutilized, primarily due to fragmented development processes, limited industrial engagement, and the lack of community feedback mechanisms. To address this challenge, the NMU Innovation Hub was developed as a digital platform for archiving both software and hardware-based research outputs while fostering collaboration among researchers, innovators, industry experts, and the wider community. The system enables users to securely archive their projects, access peer and expert feedback, and promote stronger links between academia and industry. The platform integrates a web application, a mobile application, and an administrative dashboard, all designed with emphasis on accessibility, usability, and data integrity. Its backend was developed using Node.js with Express and PostgreSQL, while the frontend employed React.js for the web interface and Flutter for the mobile application. Security was ensured through SSL encryption and JWT-based authentication. User acceptance testing was conducted with 50 participants including students (30), faculty members (8), industry experts (5), and system administrators (7). Results showed that 96% of users found the system intuitive and user friendly. The findings demonstrate that the NMU Innovation Hub has strong potential to transform how postgraduate research outputs are managed and utilized. By streamlining archiving, ensuring secure access, and enabling constructive feedback from both academia and industry, the platform bridges critical gaps that often hinder innovation from progressing beyond the university shelf and contributes to strengthening the research and innovation ecosystem of higher learning institutions and offers a scalable model for enhancing industrial collaboration and societal impact.

Keywords: Web and mobile platform, postgraduate research outputs, archiving and retrieval system, improving innovation ecosystem

Monitoring Nutrients Pollution and Climate Change Effects in Lake Tanganyika Coastal Waters using Citizen Science Approach

Happiness A. Moshi, Daniel A. Shilla, Ismael Kimirei, Catherine O'Reilly, Bernhard Wehrli, Benedikt Ehrenfels and Steven Loiselle
Email: happiness.moshi@aku.edu

Arusha Climate and Environmental Research Centre, Aga Khan University, Arusha, United Republic of Tanzania

Several studies in Lake Tanganyika have effectively employed traditional methods to explore changes in water quality in open waters; however, coastal monitoring has been restricted and sporadic, relying on costly sample and analytical methods that require skilled technical staff. This study aims to validate citizen science water quality collected data (nitrate, phosphate and turbidity) with those collected and measured by professional scientists in the laboratory. A second objective of the study was to use citizen scientist data to identify the patterns of seasonal and spatial variations in conditions of nutrient pollution and forecast potential changes based on expected changes in population and climate (to 2050). The results showed that the concentrations of nitrate and phosphate measured by citizen scientists nearly matched those established by professional scientists, with overall accuracy of 91% and 74%, respectively. For total suspended solids measured by professional and turbidity measured by citizen scientists, results show that, using 14 NTU as a cut-off, citizen scientist measurements of Secchi tube depth to identify lake TSS below 7.0 mg/L showed an accuracy of 88%. In both laboratory and citizen scientist-based studies, all measured water quality variables were significantly higher during the wet season compared to the dry season. Climate factors were discovered to have a major impact on the likelihood of exceeding water quality restrictions in the next decades (2050), which could deteriorate lake conditions. Expanding citizen science to more communities on the context of environmental monitoring would raise environmental awareness, inform management and mitigation activities, and aid long-term decision-making.

Keywords: Citizen science, Climate change, Lake Tanganyika, Nitrate, and Phosphate

Dendroanatomy – A Potential Tool for Understanding Climate Variability in Tanzania

Sami D. Madundo, Tulloh Y. Zahabu and William S. Mduma
Email: sami.madundo@sua.ac.tz

Department of Forest Engineering and Wood Sciences, Sokoine University of Agriculture, United Republic of Tanzania

Background and Objectives: Tree rings have long been used in temperate regions to reconstruct past climates, yet their potential in tropical Africa remains largely untapped. In montane ecosystems such as Tanzania's Eastern Arc Mountains, understanding tree growth responses to climate could provide a greater understanding for climate-resilient forest management. Studies from other tropical African highlands show that certain species form annual or seasonally influenced rings, enabling reconstructions of rainfall patterns, drought frequency, and forest responses to climate variability. This study aimed to assess the dendroanatomical characteristics of Podocarpus usambarensis and Ocotea usambarensis to evaluate their suitability for such analyses. Methodology: Xylarium samples originating from Magamba Nature Forest Reserve were prepared for microscopic examination following standard wood anatomical procedures. Observations were made using a compound light microscope at multiple magnifications. Growth ring boundaries, axial parenchyma distribution, vessel arrangement, and ray structure were documented. Quantitative measurements of tracheid/vessel diameters, wall thickness, vessel frequency, and ray dimensions were taken using ImageJ software. Key Results and Findings: P. usambarensis showed distinct earlywood–latewood transitions, apotracheal scanty axial parenchyma, homocellular uniseriate rays (5–9 per mm), mean tracheid diameter of 24.1 ± 10.6 μm, and wall thickness of 2.2 ± 0.6 μm. O. usambarensis was diffuse-porous, with vessels in radial multiples of 2–3, latewood bands of radially flattened fibres, vasicentric parenchyma, heterocellular multiseriate rays (4–7 per mm), mean vessel diameter of 152.1 ± 26.8 μm, and 8–15 vessels/mm². Both species showed ring structures suitable for dendrochronological study, with P. usambarensis having clearer and more consistent ring boundaries. Conclusion and Implications: This work provides the first anatomical evidence for the dendrochronological potential of these Tanzanian montane species. Establishing such species as climate proxies could open new pathways for reconstructing historical climate variability in Tanzania, supporting adaptive conservation and climate-resilient forest management.

Keywords: Dendroanatomy; Climate resilience; Growth rings; Eastern Arc Mountains; Tanzania

Utilizing plant extracts on biosynthesis of silver-zinc oxide-activated carbon: A case study of Launaea cornuta (Wild lettuce)

Elizabeth Makauki, Mwemezi Rwiza, Revocatus Machunda, Onita D. Basu
Email: elizabeth.makauki@nm-aist.ac.tz

School of Materials Energy Water and Environmental Sciences, Nelson Mandela African Institution of Science and Technology, Arusha, United Republic of Tanzania

Over 2 billion people worldwide are challenged on access to improved quality drinking water, a pivotal human right and a fundamental aspect of human dignity. Silver zinc oxide nanocomposites, Ag-ZnO NCs, a strong antimicrobial agent has gained attention with point-of-use water treatment to provide access to safer water especially in the marginalized societies. Traditional synthesis of Ag-ZnO NCs includes harsh chemical matrices as such the quest to synthesize safe and non-hazardous Ag-ZnO NCs demands the use of green biosynthesis approaches. In this research, Launaea cornuta (Wild Lettuce) leaf extract was used as a source of biochemicals to biosynthesize Ag-ZnO NCs. The synthesized Ag-ZnO NCs were impregnated in water hyacinth activated carbon for a controlled release of the NCs during water treatment. The total phenolic content was 11044 ± 63 μg/g while the total antioxidant content was 44112 ± 894 μg/g ($p < 0.05$) under 50% EtOH. The crystalline nature of Ag-ZnO NCs was confirmed by XRD analysis with 21.51 nm average particle size. The SEM and TEM images demonstrated formation of spherical shaped nanocomposites with a successful doping of Ag into ZnO. The Ag-ZnO NCs impregnated in AC further suggested an increase of surface area on activation creating more surface for Ag-ZnO NCs impregnation. The antibacterial activity of Ag-ZnO NCs indicated high microbial inhibition zone of inhibition for E. coli (21 ± 1.08 mm) and S. aureus (19.67 ± 0.47 mm). The Ag-ZnO-AC NCs ZOI were 14.00 ± 0.37 mm on E. coli and 17.33 ± 0.36 mm on S. aureus p value.

Keywords: Biosynthesis, green synthesis, plant metabolites, water treatment

Assessment of Woody Species Diversity and Structure in Natural Forest Patches at Sao Hill Forest Plantation in Mufindi District, Tanzania

Sanga Yaeli Yohana and Ezekiel Edward Mwakalukwa
Email: ezedwa@sua.ac.tz

Department of Ecosystems and Conservation, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Establishment of forest plantation is often at the cost of existing natural forests hence threatening the existence of natural biodiversity. However, the extent of this effect to the existing woody plant species in most of the government forest plantations in Tanzania has not been quantified posing challenges on its conservation. This study assessed woody plant species diversity and structure in natural forest patches found within Sao Hill Forest Plantation located at Mufindi District, Tanzania. Using systematic sampling design with 50 concentric circular sample plots which were established across various natural forest patches within Sao Hill Forest Plantation, data were collected on species name, count of each species, diameter at breast height, and all sign of human activities. Results recorded 2,480 individual trees comprising of 73 species which belongs to 35 plant families. The two species of Julbernardia globiflora and Brachystegia spiciformis were noted to be dominant confirming the dominant vegetation type to be miombo woodlands. The Shannon-Wiener diversity indices were 2.73 for adults (Dbh ≥5cm) and 3.18 for regenerants (Dbh <5cm), indicating high species diversity, while the Simpson diversity indices were 0.12 and 0.08 respectively. Mean stem density for adults was 740±307 stems/ha, and 14,771±7,749 stems/ha for regenerants, while mean basal areas were 7.32±3.03 m^2/ha and 0.78±0.45 m^2/ha, respectively. The distribution patterns indicated active regeneration and recruitment, reflecting sustainable forest dynamics. The study highlights the ecological significance of these patches in biodiversity conservation within plantation mosaic landscapes, emphasizing the need for integrated management to balance forest plantation with biodiversity conservation in the Sao Hill Forest Plantation.

Keywords: biodiversity loss, commercial forestry, government plantations, Miombo woodlands, mosaics landscapes

Effects of Climate Variability and Change on Streamflow in the Bubu River Catchment, Tanzania

January J. Mlomo, Festo R. Silungwe, Japhet J. Kashaigili
Email: mlomo1997@gmail.com

Department of Civil and Water Resources Engineering, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

The Bubu River Catchment in central Tanzania is vital for regional water security, particularly with the planned Farkwa Dam. This study aimed to assess historical (1971–2024) and projected (2025–2070) hydroclimatic variability to support water resource planning. Using historical data and future climate projections under the RCP 8.5 scenario, machine learning models, XGBoost, Random Forest, LightGBM, and CatBoost, were applied to simulate streamflow. Among these, XGBoost performed best (NSE = 0.96, RRMSE = 3%). Feature importance analysis revealed day-of-year, lagged temperature, and evaporation as the most influential variables, indicating strong seasonal controls and catchment memory effects. Historical analysis showed marked wet and dry seasons, with streamflow dominated by subsurface and delayed flows, as reflected by the weak correlation with rainfall (r = 0.12). Future projections highlight evaporation as a key hydrological driver (r = 0.70), underscoring the growing influence of evapotranspiration under climate change. Streamflow is expected to remain mostly below 5 m^3/s, with periodic peaks exceeding 150 m^3/s, indicating persistent seasonal variability and vulnerability to extremes. These findings demonstrate the catchment's sensitivity to climatic shifts and the utility of data-driven models in capturing complex hydrological dynamics. It is recommended that climate-informed modelling be incorporated into adaptive water resource management and dam planning to enhance long-term water supply resilience in the face of changing hydroclimatic conditions.

Keywords: Climate Change, Hydrological Modelling, Streamflow Projection, Machine Learning, Climate Adaptation, eXtreme Gradient Boosting (XGBoost)

Heatflation and Food Security: Unpacking the Double Burden of Climate and Trade Shocks in African Food Systems

Bashir Adelodun, Tammara Soma, Emmanuel Sulle
Email: bashir.adelodun@aku.edu; adbash2008@gmail.com

Arusha Climate and Environmental Research Center, Aga Khan University, Arusha, United Republic of Tanzania
School of Resource and Environmental Management, Simon Fraser University, Burnaby, Canada

Climate change and trade policy jointly shape food security outcomes in Africa, a region highly exposed to climatic extremes and dependent on both domestic production and cross-border food flows. Heatflation, a food price inflation driven by rising temperature and heatwave, represents a critical but underexplored dimension of climate–food system interactions. This study examines whether climate stress and trade exposure act jointly to influence food prices ("heatflation") and food supply growth using a panel of 38 African countries over 21 years (2001–2020) with annual data of consumer food price index, climate extreme, and trade policy. Climate indicators include number of hot days (T-max > 35°C), drought indices (SPEI), and profile soil moisture. Trade policy measures agricultural trade openness. Common-Correlated Effects Autoregressive Distributed Lag Models (CS-ARDL/ECM) with country and year fixed effects were employed. Further, structural estimates with Dumitrescu–Hurlin panel Granger tests (1–3 lags) and map subregional/country heterogeneity and cross-sectional averages were performed. The interaction of heat and trade openness has short-run predictive for inflation at lag 1, consistent with near-term "heatflation" amplification in more trade-exposed markets. Policy incidents such as export bans are associated with short-term protection for domestic consumers but long-run amplification of price volatility. These results highlight the synergistic role of environmental and policy factors in shaping food system resilience. Addressing heatflation requires not only climate-smart agricultural adaptation but also flexible and cooperative trade policies that prevent amplification of local shocks. Recognizing the dual pressures of climate variability and policy constraints provides a more comprehensive framework for understanding food system vulnerability and mitigating food insecurity in Africa.

Keywords: Heatflation, Climate change, Trade policy, Food systems, Africa

Green valorization of selected invasive plant biomass into cellulose feedstock for the fabrication of biodegradable cellulose-based superabsorbent polymers

Joshua A. Oyetade, Abigail Nason, Lilian Mulimi Adeyemi O. Adeeyo, Revocatus L. Machunda

Email: oyetadej@nm-aist.ac.tz

School of Materials Energy, Water and Environmental Sciences, Nelson Mandela African Institution of Science and Technology, Arusha, United Republic of Tanzania

The aggressive growth and uncontrolled spread of invasive plant species have posed significant ecological concerns both on terrestrial and aquatic ecosystems, with consequent loss in biodiversity and disruption of the native ecosystem. At the same time, there has been significant demand for biomaterials, especially cellulose sourced from lignocellulosic biomass as feedstock for the development of advanced materials. Thus, the study explores the valorization of invasive lignocellulosic plant species as an appreciable alternative for cellulose feedstock and for the development of advanced hybrid materials called cellulose-based super absorbent polymers (CB-SAPs). The study developed an amalgamated product consisting of extracted cellulose from Venezuelan treebine, coupled in situ with polyacrylic acid for the fabrication of CB-SAPs. The methods investigated cellulose loadings (0.5–2.5 wt%) with initiator (0.25–0.75 g) and crosslinker (0.05–1.5 g) amount while evaluating the conditions such as pH (3–11) and salt in various solutions (NaCl, $CaCl_2$, $AlCl_3$). Analysis of the plant's constituents shows high lignin (38.56%), hemicellulose (28.85%) and cellulose (16.64%) content. Microscopic imaging revealed a porous and sponge-like architecture for the cellulose and a lamella-layered morphology for CB-SAP, while the optimal water absorbency (83.05 g/g) occurred at pH 7 with 1 wt% cellulose. The salt solutions, particularly with multivalent ions, reduced absorbency and higher initiator and crosslinker levels also decreased performance. Thus, the study developed hybrid CB-SAPs with appreciable absorbency and degradability fit for applications in personal care products and medicine. Also, the study harnesses the valorization of invasive plant species using green infrastructure for product development while protecting the natural ecosystems.

Keywords: Invasive plants, valorization, cellulose, polymers, fabrication

Safeguarding the Lifeline of the Mara: Harnessing Biodiversity Conservation and Ecosystem Management for Sustainable development in Mara River Catchment, Tanzania

Safia M. Basawadi, Beatus Temu, Makarius C.S. Lalika
Email: saffiamohamed26@gmail.com

Department of Forest and Environmental Economics, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

The Mara River Catchment is a critical ecological corridor that supports globally significant biodiversity and sustains pastoral and rural livelihoods. However, the catchment faces unprecedented threats from habitat degradation, overexploitation of resources, deforestation, and weak cross-border management. Despite various conservation interventions, gaps remain in integrating local ecological knowledge, cross-sectorial coordination, and sustainable rural livelihoods into basin-wide ecosystem management strategies. This study assessed the role of biodiversity conservation and ecosystem management in nurturing sustainable development within the Mara River Catchment. Socio-economic data were collected through questionnaires, while ecological data were gathered via key informant interviews and focused group discussions. Socio-economic data were analyzed using SPSS, and ecological data were subjected to GIS for land-use analysis. Data on macro-invertebrates and riparian flora (key indicator species) were analyzed using diversity indices. Findings revealed that between 2000 and 2024, built-up area increased by 35.7 km², water bodies decreased by 3.2 km², vegetation declined by 43.5 km², bare soil increased by 30.2 km², firm land expanded by 31.5 km², and riparian species decreased by 24.4 km². This highlights a direct correlation between degraded riparian zones and reduced biodiversity, with significant implications for water quality, food security, and climate resilience. The study concludes that protecting the Mara River requires more than environmental regulations—it demands a holistic ecosystem approach that empowers local stakeholders as custodians of biodiversity. Sustainable development is achievable when biodiversity conservation is mainstreamed into land use, livelihoods, and governance systems.

Keywords: Mara River Catchment Biodiversity conservation, ecosystem management, ecosystem health, habitat degradation.

From Pixels to Prescription: A Multimodal Learning Approach for Automated Plant Disease Detection and Guidance in Tanzania

Kadeghe G Fue, Dickson Massawe
Email: kadefue@sua.ac.tz

Department of Agricultural Engineering, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Background: Crop diseases and pests pose a significant threat to global food security, causing substantial economic losses, particularly in developing regions like Tanzania. While early detection is crucial, it is often hampered by a lack of expertise in rural areas. This study addresses this challenge by developing an automated, multi-step system for crop disease identification and advisory, leveraging deep neural networks and multimodal learning.
Methods: We utilized a dataset of 10,274 images of common crops from the Morogoro region of Tanzania, including beans, tomatoes, and bell peppers, affected by various diseases. A Convolutional Neural Network (CNN) based on the VGG16 architecture was trained to classify crop diseases, achieving high accuracy through transfer learning and data augmentation techniques. This classifier was then integrated with a Large Language and Vision Assistant (LLaVA) to create an interactive advisory system capable of providing conversational explanations and management advice.
Results: The VGG16-based CNN classifier demonstrated strong performance, achieving an overall accuracy of 96.5% on the test set, with an average F1-score of 0.99 across all classes. The integrated LLaVA system successfully provided accurate and contextually relevant advice in qualitative tests. For example, when presented with an image of a bean leaf with Angular Leaf Spot, the system not only identified the disease but also offered actionable management strategies. An evaluation by an agronomy expert rated the system's responses with a correctness of 4.5/5 and helpfulness of 4.7/5.
Conclusion: This research demonstrates the successful development and integration of a high-accuracy CNN classifier with a multimodal AI assistant for plant disease identification and advisory. The system offers a promising, low-cost solution to support smallholder farmers in making timely and informed decisions, thereby reducing crop losses and enhancing food security. Future work will focus on expanding the dataset, incorporating multilingual support, and deploying the system for field trials to measure its real-world impact.

Keywords: CNN, MultiModal, Vision Assistant, Crop Diseases

The Role of Digital Influencers and Online Communities in Shaping Climate Change Discourse and Environmental Behaviour Among Secondary School Adolescents in Morogoro Municipality, Tanzania

Jamal Jumanne Athuman
Email: jamal@sua.ac.tz

School of Education, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

This study examined the role of digital influencers and online communities in shaping climate change discourse and promoting pro-environmental behaviours among secondary school adolescents in Morogoro Municipality, Tanzania. A total of 220 students (51.8% female, 48.2% male) from four purposively selected schools—Tusikamane, Kihonda, Nanenane, and Mgulasi—were surveyed using a structured, self-administered questionnaire. The study employed a mixed-methods design, integrating quantitative analysis via SPSS and qualitative thematic analysis. Findings revealed substantial engagement by digital influencers in climate advocacy, with 67% of analyzed influencer posts addressing environmental themes such as deforestation (22%), plastic pollution (18%), and youth activism (16%). Regression analysis indicated that frequency of influencer exposure significantly predicted higher climate knowledge ($\beta = 0.38$, $p < 0.001$). Communication strategies emphasizing Kiswahili, consistent posting, and localized storytelling were significant predictors of perceived influencer credibility, explaining 34.7% of the variance ($R^2 = 0.347$, $F(3,216) = 41.06$, $p < 0.001$). Chi-square analysis revealed a strong association between high influencer credibility and reported environmental action ($\chi^2(2) = 12.65$, $p = 0.002$). Binary logistic regression showed that students rating influencers as highly credible were 2.82 times more likely to adopt eco-friendly practices (OR = 2.82, 95% CI [1.42–5.61], $p = 0.003$). Qualitative insights highlighted active peer-to-peer amplification through WhatsApp groups, eco-club collaborations, and user-generated content such as memes and short videos. Challenges identified included limited internet access, high data costs, English-only content, and a lack of locally relevant examples. Opportunities included integrating Kiswahili-based content, gamified school campaigns, and recognition of youth digital climate champions. The results underscore the potential of social media influencers as informal educators, capable of fostering climate literacy and behavioural change among adolescents.

Keywords: Digital influencers, Climate change communication, Online communities, Digital Platforms

Predicting Evapotranspiration Parameters in Tanzanian Irrigation Schemes: A Competitive Analysis of GraphCast, Pangu, SFNO, and DLESyM

Kadeghe Fue,
Email: kadefue@sua.ac.tz

Department of Agricultural Engineering, Sokoine University of Agriculture, Tanzania

Introduction: Efficient water resource management is paramount for enhancing agricultural productivity and ensuring food security in Tanzania. Reference evapotranspiration (ETo) is a critical agrometeorological parameter that governs irrigation scheduling. However, accurately forecasting the input variables for the FAO-56 Penman-Monteith ETo equation—such as temperature, solar radiation, humidity, and wind speed—remains a significant challenge due to the sparse distribution of ground-based weather stations. The advent of sophisticated AI-driven weather prediction systems presents a transformative opportunity. This study provides a comprehensive comparative analysis of four state-of-the-art models: GraphCast Operational, Pangu-Weather (6-hour), FourCastNet (SFNO), and the Deep Learning-based Ensemble System for Meteorology (DLESyM), to assess their utility and competitive performance in predicting ETo parameters across ten key irrigation areas in Tanzania.

Methods: The study was conducted across ten major irrigation schemes, representing the diverse agro-climatic zones of Tanzania. Forecast data for maximum and minimum temperature (T_{max}, T_{min}), incoming solar radiation (R_s), relative humidity (RH), and wind speed (u_2) at a 10m height were extracted from each of the four models for the 2024 growing season. These predictions were validated against ERA5 dataset from Copernicus Climate Data Store. The performance of each model was quantitatively evaluated using standard statistical metrics, including the Root Mean Square Error (RMSE), Mean Absolute Error (MAE), and the Coefficient of Determination (R^2). The competitive analysis also considered the operational aspects, such as forecast lead time and computational accessibility.

Results: All four models demonstrated a high potential for operational use, though with distinct performance characteristics. GraphCast Operational consistently yielded the most accurate forecasts for air temperature (T_{max}, T_{min}) with an average RMSE below 1.1°C across all sites. Pangu-Weather exhibited superior performance in predicting short-term wind speed dynamics, a crucial component for the aerodynamic term in the ETo calculation. SFNO and DLESyM showed strong competitiveness, particularly in forecasting solar radiation, but displayed slightly higher biases in the humid, coastal irrigation schemes. Overall, GraphCast's 10-day forecast horizon offered the greatest strategic value for medium-term water allocation planning, while Pangu's high-resolution 6-hour updates were optimal for daily operational scheduling.

Conclusion: AI-based weather models can significantly improve the accuracy and lead time of ETo parameter estimation, thereby strengthening irrigation water management in Tanzania. No single model was found to be universally superior; the optimal choice is contingent on the specific meteorological parameter and the required forecast horizon. A hybrid approach, leveraging the strengths of each model, could provide the most robust solution for precise and climate-resilient irrigation scheduling across the nation. A hybrid model has been integrated to the backend of the Mwagilia App, a Tanzanian app used to advise farmers on irrigation scheduling.

Keywords: Reference Evapotranspiration (ETo), AI Weather Models, GraphCast, Irrigation Scheduling, Water Management, Tanzania

Conference Theme 4

Governance, Policies and Institutions

KEYNOTE SPEAKER

Role of policies and institutions in driving sustainable development: striking a balance between endogenous and AIs knowledges

Prof. Opportuna Kweka (UDSM)

Uncovering Policy and Institutional Gaps in Lablab Production Across Central and Northen regions of Tanzania and Lessons from Sub-Saharan Africa

Hadijah A. Mbwana, Victoria F. Gowele and Raphael T. Chibunda
Email: hadija27@yahoo.com

Department of Policy Planning and Management, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Lablab (Lablab purpureus) is a drought-tolerant, multipurpose legume with substantial potential to enhance food security, livestock nutrition, and climate resilience in smallholder farming systems. Despite its agronomic and ecological value, lablab remains underutilised and poorly supported by national agricultural policies in Tanzania. This study assessed the nature of institutional and policy support for lablab production, the challenges faced by smallholder producers, and comparative policy lessons from other sub-Saharan African (SSA) countries. A cross-sectional mixed-method approach was employed, involving structured surveys with 200 lablab farmers from Arusha, Manyara, Singida, and Dodoma regions, as well as four focus group discussions comprising 32 participants including male and female, Key Informant Interviews comprised by 22 participants from both government and non-government institute and document reviews. Results revealed that only 11% of farmers received any training or financial support, with regional disparities favouring Singida and Manyara. Major barriers included limited awareness (82.5%), complex application procedures (61.5%), and weak market linkages (94%). Policy analysis showed that Tanzania lacks formal recognition of lablab as a strategic crop, unlike Kenya and Ethiopia, where lablab is integrated into climate-smart and feed-related programmes. The study concludes that lablab production in Tanzania suffers from fragmented institutional support and insufficient policy prioritisation, constraining its potential to contribute to national agricultural and livestock development goals. The findings call for comprehensive policy reforms, investment in extension and seed systems, and integration of lablab into strategic national programmes. Strengthening support structures and enabling environments will unlock the crop's full potential for food-feed systems and rural resilience in Tanzania.

Keywords: Prickly pear, white sapote, indigenous fruits, nutrient composition, antioxidant activity, Tanzania, micronutrient deficiencies

Data-Driven Policy for Insecticide Resistance Management in Malaria Vectors in Tanzania Mainland

Theresia Estomih Nkya
Email: theresia.nkya@gmail.com

Department of Parasitology and Entomology, University of Dar es Salaam-Mbeya College of Health and Allied Sciences, Mbeya, United Republic of Tanzania

Background: Insecticide resistance (IR) in malaria vectors threatens the effectiveness of long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS) in Tanzania. Evidence-informed policy is essential to optimize resistance management and ensure sustainable malaria control. This study synthesizes national IR patterns, management strategies, and evidence gaps to support data-driven governance. Objective: To assess insecticide resistance patterns, management strategies, and evidence gaps in Tanzanian malaria vectors (2015–2024) to inform data-driven policy and governance. Methods: A scoping review of literature published between 2015–2024 was conducted using PRISMA-ScR guidelines. Databases were systematically searched for studies on IR patterns, surveillance practices, and management strategies. Data on vector species, resistance mechanisms, and intervention outcomes were extracted and analyzed to identify trends and policy-relevant gaps. Results: From 910 records, ten studies met inclusion criteria. Pyrethroid resistance was consistently reported, driven by knockdown resistance (kdr) mutations and metabolic mechanisms; DDT resistance was common, while carbamate resistance was moderate. Organophosphates (pirimiphos-methyl) and newer insecticides (clothianidin, chlorfenapyr) remained effective. Management strategies included pyrethroid–PBO nets, IRS rotation, and integrated vector management, yet surveillance coverage and mechanistic profiling were inconsistent. These findings reveal critical data gaps limiting evidence-based decision-making for IR management. Conclusions and Implications: Insecticide resistance is widespread among malaria vectors in Tanzania, particularly to pyrethroids and DDT. Strengthening routine surveillance, expanding mechanistic profiling, and implementing integrated vector management strategies are essential. The findings can inform national malaria control policies, guide insecticide selection, and optimize resistance management to sustain vector control effectiveness.

Keywords: insecticide resistance, malaria vectors, Tanzania, policy, data-driven decision-making

Re-Thinking Laws and Political Will for Inclusive and Climate-Resilient Society: A Review on Restored Balanced Duty on Environmental Conservation in Tanzania

Mectrida Bonephace
Email: meckyb06@gmail.com

Department of Policy Planning and Management, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

The government has reviewed the National Environmental Policy (the NEP) of 1997 for providing guidance and oversight on environmental management; particularly on achieving climate change resilience; an aspect of the policy which was an obvious lacuna. This is a review paper on an aspect of "inclusivity" of actors in confronting climate change impacts; tallied with other aspects such as the prevalence of laws and political will towards feasibility of the NEP. Today, there is a new NEP 2021 in place; whose formulation is motivating towards environmental management. According to the NEP 2021, climate change is attributed directly or indirectly to human activities that alter the composition of the global atmosphere. For this, the new NEP is commended for introducing an aspect of coordinated efforts among relevant actors; which ostensibly coordinates the efforts of human(s) in respect of tackling climate change impacts. Nevertheless, this review opines that, for the NEP 2021 to accomplish the mission on inclusive climate and resilient society, it takes what is not included in the NEP 2021. For instance, the dimensions of law(s) and political will are forgotten aspects; yet are the key aspects towards successful mission of the NEP 2021. It is common knowledge that policy missions and visions need a backup of enforceable legal instruments to 54aterialize. Nevertheless, the NEP 2021 has made the assumptions that legal intervention will be guided by the Environmental Management Act; which is a misnomer in law. This review reveals circumstances where laws and law-makers are likely to impede the efforts and sprits of inclusive environmental management and equally likely to obstruct the devotion(s) towards achieving climate change and resilient society. This review recommends issues to factor-in during policy formulation for feasible implementation of policy missions; the contrary of which renders the policy prone to impractical and remain just documentation.

Keywords: Actors, Political Will, Laws, Climate Change Resilience.

Diversity in farm production, household food security and women dietary diversity: results from a cross-sectional study among smallholders in rural Tanzania

Victoria F. Gowele
Email: vgowele@sua.ac.tz

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Background and objectives: The relationship between agriculture and nutrition is well recognized as diversified agricultural production can contribute to improved food and nutrition security. This study was undertaken to assess the agriculture and food security situation in the study areas in Kongwa, Chamwino and Bahi districts, in Dodoma region.
Methodology: A total of 630 households who were beneficiaries of the "Diverse Food System Project" in three districts of Kongwa, Chamwino and Bahi in Dodoma Region participated in this study. Diversity in farm production was determined using a prepared list of all foods produced in the target areas (cereals, roots, tubers, and bananas, legumes, seeds, and nuts, fruits, vegetables, fish, meat, eggs and milk-dairy products). Minimum Dietary Diversity for Women of Reproductive Age (MDD-W) was determined using 24-hour recall. Food security was assessed using the standardised Food Insecurity Experience Scale (FIES)-Tool administered to the head of the households.
Results: The overall Farm Production Diversity score was 3.9 indicating households produced nearly four different types of food groups. More than a half (53.7%) of Women of Reproductive Age (WRA) consumed less than 5 food groups. Food insecurity was experienced by 46.5% of the surveyed households. Relying on less preferred and less expensive foods (68.1%), reducing number of meals eaten (50.5%), engaged in casual labourer in both rural and urban areas (53.5%), consuming seed stock held for next season (46.7%) and limiting portion size at mealtimes (44.9%) were the coping strategies mostly employed by the households during food shortage.
Conclusion and implications: While farm production diversity contributes to improved dietary diversity and resilience, it is insufficient on its own to eliminate food insecurity. Addressing food insecurity requires a multifaceted approach that includes improving market access, economic opportunities, infrastructure, and nutritional education.

Keywords: Farm production diversity, dietary diversity, smallholders, rural, Tanzania

Unmasking the Role of Institutional Support and Information Access in Adopting Climate-Smart Agriculture in Mvomero District, Tanzania

Nyamsabhi M. Nyamwero, Michael Kadigi and Samwel J. Kabote
Email: nyamsabhin@gmail.com

Department of Policy, Planning and Management, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

This study examines the role of institutional support and climate information in influencing the adoption of Climate-Smart Agriculture (CSA) in Mvomero District, Tanzania. Empirical studies show an increasing effort to promote CSA technologies. Such technologies are critical for heightening resilience to climate change and agricultural productivity. However, adoption of CSA technologies among smallholder farmers is unimpressive in Sub-Saharan African (SSA) countries, including Tanzania. This study employed a cross-sectional research design and a survey method to collect data from a random sample of 267 smallholder farmers. To situate the study in a proper context, we used Institutional Theory and Diffusion of innovations Theory. The multivariate probit model was used to determine the influence of institutional support, particularly extension services, training, credit access, subsidies, tax incentives, and cooperative membership, and climate information access obtained through village meetings, awareness campaigns, and mobile phones. The results show that institutional support and climate information played a critical role in the adoption of CSA technologies. CSA technologies, such as intercropping and organic fertilisers, demonstrated strong complementarities, whereas others, like irrigation and crop rotation, exhibited trade-offs. These results imply that smallholders adopt CSA Technologies in bundles rather than in isolation due to compatibility and resource constraints. The study concludes that scaling up the uptake and adoption of CSA technologies requires institutional and information interventions that are responsive to local contexts. Policies should prioritise bundled technologies, strengthen rural extension and credit systems, and expand access to digital advisory services such as mobile-based services to bolster climate resilience among smallholder farmers in Mvomero district.

Keywords: Institutional Support, Climate-Smart Agriculture, Multivariate probit model, and Climate Information Access

Situational Analysis of the Honeybee Products Market in Tabora Region in Tanzania

Mnkeni, H. and Makindara, J
Email: mnkenih@gmail.com

Department of Natural Resources Management and Conservation, Sokoine University of Agriculture, Mpanda, Katavi, United Republic of Tanzania

This study assessed the market of honeybee products in Tabora Region, Tanzania. The overall objective of the study was to assess the status of the honeybee products market in Tabora Municipality and Sikonge District in the Tabora Region. Specifically, the study was guided by the following objectives: i) assessing the structure of the honeybee products market in Tabora Municipality and Sikonge District, ii) examining the conduct of the honeybee products market in the study area, and iii) determining the performance of the honeybee products market in the study area. The study was guided by the Structure–Conduct–Performance (SCP) framework and agricultural marketing theory. A descriptive research design was adopted, whereby 60 respondents were interviewed using structured questionnaires and key informant interviews. The market structure is highly concentrated: traders 75%, producers 16.7%, mixed actors 8.3%. The HHI score of 5972.22 indicated dominance by few actors. Regarding conduct, 70% applied market-driven pricing, 24.29% negotiation-based, and 5.71% fixed pricing. Over 52% of transactions lacked formal contracts. Quality standards were recognized by 85%, enforced by SIDO (48.3%), TFS (45%), and TBS (36.7%). Market entry barriers were absent for 73.3%, but 26.7% reported constraints. Performance was moderately positive: 65% "somewhat profitable," 10% "very profitable." Sales trends: 46.67% slight growth, 28.33% significant increase, 25% stable. Price fluctuations affected 65%, and access to larger markets was hampered by poor infrastructure (34%), regulatory challenges (25.18%), and high transport costs (21.58%). From the findings, it can be concluded that honeybee products market shows potential for growth and profitability but is constrained by concentration, informal practices, and inconsistent pricing. Strategic interventions include promoting formal contracts, structured pricing, and supporting producer cooperatives to improve bargaining power and market reach are recommended to improve the situation.

Keywords: Honeybee products, market structure, SCP framework, agricultural marketing, Tanzania.

Conference Theme 5

Sustainable Agriculture and Food Systems

KEYNOTE SPEAKER

Towards Agroecology Intensification for Sustainable Agriculture, Food Systems and Nutrition in Tanzania: An Overview

Prof. Kallunde Pilly Sibuga (SUA)

The Need for a Right to Food Approach: Transforming the food system by addressing the root causes of food loss on farms

Tammara Soma, Rajiv Kozhikode, Rekha Krishnan
Email: tammara_soma@sfu.ca

School of Resource and Environmental Management, Simon Fraser University, Burnaby, Canada

Reducing food loss is key to improving farmers' economic well-being and the sustainable management of water, energy, labour, and other resources. To develop appropriate solutions, we seek to identify the reasons for farm-level, post-harvest losses, and more specifically, why edible food intended for human consumption does not reach the intended recipients and remains unharvested in British Columbia, Canada. The study also explores the barriers to adopting solutions such as gleaning, food donation tax incentives, and selling "ugly" fruits and vegetables. We conducted forty interviews with farmers and stakeholders in the food and agricultural industry and found issues of overproduction due to power imbalances, gaps in infrastructure, rejected produce due to stringent aesthetic values, precarious labour, and economic and environmental reasons for farm-level losses. In this paper, opportunities to address food loss are also identified by farmers and other agri-food stakeholders. Drawing from practice theory, a wide array of structural factors beyond the farmers' control often limits their scope for reducing food loss. As such, focusing exclusively on changing farmers' practices is unhelpful. Recommendations from this study include investing in processing infrastructure, connecting farmers with alternative markets such as "farm to school" programs, focusing on the "food as a right" paradigm, and revising policies such as the current donation tax incentives in Canada, which fail in the long term to benefit many farmers and food-insecure households. Findings from this study may inform post-harvest policies in other jurisdictions.

Keywords: Food loss, Food surplus, Practice theory, Food waste, Post-Harvest Loss Right to food

Socio-economic determinants, production trends, and variability of legume yields among smallholder farmers in semi-arid Mkalama District, Tanzania

Sanga Yaeli Yohana and Ezekiel Edward Mwakalukwa
Email: ezedwa@sua.ac.tz

Department of Policy Planning and Management, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

This study investigated legume production performance and its socio-economic factors among smallholder farmers in Mkalama District, Tanzania. A cross-sectional survey of 138 farmers was conducted using structured questionnaires, and data were analysed with descriptive statistics, one-way ANOVA, and chi-square tests. Results showed that the mean total legume production was 784.52 kg per farmer (SD = 1489.35 kg), with high variability in output. Beans were the dominant crop, cultivated by 84.06% of farmers (mean yield 386.04 kg), while groundnuts and green gram were each grown by one-third of respondents. Production trends over the past decade indicated instability, with 48.55% of farmers reporting fluctuations, 35.51% reporting declines, and only 2.90% noting increases. ANOVA results revealed that income and farm size significantly influenced production ($p < 0.001$), with farmers earning above 2,000,000 TZS producing an average of 2678.08 kg compared to 234.13 kg among those earning below 200,000 TZS. Similarly, farmers with over 6 acres averaged 1477.35 kg, more than five times the output of those with 1–3 acres. Education level showed no significant effect on production, and chi-square tests found no significant associations between demographic variables and production trends ($p > 0.90$). The findings highlight substantial variability and instability in legume production, driven largely by resource endowment rather than demographic characteristics. Policy interventions should prioritize climate-resilient technologies, equitable input access, market linkage strengthening, and targeted support for resource-poor farmers to enhance productivity and stabilize yields in semi-arid zones.

Keywords: biodiversity loss, commercial forestry, government plantations, Miombo woodlands, mosaics landscapes

Nutrition-sensitive Agriculture – Is it Possible in Morogoro Rural District? Awareness and Practices among Farmers

Innocent Sanga and John Msuya
Email: innocent.sanga@sua.ac.tz

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Introduction: Nutrition-sensitive agriculture is an approach that seeks to ensure the production of a variety of affordable, nutritious, culturally appropriate and safe foods in adequate quantity and quality to meet the dietary requirements of populations in a sustainable manner. This study aimed at analyzing ways in which nutrition-sensitive agriculture is practiced and assessing awareness of the concept among the key stakeholders in the area. These included government officials from district, ward and village levels, officials from non-governmental organizations, agriculture inputs suppliers, food vendors and grain millers. Methods: The study followed a cross - sectional design and data were collected by using semi-structured questionnaires, key informant interviews and transect walk. Quantitative data were analyzed by using SPSS version 20 while quotes and transect sketches were produced from qualitative data. Results: The study found that home gardening (85.3%) and livestock keeping (57.4%) were the most practiced ways of nutrition-sensitive agriculture. Other ways, including use of biofortified crops, use of watering techniques in production of fruits and vegetables, fish farming, use of soil fertility conserving techniques and use of improved food crop varieties were hardly practiced. More than 90% of household heads were aware of the importance of agriculture to nutrition. The most mentioned benefits were source of income and employment, source of food for household consumption, making easy to access nutrient that although awareness about nutrition-sensitive agriculture was quite high, the actual practices were low. Conclusion: Farmers require technical and material support to be able to adopt and implement several ways of agriculture that are nutrition sensitive. On the other hand, stakeholders at wards and district level need to receive appropriate information that describe their role in facilitating implementing of the concept among the farmers.

Keywords: Nutrition-sensitive agriculture, nutrient dense foods, home gardening, livestock keeping, biofortified crops

Islands of Agriculture: Choices and challenges of small-scale farming at Songo Mnara, Tanzania

Sarah Walshaw, Cecylia Mgombele, Jeffrey Fleisher, and Stephanie Wynne-Jones
Email: swalshaw@sfu.ca

Department of History, Simon Fraser University, Vancouver, Canada

Songo Mnara is an island in the Kilwa archipelago that houses a 14th-15th C stonetown designated as a World Heritage site. Today, amidst coral outcroppings, there are fields of cultivation characterized by berms (raised field perimeters) and protected from saltwater incursion by dams. As global warming causes rising sea levels, small scale farmers are increasingly challenged to manage the earthworks and plant crops that are culturally relevant but also tolerant of brackish water. What can we learn from Songo Mnara's past and present inhabitants about local experiences of island cultivation? The Songo Mnara Archaeological project used archaeological excavation, survey, and interviews with local expert farmers to examine lived experiences across the town and its hinterland during its 100-year occupation. Plant remains from 15th C contexts were recovered through flotation of sediments from a variety of households, including the "palace", stone-coral houses, and earthen structures. Recovered plant remains included African grains (mtama, sorghum; uwele, pearl millet), rice (mpunga/wali) a variety of beans, baobab and cotton, and a few wild/weedy plant types. Chaff from grains was observed in the macrobotanical record as well as in analysis of phyoliths (plant silica bodies). The presence of chaff suggests the routine processing of grain by women in the back of the house, or just outside the structure. Local expert farmers were generous in sharing crop materials and the knowledge held about their uses and values today. Some families had to abandon their cultivation plots because of a failure of the dam and salinization of their fields. Among the intact fields, it was observed that rain fed rice crops were planted in the flats, while legumes and sorghum were planted atop the berms. This strategy may have been employed in the past, given the mix of plant taxa found in the archaeological record at Songo Mnara.

Keywords: botanical heritage, global warming, small-scale agriculture, Indigenous ecological knowledge

Motivational Drivers Influencing the Consumption of Imported and Locally Made Apparel in Tanzania

Gudila A Kereth

Email: gkereth@sua.ac.tz

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

This paper examines the motivational drivers influencing consumer preference for both imported and locally made apparel in promoting climate resilience. The motivational drivers sought in this study include personality, economic conditions, life-cycle stage, self-concept, lifestyle, and occupation concerning apparel consumption. Considering these drivers within a climate-resilient context encourages sustainable consumption and environmental sustainability. A cross-sectional design was employed to gather quantitative data on motivational factors behind the purchase of imported and locally made apparel. Cluster and purposive sampling techniques were utilised to select shopping malls, made-to-measure shops, and second-hand apparel markets in Dar es Salaam city of Tanzania. Systematic random sampling (nth) was used to select consumers aged over 18 years purchasing outer garments for personal use to fill in the questionnaire. Respondents' answers were coded on a five-point Likert scale, ranging from 5 (Strongly Agree) to 1 (Strongly Disagree). Proportional averages were calculated to represent respondents' opinions. Based on proportional averages of personal motivational drivers, the findings revealed that the aggregate proportional averages were =0.6248 for personality, =0.5676 for self-concept, =0.5173 for consumers' lifestyle, =0.3686 for occupation, =0.6599 for economic condition and =0.6176 for consumer life-cycle. The findings revealed that more than 50% of respondents agreed to purchase apparel based on these drivers. Statistically, consumers' self-concept and lifestyle significantly influenced respondents on the consumption of apparel ($p < 0.05$). The study concluded that self-concept and consumers' lifestyle were the motivational drivers inspiring respondents to purchase apparel. The study recommends that personality, economic condition, life-cycle stage, self-concept, lifestyle, and occupation should be examined in other big cities of Tanzania to determine how they influence climate-resilient apparel consumption. Since the purchase and consumption of apparel are based on these drivers, it is essential to consider these factors.

Keywords: Drivers, Consumers, Apparel

Entomopathogenic Fungi Associated with Spodoptera Frugiperda in Tanzanian Maize Farms

Regan M. Nyoni, Agatha Aloyce, Mwema Felix Mwema and Ernest Rashid Mbega
Email: mwema.felix@nm-aist.ac.tz

Nelson Mandela African Institution of Science and Technology, Arusha, United Republic of Tanzania

Entomopathogenic fungi (EPF) are promising biological control agents for managing agricultural pests, like Spodoptera frugiperda (fall armyworm), which is a major threat to maize production. The present study used morphological and molecular techniques to determine the occurrences and distribution of EPF associated with S. frugiperda in maize farms. Field surveys were conducted across diverse agroecological zones, collecting soil samples, insect cadavers in Morogoro (Morogoro rural), Ruvuma (Songea District), and Kilimanjaro (Mwanga District). Morphological identification involved culturing fungal isolates on Potato Dextrose Agar, followed by microscopic examination of conidial and hyphal structures. The isolates were also observed under the microscope for microscopic morphological features. Molecular characterization was performed using PCR amplification and sequencing of the ITS region of rDNA, to enable precise taxonomic identification and phylogenetic analysis. A total of 24 EPF isolates were obtained, with their sources categorized into maize farms and cadavers of S. frugiperda. The comparison of isolates using a compound microscope showed that some isolates had dark color olive/brown color, covered with wooly tufts and smooth surfaces, whereas some showed brighter bright-yellow/green color, covered with thick short piles like cotton on the sides and a rough surface. Molecular analyses confirmed the identity of EPF isolates and revealed high genetic diversity within populations. The findings revealed the occurrence of EPF species like Metarhizium anisopliae, Aspergillus terreus, Aspergillus flavus, Aspergillus fimeti, Talaromyces sp, Cladosprium oxysporium, and Cladosporium cladosporiodes. The evolutionary analysis of the sequences also revealed that the isolates belonged to 2 main clades with subclades, indicating the widespread diversity among them. The study is among the few that integrate morphological and molecular approaches for comprehensive EPF characterization. The insights gained provided a foundation for developing location-specific biocontrol strategies against S. frugiperda in maize farming, contributing to sustainable pest management and enhanced crop productivity.

Keywords: *Spodoptera frugiperda*, biological control and entomopathogenic fungi

POSTER ABSTRACTS

Detection and Quantification of Antimicrobial Residues in Manure from Commercial Chicken Farms in Selected Regions of Tanzania

Fares J. Biginagwa, Christopher Mwankuna, Alexander Mzula, Erica Westwood, Sunday O. Ochai, Hezron E. Nonga, Anders Dalsgaard, and Robinson H. Mdegela
Correspondence: fares.john@sua.ac.tz

Department of Veterinary Medicine and Public Health, Sokoine University of Agriculture, United Republic of Tanzania

Antimicrobial resistance is partly driven by the overuse of veterinary drugs in intensive poultry production, particularly in commercial chickens. Up to 90% of administered antimicrobials are excreted in manure, which, when applied uncured as fertilizer, introduces residues into the environment and facilitate the spread of resistance. The objective of this study was to quantify antimicrobial residues in manure from commercial chicken farms. High-Performance Liquid Chromatography (HPLC) based method was developed and optimized to simultaneously detect and quantify amoxicillin, sulfadiazine, trimethoprim, oxytetracycline, sulfamethoxazole and chlortetracycline residues in 133 manure samples from Dar es Salaam (n=71), Morogoro (n=32) and Unguja (n=30). The optimal recovery (74.1 to 129.4%) was obtained after using acidified pH and double extraction approach. Out of 133 samples, 104 (78.2%) contained antimicrobial residues, with 47% (n=63) of positive samples having multiple compounds. The most frequent combination involved three antimicrobials (43%), predominantly sulfamethoxazole, trimethoprim, and chlortetracycline. Manure from broiler farms had a higher prevalence of antimicrobial residues (83.3%) and drug combinations (66.7%) than layer farms. Regionally, Dar es Salaam had the highest proportion of positive samples (95.8%). Maximum residue concentrations reached 556.1 mg/kg for chlortetracycline, 411.7 mg/kg for amoxicillin and 342.9 mg/kg for oxytetracycline. Significant regional differences were observed for sulfadiazine ($p = 0.020$), trimethoprim ($p < 0.001$), and oxytetracycline ($p = 0.001$), with Dar es Salaam showing the highest prevalence in both production types. The concentrations of all antimicrobials analyzed in this study exceed proposed thresholds by several orders of magnitude. The current findings require urgent intervention, including education to farmers, stringent antimicrobial stewardship, manure management and promotion of manure curation technologies such as composting. These measures will help to mitigate or reduce the dissemination of antimicrobial residues and the emergence of antimicrobial resistance in the environment.

Keywords: Antimicrobial resistance; Chromatographic residue analysis; Driver for resistance; Resistant microbes, Manure curation

Blending Tradition with Technology: Community-Driven Innovations for Climate Change Resilience in Rural Settings

Simon Peter Ngalomba and Diana Christopher Kahwili
Correspondence: simonngalomba@yahoo.com

Educational Foundations, Management and Lifelong Learning, University of Dar es Salaam, United Republic of Tanzania

Rural communities are most severely impacted by climate change, experiencing conditions such as unpredictable rainfall, prolonged droughts, flooding, soil degradation and diminishing biodiversity. This study examines community-driven innovative climate change resilience in rural settings through the lens of Community-Based Adaptation (CBA) theory, which emphasizes participatory approaches, local empowerment, and context-specific solutions to climate risks. Guided by CBA, the study explores how rural communities integrate indigenous practices with modern innovations to enhance resilience against environmental shocks such as droughts, floods and unpredictable weather patterns. Using a qualitative multiple case study design, data were collected from three rural regions that have implemented grassroots resilience initiatives, including focus group discussions, key informant interviews and field observations. The analysis revealed three key findings. First, the integration of indigenous knowledge with low-cost technologies significantly enhances adaptive capacity. For example, combining traditional agroforestry with solar-powered drip irrigation improved crop yields while conserving water in drought-prone areas. Second, inclusive community governance structures accelerate innovation uptake. When decision-making bodies included women, youth and marginalized groups, the resulting climate strategies were more equitable, culturally relevant and widely adopted. Third, local ownership and peer-to-peer learning strengthen long-term sustainability. Initiatives that were led, managed and monitored by the community rather than imposed externally-demonstrated higher continuity, even after donor funding ended. The findings emphasize that community-driven resilience thrives when supported by enabling environments, including access to microfinance, technical training and institutional linkages with government agencies and research institutions. While financial and infrastructural challenges remain major barriers, community solidarity, shared values and collective problem-solving emerged as powerful drivers of resilience innovation. In conclusion, community-driven innovative climate change resilience offers a transformative pathway for rural development, where adaptation strategies are grounded in local realities and informed by scientific and indigenous knowledge systems. The study recommends strengthening community governance structures, integrating resilience education into local capacity-building programs and creating policy frameworks that formally recognize and fund grassroots climate innovations. By embedding adaptive practices in everyday rural life, communities can transition from vulnerability to leadership in shaping sustainable climate futures.

Keywords: adaptive practice, innovation, peer-to-peer learning, indigenous knowledge, resilience.

Maximizing Forest Resources Efficiency Through Comparative Anatomical Analysis of Branch and Stem Wood in Tanzania Khaya Species

Amina R. Mussa and Sami D. Madundo
Correspondence: amina.rama.mussa@gmail.com

Department of Forest Engineering and Wood Sciences, Sokoine University of Agriculture, United Republic of Tanzania

Background Introduction and Objectives: Rising global demand for hardwoods, combined with high levels of wood waste, necessitates whole-tree utilization strategies. Branch wood (which is often discarded as waste) may offer comparable properties to stem wood for value-added applications. This study therefore assessed the wood density and anatomical characteristics of branch and stem wood in Khaya anthotheca and Khaya senegalensis to evaluate branch wood's potential as a supplementary raw material and to develop diagnostic features for species identification. Methodology: Two mature trees of each species were sampled at the Sokoine University of Agriculture. Discs were collected from the main stem (1.3 m) and primary branches (at approximately 2 m). Wood density was determined using the oven-dry method. Fiber dimensions, vessel characteristics, ray traits, and tissue proportions were quantified using light microscopy and ImageJ software, following IAWA standards. Data analysis included descriptive statistics, independent t-tests, ANOVA, and Pearson correlations. Key Results and Findings: K. anthotheca showed significantly higher mean density (0.630 g cm^{-3}) than K. senegalensis (0.487 g cm^{-3}, $p < 0.001$), with no significant density difference between stem and branch wood within species. Stem wood of K. anthotheca had larger vessel diameters and longer fibers, while branch wood showed higher vessel frequency and parenchyma proportion. K. senegalensis stem fibers were longer than branch fibers, with smaller anatomical variation in vessel traits. Density correlated positively with cell wall thickness and ray width, and negatively with vessel frequency and parenchyma proportion. Conclusion and Implications: Branch wood in both species has density comparable to stem wood, despite anatomical differences, supporting its use in structural and high-value products. Incorporating branch wood into production chains can reduce waste, diversify raw material sources, and promote sustainable forest management.

Keywords: whole-tree utilization, Khaya anthotheca, Khaya senegalensis, wood density, anatomical properties

Barriers to Implementation of Biosecurity Regimes in the Mitigation of Antimicrobial Resistance in Commercial Poultry in Tanzania

Siha Mdemu, Augustine B. Matondo, Jens Peter Christensen, Ahmed E. Amasha, and Robinson H. Mdegela

Correspondence: sihamdemu@yahoo.com

Department of Veterinary Medicine and Public Health, Sokoine University of Agriculture, United Republic of Tanzania

Introduction: Biosecurity measures are critical strategies in preventing the introduction and spread of diseases in farms and consequently, reducing the use of antimicrobials, a driver for emergence of antimicrobial resistance (AMR). However, its implementation is often limited in low-income countries due to various factors such as socioeconomic challenges, farming practices and limited resources. Methods: A survey involving 203 commercial poultry farms in Morogoro, Dar es Salaam and Unguja was conducted to assess the current biosecurity levels and identify its related factors. Data were analyzed using descriptive statistics, ANOVA, t-test and multivariable regression. Results: The mean score for external, internal and overall biosecurity was 52.9±14.5, 60.5±8.7, 58.2±8.6 respectively, which ranged from 37.9% to 88.0%. Farmers with more than two years of experience in keeping layers had significantly higher mean internal biosecurity scores (55±14.6) than those with experience of two years or less (47±12.9), p=.002. Large-scale farms had significantly higher internal biosecurity scores (63.1±16.4) than both small-scale (51.5±12.8, p=.002) and medium-scale farms (51.5±15.2, p=.005). Additionally, the average external biosecurity scores were significantly lower in farms supervised by farmers with primary education (57.8±7.9) than both those under farmers with secondary (61.3±9.3, p=.042) and tertiary education (62.1±8.2, p=.019). A multivariable linear regression model suggested that individuals with tertiary and secondary education are more actively involved in the implementation of measures related to the prevention of spread of disease-causing agents within and between farms. Conclusion: Biosecurity implementation in commercial layer farms were influenced by education level, scale of production and farming experience. These findings indicate that tailored interventions and evidenced-based policies are essential for strengthening biosecurity practices, and potentially enhancing poultry health and productivity in layer farms.

Keywords: Biosecurity measures, poultry diseases, farms, Biocheck.UGent™, cross-sectional.

Women, Land, And the Climate Crisis: Building Resilience Through Inclusion in Moshi District Council

Nice Kimaro
Correspondence: nicejk26@gmail.com

Department of Policy, Planning and Management, Sokoine University of Agriculture, United Republic of Tanzania

The intersection of gender, land rights, and climate change poses significant challenges for sustainable development in Tanzania. In Moshi District Council, women are central to agricultural production and natural resource management, yet face persistent barriers to secure land ownership due to discriminatory customary practices, unequal inheritance systems, and limited access to finance and technology. These constraints heighten their vulnerability to climate-induced shocks, including droughts, erratic rainfall, and soil degradation. The study aims to examine the status of women's land tenure security in Moshi District Council; assess how land ownership and control influence women's capacity to adopt climate-smart agricultural practices and diversify livelihoods, and explore the role of statutory and customary institutions in shaping women's land rights. Using a mixed-methods approach including household surveys, focus group discussions, and key informant interviews, the research investigates the relationship between women's secure land rights and community resilience. Findings indicate that inclusive land governance, supported by gender-responsive policies, statutory reforms, and community-based adaptation strategies, significantly improves household and community resilience. The paper concluded that a combination of legal enforcement, cultural transformation, and multi-stakeholder partnerships is needed to address the gendered land climate relationship.

Keywords: Women's land rights, Moshi District Council, climate resilience, gender inclusion, land tenure security.

Fungi In Plant Tissues and Soil Samples in The Arusha Region of Tanzania, East Africa

Zamir K. Punja
Emal: punja@sfu.ca

Department of Biological Sciences, Simon Fraser University, Burnaby, Canada

Samples of plant tissues with fungal infection (leaf spots, blighting) were collected at sites in the Arusha region of Tanzania during 2024. In addition, soil samples were obtained from areas representing a mountain site, an organic vegetable production field, an avocado field, and a compost pile. The plant tissues were air-dried and transported to the laboratory for fungal recovery following surface-sterilization. The soil samples were stored at 4 C prior to soil dilutions being prepared and plated onto agar medium. The medium used for recovery of all fungi from these sources was potato dextrose agar with 140 mg/L of streptomycin sulphate. For fungal colonies recovered, a sub-group was selected for DNA extraction and PCR identification using the primers ITS1-ITS4 to amplify a region of rDNA. The resulting sequences were compared using BLASTn. In addition, total DNA was extracted from soil samples and subjected to whole genome sequencing (NGS). Reads were classified using a metagenomics classification algorithm that assigned a taxonomic identification to each sequencing read and estimated the abundance of each fungal species in the sample. Colonies on agar plates were identified as Aspergillus calidoustus from mountain soil and compost, Fusarium oxysporum from mountain soil and vegetable production field, Ganoderma lobatum from avocado soil, Trichoderma harzianum from mountain soil and vegetable field, and Alternaria alternata from mountain soil and vegetable field. Penicillium species were present in all samples. The soil microbiome analysis revealed that only 12% of the reads could be classified using currently available databases. These results demonstrate that commonly occurring fungi are present in soil samples and tissues and represent both plant pathogens and saprophytes. However, a large proportion of uncultured fungi in soil samples appear to be unique and not matched to current databases, suggesting they are previously unidentified and likely to be novel to the region.

Keywords: soil fungi, plant pathogens, molecular identification

Effects and Practices of Sustainable Agricultural Mechanization on Income, Food Security, and Productivity among Agrarian Households in Tanzania

Emmanuel Adesoji and Kalekwa Misamo
Correspondence: misamo3110@gmail.com

Department of Agriculture Extension and Community Development, Sokoine University of Agriculture, United Republic of Tanzania

Introduction: Smallholder farmers remain central to Tanzania's rural economy, yet low productivity and persistent food insecurity continue to hinder development. Sustainable Agricultural Mechanization (SAM)—the use of appropriate machinery and technologies that are environmentally and socially sustainable—offers opportunities to improve yields, reduce drudgery, and enhance household income. This study examines the influence of SAM practices on household income, food security, and productivity in Tanzania. Methods: The study employed secondary data from the Tanzania National Panel Survey (NPS) Wave 5 (2019/2020), covering 4,709 households. Descriptive statistics and multiple linear regression models were used to analyze the relationship between SAM adoption and agricultural outcomes, controlling for household demographics, landholding size, agro-ecological zones, and market access. SAM adoption was measured through mechanized land preparation, planting, irrigation, and post-harvest technologies, while food security indicators were drawn from household consumption patterns. Results: Findings show that SAM adoption remains low, with 94% of households relying on hand hoes, while fewer than 7% reported using tractors. Despite limited uptake, SAM adoption was significantly associated with improved outcomes. Regression results indicate that SAM users recorded a 17.6% increase in annual farm income ($p < 0.01$). Productivity gains were also evident, with maize yields increasing by 21.4%, rice by 19.7%, and sunflower by 15.2% compared to non-adopters. SAM adopters were more likely to have market access within 10 km, belong to farmer organizations, and attain at least primary education. Conclusion: The study confirms that SAM positively contributes to income, food security, and productivity among agrarian households. However, high capital costs, limited-service provision, and inadequate infrastructure remain major barriers to adoption. Policy recommendations include expanding rural mechanization services, introducing affordable credit and leasing schemes, and strengthening extension support. Promoting environmentally sound mechanization can accelerate progress toward national food security and Sustainable Development Goals.

Keywords: Sustainable Agricultural Mechanization, Agrarian farmers, Food security, Agricultural productivity, Household income, Extension services and Mechanization adoption

Transforming Coastal Waste into Agricultural Value: Formulation of a Granulated Organic Fertilizer from Inedible Seaweeds in Tanzania

Shengelo Edward Manga, Ruth Moirana and Ernest Mbega
Correspondence: mangas@nm-aist.ac.tz

Department of Life Science and Bioengineering, Nelson Mandela African Institution of Science and Technology, Arusha, United Republic of Tanzania

Coastal regions of Tanzania are increasingly burdened by the mass accumulation of inedible seaweed species such as Sargassum, Ulva, and Laurencia, which degrade marine ecosystems and disrupt livelihoods dependent on fishing and tourism. Concurrently, Tanzanian agriculture suffers from declining soil fertility and high reliance on costly synthetic fertilizers. This study presents a sustainable solution that integrates low-cost mechanization with bioresource valorization by converting inedible seaweeds into a granulated organic fertilizer. Six seaweed species were collected from Dar es Salaam's coastline and assessed for macronutrients, micronutrients, and phytohormones. Sargassum spp. was selected as the core ingredient due to its high potassium content (7.87%) and growth hormones such as gibberellic acid (1.48 mg/100g) and kinetin (2.08 mg/100g). The formulation process blended seaweed powder with humic acid, phosphoric acid (extracted from bone ash), molasses, and rabbit urine using a simple granulation technique adapted to small-scale mechanization. The resulting fertilizer granules showed improved nutrient stability, ease of application, and effective soil enrichment. Pot trials demonstrated enhanced levels of nitrogen, phosphorus, and organic carbon in treated soils. This research exemplifies a circular bioeconomy model, transforming coastal waste into a value-added input through scalable, climate-smart mechanization. The innovation supports smallholder farmers with affordable organic solutions, promotes sustainable land-sea resource integration, and aligns with broader efforts to reduce synthetic inputs and enhance resilient agrifood systems in Africa.

Keywords: Inedible Seaweeds and Granulated Organic Fertilizer

The Role of Custodian Communities in Devolved Forest Conservation: Lessons from A Retrospective, Mixed Method Observational Study of The Ifakara-Lupiro-Mang'ula Wildlife Management Area in Southern Tanzania

Lucia J. Tarimo, Deogratius R. Kavishe, Mohamedi Kamuna, Fidelma Butler, Felister Mombo and Gerry F. Killeen
Correspondence: ltarimo@ucc.ie

Department of Forest and Environmental Economics, Sokoine University of Agriculture, United Republic of Tanzania

The establishment of Wildlife Management Areas (WMAs) in Tanzania aims to involve local communities in conserving natural resources on their land while also providing sustainable socio-economic benefits. WMAs are established on community lands to ensure the protection of wildlife and their habitats along the fridges of centrally managed protected areas like National Parks and Game Reserves. The primary data source for this study was a longitudinal series of seven rounds of surveys of human, livestock and wildlife activities carried out across the Ifakara-Lupiro-Mang'ula (ILUMA) WMA, between 2022-2025. Previous cross-sectional studies suggest that small, authorized fishing camps established legally inside the ILUMA WMA, act as resident custodian communities who actively collaborate with the WMA to enforce conservation of the surrounding forest ecosystem. Here retrospective cartographic analysis of a longitudinal series of surveys of human, livestock and wildlife activities across ILUMA reveal a clear increase of illegal timber harvesting following the displacement of these communities by extreme floods in 2024. The narratives from these residents explain that in their absence, charcoal burners, timber harvesters, and even game meat poachers take advantage of the opportunity to enter the forest unobserved. These observations further support the view that custodian communities within the WMAs may play vital roles in conservation efforts, particularly in the settings where financial resources for enforcement of regulations are limited.

Keywords: Conservation, natural resources, custodian community, Wildlife Management Areas

Influence of Lineaments on Groundwater Flow and Occurrence in Mpwapwa District, Central Tanzania

Macarius Jonathan, Ibrahimu C. Mjemah. Offoro N. Kimambo and Amina A. Hamad
Correspondence: offoro@sua.ac.tz

Department of Geography and Environmental Studies, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

The influence of lineaments on groundwater yield and occurrence in the gneissic granite terrain of Mpwapwa district was investigated using Piezometric map, yield zonation map, Borehole zonation map and the depth-to-water-table map. A Piezometric map was generated to comprehend groundwater flow patterns, revealing predominant flow in the Northeast – Southwest and Northwest – Southeast directions, which align with the lineament orientation. The yield zonation map showed that boreholes in regions with low lineament density generally exhibited lower yields, regardless of their location on recharge areas, compared to those near areas with a high density of lineaments on recharge zones. The borehole-depth zonation map showed that boreholes in the northern and southern parts of the district are slightly shallow compared to others due to their proximity to a high lineament density. Additionally, the depth-to-water table map overlaid with the lineament map revealed that areas with higher lineament density formed a network, retaining water at a relatively shallow depth, thus indicating potential areas for groundwater extraction. Conversely, in areas where lineaments were sparse or absent, water occurred at greater depths below ground level. These findings suggest that lineaments influence groundwater in two ways, by acting as drainage paths to flow of groundwater as well as retaining groundwater especially in areas with high lineament density, these areas are most suitable for groundwater extraction, as groundwater is retained at shallow depths.

Keywords: Lineament, Groundwater occurrence, Groundwater flow, Mpwapwa, Tanzania

Knowledge and Perceptions towards Climate Change and Environmental Issues among Stakeholders in ECD Centers in Mombasa and Kilifi Counties

Samlee Nyambu, Vibian Angwenyi, Beautrice Mkubwa, Rachel Odhiambo and Amina abubakar

Correspondence: samlee.nyambu@aku.edu

Institute of Human Development, Aga Khan University, Nairobi, Kenya

Introduction: Climate change impacts most aspects of early childhood development (ECD). Therefore, a comprehensive understanding of climate change is imperative for effective educational practices. For communities to adequately educate children regarding environmental issues and the complexities of climate change, it is essential that they first understand the subject matter and its implications. OBJECTIVES: This study explored the level of knowledge and perceptions towards climate change and environmental issues among key stakeholders in the ECD sector at the Kenyan Coast. Methodology: A mixed-methods approach was used to collect quantitative and qualitative data from stakeholders of 30 ECD centers in Mombasa and Kilifi counties, 15 in each county. The target stakeholders included ECD teachers, key informants, and staff from the Madrassa Early Childhood Program Kenya (MECP-K), which supports community-based ECD centers in those counties. Key informants consisted of parents, local health experts, community leaders, local administrators, and community health promoters. Quantitative data was gathered through a survey questionnaire distributed to the staff of MECP-K. Qualitative data was obtained through in-depth interviews with key informants and teachers and thematically analyzed to identify recurring patterns related to stakeholders' understanding and perceptions of climate change. Quantitative data was analyzed using descriptive statistics in R version 4.5.0 to examine trends and response distributions. Results: Knowledge of climate change was generally high, with (n=17) 100% of staff and (n=60) 89.6% of teachers indicating awareness, and most acknowledging its importance. Climate hazards such as droughts, floods, and heatwaves were reported in both counties. Heatwaves emerged as the most common hazard, cited by (n=16) 53.7% of key informants in Mombasa and (n=8) 47.2% in Kilifi. Respondents commonly associated climate change with changes in weather patterns, especially temperature and rainfall shifts. Conclusion: Respondents demonstrated a high level of climate change knowledge, including awareness of its causes and effects. Their perceptions reflected a strong recognition of climate change as a pressing issue, shaped by local experiences of extreme weather events.

Keywords: Developmental Disabilities, Mental Health, Health Information System, Primary Health Care, Kenya

Tracking and Evaluating Developmental Disabilities Health Indicators Among Children in SPARK Research: A Mixed-Methods Study in Kilifi and Nairobi County Health Facilities

Samlee Nyambu, Vibian Angwenyi, Beautrice Mkubwa, Rachel Odhiambo and Amina abubakar

Correspondence: samlee.nyambu@aku.edu

Institute for Human Development, Aga Khan University, Nairobi, Kenya

The global burden of disability study estimates that millions of children with developmental disorders/disabilities (DDs) are in Africa. Primary healthcare (PHC) facilities often lack necessary services, untrained health professionals with limited capacity to diagnose and manage DDs. Through SPARK (SupPorting African Communities to Increase the Resilience and Mental Health of Kids with Developmental Disorders and their Caregivers in Kenya and Ethiopia) research, community and primary health care workers received training to support early identification, referral, and assessment of children suspected to have DDs. Health professionals in Nairobi and Kilifi County were trained using principles of the WHO's mhGAP programme to assess children at risk of DDs. This study evaluates trends in health services indicators reported in the Kenya Health Information System (KHIS) by public health facilities where SPARK research was implemented. It identifies existing gaps and potential areas for strengthening the health information systems, particularly focusing on mental health and childhood disabilities. To investigate the trends, documentation practices, and reporting of facility-based mental health and disability related indicators in the Kenya Health Information System (KHIS) within catchment facilities of SPARK research in Nairobi and Kilifi Counties. A mixed-methods study was conducted in public health facilities participating in SPARK research. Quantitative data on health indicators capturing developmental disorders were extracted from the KHIS during and 6 months pre- and post-SPARK research implementation. Descriptive statistics were used to assess indicator trends. Qualitative data was collected through focus group discussions with healthcare workers to explore barriers and enablers affecting the documentation and reporting of mental health and disability related indicators in routine facility registers and KHIS. There were mixed trends in mental health (MH) and disability indicators reported in the KHIS. Key observations were missing data in lower-level facilities and community records. Health professionals interviewed reported that facilities recorded more referrals, assessments, and documentation of suspected DD cases during SPARK research implementation. MoH reporting tools missing key MH and disability indicators, mismatch of indicators between physical patient registers and the KHIS and high workload were reported as the main challenges to reporting and documentation. Sustained progress requires integrating DD indicators into the various facility-based forms to facilitate reporting to the KHIS, investment in staff training and health information systems are critical.

Keywords: Developmental Disabilities, Mental Health, Health Information System, Primary Health Care, Kenya

Perceptions of Climate Variability and Change on Groundwater Access in Semi-Arid Tanzania

Evarest M. Abraham, Devotha B. Mosha, Msafiri Y. Mkonda, and Adrian Healy
Correspondence: evarestabraham@sua.ac.tz

Department of Geography and Environmental Studies, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Background and objectives in the semi-arid region of Dodoma, Tanzania, groundwater serves as the primary water source, with climate variability and change exacerbating water insecurity. This study explores community perceptions of climate variability and changes. It further examines how these perceptions affect household access to groundwater in both rural and urban contexts. Methodology A cross-sectional mixed-methods design was employed. Data were collected through 500 household surveys, 8 focus group discussions, and 12 key informant interviews across four districts. Climatic records (1995–2024) from the Tanzania Meteorological Authority were analysed using the Mann-Kendall test, Sen's slope, and Standardised Precipitation Index. Household groundwater access was assessed through a composite index of cost, distance, and reliability, analysed using descriptive statistics, chi-square tests, and multinomial logistic regression. Key results Community perceptions on climate variability included trends of unpredictable rainfall, shortened rainy seasons, and increasing temperatures. Regression analysis indicates that in urban settings, perceptions of erratic rainfall and rising temperatures correlate with diminished groundwater accessibility. Conversely, in rural areas, perceptions of an earlier cessation of the rainy season are associated with adaptation strategies, such as digging of shallow wells. Furthermore, rural households are confronted with long travel distances, whereas urban households face elevated costs and unreliable water supplies. These conditions have led to a reliance on unsafe water sources, seasonal migration, and increased burdens on vulnerable populations, particularly women, the elderly, and low-income households. Conclusion and implications Climate variability and change are reshaping groundwater access in Dodoma through environmental and socio-economic pathways, worsening inequities. Climate-sensitive water governance and infrastructure investments are essential to ensure groundwater access for vulnerable populations.

Keywords: groundwater access, climate variability, climate change, semi-arid, Tanzania

Sulphur Status in Smallholder Grain Legume Systems: Integrated Soil-Plant Analysis Across Tanzania's Major Growing Regions

Martin M. Moshi, Nyambilila A. Amuri and Raymond R. Weil
Correspondence: martin.moshi@sua.ac.tz

Department of Soil and Geological Sciences, Sokoine University of Agriculture, United Republic of Tanzania

Sulphur (S) is essential for legume protein quality, yet its availability in Tanzanian grain-legume (GL) systems is poorly quantified. This study aimed to evaluate soil SO_4-S, leaf S at flowering, grain nutrient composition and N:S ratios across major GL regions (Dodoma, Tabora, Morogoro, Mbeya) to identify soil S status and inform management. We surveyed 82 fields: 54 soil and grain samples from Dodoma and Tabora and 28 soil and leaf samples from Morogoro and Mbeya. Standard soil and plant analyses quantified SO_4-S, pH, Oc, total N, macronutrients, leaf S and grain nutrient composition; grain N:S ratios was calculated. Correlation and multiple linear regression models assessed drivers of grain S. Soil S ranged 0.16–24.95 mg kg^{-1}; Morogoro and Mbeya showed the greatest deficiency with 57–71% of fields classified very low/low, whereas most Dodoma and Tabora fields were medium–high. Soil pH spanned 4.70–7.73; Oc 0.16–0.66%; total N 0.01–0.07%. Leaf S frequently fell below the critical 0.20% (Morogoro GN 0.10–0.19%; CB 0.14–0.17%; Mbeya CB 0.10–0.25%). Grain S averaged 0.17 ± 0.03% (Dodoma 0.18 ± 0.03%, Tabora 0.16 ± 0.02%); grain N:S ratios ranged 15.7–47.2. Soil S was the strongest predictor of grain S (MLR: $R^2 = 0.526$, $p < 0.001$) and inversely related to N:S; exchangeable K, pH, Oc, altitude and planting date had secondary effects. Early planting and S fertilisation in Mbeya correlated with higher leaf and grain S. S deficiency is widespread particularly in Morogoro and Mbeya and constrains legume protein quality. Targeted S fertilisation, organic matter buildup, optimized planting dates and pH management are recommended for region specific S strategies.

Keywords: Sulphur deficiency, Grain legumes, N:S ratio, Soil fertility, Tanzania, Nutrient management, Common bean, Groundnut

Archaeobotanical evidence of the impacts of local community resiliency on food systems along the nineteenth century Caravan route in southern Tanzania

Cecylia P. Mgombere

University of Dar es Salaam, Tanzania

This was the first archaeobotanical study to be conducted at the southern Caravan halt. It sought to understand local community resiliency in safeguarding their farming practices and food system during the nineteenth century ivory and slave trade. Using historical archaeology approach, the study was conducted at the caravan settlement of Kikole.

The study had three specific objectives: first, to recover archaeobotanical remains from a selected settlement identified directly along the caravan routes; second, to analyze the recovered archaeobotanical remains with a view to determining the food system and crop species grown at the settlement during the caravan trade; and third, to assess the spatial-temporal changes in food system through the composition of crop species grown and consumed at the studied settlement in the context of caravan trade expansion during the nineteenth century.

Methodologically, the study employed scientific excavation to retrieve soil samples from various archaeological contexts. Soil samples were subjected to flotation using the bucket flotation method. Laboratory analysis was accomplished using a stereoscopic light microscope, and crops identification was made possible through seed reference collections, texts, and local flora guides documented from the study area.

The overall results indicate the presence of local crops dominating during the nineteenth century, including finger millet, pearl millet and legumes. It was noted that, although the trade had impacts to the community due to interactions with outside communities, the Kikole community was so resilient to maintain their food systems by the means of continuing cultivating their local crops. However, new crops such as Asian rice, coconuts and maize were also documented.

Keywords: Archaeobotany, food systems, resilient farming practices, and local crops.

Nutritional Status, Dietary Diversity and Nutrient Adequacy of Adult Villagers in the Semi-Arid Pastoral Community at Monduli District, Tanzania

Beatha Mkojera, Richard Mongi and James Chacha

Department of Food Science and Agro-processing, School of Engineering and Technology, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Livelihoods for pastoralist communities in northern Tanzania heavily rely on natural resources and livestock; however, recurrent droughts and limited income aggravate food insecurity. While nutrition interventions often target children, women, and the elderly, little is known about adults' dietary patterns and nutrient adequacy in Monduli District. This study assessed the nutritional status, dietary diversity, and nutrient intake of adults in Naitolia village to generate evidence for tailored nutrition education programs.

A cross-sectional descriptive survey was conducted among 252 adults (155 from Engusero and 97 from Ormangwai subvillages). Eligibility included permanent residence (>1 year) and informed consent. Data collection involved a 24-hour dietary recall to estimate nutrient intake, compared against WHO Dietary Reference Intakes (DRIs). Haemoglobin levels were measured to determine anaemia status, and participants' nutrition knowledge was also evaluated.

The findings showed that age and nutrition knowledge significantly influenced nutritional outcomes. Household size, sex, and living arrangements had no significant impact on nutrition status, though confounding factors such as income, education, cultural practices, and healthcare access may play a role. Notably, 19% of adults were anaemic, with haemoglobin levels below 13.5 g/dL for men and 12 g/dL for women. While carbohydrate intake was adequate, intake of most essential nutrients fell below recommended levels, indicating widespread nutrient inadequacy. Limited awareness of balanced diets and appropriate meal composition further contributed to poor nutrition.

Conclusion: Adults in this semi-arid pastoralist community face a high risk of nutrient deficiencies and anaemia, largely due to poor dietary diversity and inadequate nutrition knowledge. Community-based education interventions are urgently needed to improve awareness and promote balanced, nutrient-rich diets.

Co-designing Contextualized Innovative Solutions for Improving Group Salt Consolidation Model: Findings from a Human-Centered Design in Tanzania

Rose Victor Msaki, Joyce Ngegba, Nangida Jeska Mchome, Elizabeth Lyimo, Fatma Abdallah, Nyamizi Julius, Vincent Assey, Ray Masumo, Patrick Codji, Germana Leyna, and Kahabi Isangula

Muhimbili University Health and Allied Sciences, Dar es Salaam, Tanzania
The Aga Khan University, Dar es Salaam, United Republic of Tanzania

Background and objectives: In Tanzania, approximately 43% of salt in the market remains non-iodated, mainly due to limited participation of small- and medium-scale salt producers (S/MSSPs) in iodation. To address this, the government introduced a group salt consolidation model in 2021, providing iodization technology and training. However, its effectiveness has not been evaluated. This study aimed to assess the model's implementation, identify barriers, and co-design a more effective, context-specific approach using a Human-Centered Design (HCD) framework (Abookire, 2020).
Methodology: A cross-sectional study applied a five-step HCD process. Initial discovery involved focus groups and key informant interviews with S/MSSPs and Council Health Management Teams (CHMTs) in three purposively selected salt-producing districts. Insights guided consultative ideation sessions and co-creation meetings, which generated a rough prototype. This prototype was then validated through focus groups in two additional districts. Final refinement involved S/MSSPs, CHMTs, and national stakeholders, concluding with documentation and dissemination of lessons learned.
Key results: Key barriers included knowledge gaps, production challenges, weak leadership, and limited funding. Ideation yielded 34 potential solutions, narrowed down to 10 intervention areas. Four were prioritized and formed the rough prototype. Validation emphasized the need for inclusive communication, comprehensive intervention implementation, and salt production improvements. The refined prototype focused on three key interventions: education programs on importance of iodine for salt producers and public at large, strengthening producer groups, and improving salt market access.
Conclusion and implications: The HCD approach effectively engaged S/MSSPs and stakeholders in co-developing a tailored solution to improve iodized salt production. The refined model centered on education, organizational strengthening, and market development holds promise for enhancing salt iodation and public health in Tanzania. Further field testing is recommended to inform national scale-up efforts.

Keywords: Group consolidation model; Human-Centered Design; Iodized salt; Salt production; Tanzania

Exploring Community Awareness and Perceptions of Electronic Waste Management Practices in Urban Informal Settlements: A Qualitative Study in Dar es Salaam, Tanzania

Sheila J. Msangi, Budodi W. Walwa and Abdallah S. Mahia
Correspondence: salums@nm-aist.ac.tz

School of Life Sciences and Bio Engineering, Nelson Mandela African Institution of Science and Technology, Arusha, United Republic of Tanzania

Background and objectives: The rapid growth of electronic products has led to increased generation of electronic waste (e-waste), posing significant health and environmental risks, particularly in low- and middle-income countries with weak management systems. In Tanzania, informal settlements in Dar es Salaam face acute challenges due to limited infrastructure and reliance on unsafe disposal methods such as open burning and indiscriminate dumping. This study seeks to explore community awareness, perceptions, and socio-cultural influences on e-waste management practices in selected informal settlements of Dar es Salaam.

Methodology: A qualitative study design will be employed, utilizing focus group discussions (FGDs) and in-depth interviews (IDIs) with community members. The study will address four objectives: (i) assessing awareness of health and environmental risks linked to e-waste; (ii) exploring perceptions and attitudes toward disposal and recycling; (iii) examining socio-cultural and economic factors shaping e-waste practices; and (iv) identifying community-based solutions for sustainable management.

Key findings (anticipated): Preliminary data from the literature suggest that community members have limited awareness of e-waste risks, with disposal often influenced by economic necessity, cultural norms, and lack of alternatives. Informal actors such as repairers and collectors, play a central role but operate without adequate support or regulation. The study is expected to explore locally relevant practices and community-generated ideas that could inform inclusive e-waste management strategies.

Conclusion and implications: Findings will provide critical evidence for policymakers, local authorities, and NGOs to design culturally sensitive, community-based interventions that integrate informal actors. This research aligns with national policy frameworks and supports the Sustainable Development Goals (SDGs) on health, sustainable cities and responsible consumption.

Keywords: e-waste management, informal settlements, community perceptions, Dar es Salaam, environmental health.

Pharmaceutical Trade as a Catalyst for Inclusive Growth and Health Equity

David Jacob Mtweve and Senia Nhamo
Correspondence: david.mtweve@nm-aist.ac.tz

Nelson Mandela African Institution of Science and Technology, Arusha, United Republic of Tanzania

Introduction/Aim: This study examines the impact of pharmaceutical trade on inclusive growth, with a particular focus on its implications for healthcare access and economic development. Given the critical role of pharmaceuticals in public health and economic progress, understanding the trade dynamics in this sector is essential for shaping policies that promote equitable growth.
Methods: The study employs a pooled Ordinary Least Squares (OLS) regression model to analyse the relationship between pharmaceutical trade openness and an inclusive growth index. The analysis controls for GDP per capita, education levels, and infrastructure development. Data for this study were obtained from reputable global sources, including the United Nations Commodity Trade Statistics Database (UNCOMTRADE) for pharmaceutical trade data, the United Nations Conference on Trade and Development (UNCTAD) for the inclusive growth index, and the World Bank's World Development Indicators (WDI) for control variables. The dataset covers 105 countries for the year 2021.
Results: The findings indicate a statistically significant positive relationship between pharmaceutical trade openness and inclusive growth. This suggests that increased pharmaceutical trade enhances both economic progress and equitable healthcare access. The results highlight the potential role of pharmaceutical trade in strengthening health financing, improving supply chain efficiency, and expanding access to essential medicines, particularly in low- and middle-income countries.
Conclusion: Policymakers should consider trade policies that facilitate the equitable distribution of pharmaceuticals while addressing affordability and regulatory challenges. However, this study is limited by its reliance on a single-year dataset, which restricts the ability to establish causal inference. Future research incorporating longitudinal data and advanced econometric techniques is needed to provide a deeper understanding of the complex dynamics between pharmaceutical trade, healthcare accessibility, and inclusive growth.
Future Research: Further studies should employ longitudinal data and advanced econometric techniques to explore causal relationships more robustly. Examining how different trade policies, intellectual property regulations, and regional trade agreements affect pharmaceutical access and inclusive growth would provide deeper insights. Additionally, investigating the role of domestic pharmaceutical production and its interaction with trade policies could enhance our understanding of how to create a more inclusive global pharmaceutical market.

Keywords: Pharmaceutical trade, inclusive growth, healthcare access, economic equity, trade policy

Prevalence, Risk Factors and Access to Care for Gestational Diabetes Mellitus in Tanzania: Narrative review

Akwilina Wendelin Mwanri[1]and Safiness Simon Msollo
Correspondence: akwmwanri@sua.ac.tz

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Prevalence of Type 2 diabetes mellitus is increasing worldwide. It was estimated that in 2012 one in 10 Tanzanians had type two diabetes, with most diabetes patients living without awareness of their status. Prevalence of gestational diabetes is increasing parallel with the increase in prevalence of Type 2 diabetes. This review summarizes published research on the magnitude and risk factors for gestational diabetes mellitus in Tanzania. A total of ten published papers up to July 2025 were accessed through PubMed and Google Scholar, reviewed and summarized. Studies published from 2014 to 2025 reported the prevalence of gestational diabetes of up to 32% in urban and up to 21% in the rural areas. Identified risk factors were family history of type 2 diabetes, mid upper arm circumference ≥28cm, pre-pregnancy obesity, percentage total body fat, previous macrosomia, previous still birth and maternal age. Although maternal diabetes and unrecognized type 2 diabetes mellitus may lead to maternal and foetal morbidity and mortality, timely diagnosis and management strategies rarely exist. Currently, universal screening exists where every pregnant woman is tested for glucose in urine. However, it is known that screening through urine is less sensitive and it detects only one out of 20 women with GDM. Prevalence of GDM is increasing in Tanzania, parallel with increase in overweight and obesity among women of reproductive age. Furthermore, there is limited screening strategies using recommended WHO guideline due to shortage of staff, equipment and supplies. There is a need to develop a clear diagnosis and management strategy and nutrition guideline for diabetes during pregnancy in Tanzania to prevent poor outcomes for the mother and the child.

Keywords: Gestational diabetes, screening, prevalence, risk factors, Tanzania

Financial Management Practices and Agri-SME Performance: The Mediating Role of Subjective Financial Literacy

Kulwa Mwita Mang'ana
Correspondence: kulwa.mangana@nm-aist.ac.tz

School of Business Studies and Humanities, Nelson Mandela African Institute of Science and Technology, Arusha, United Republic of Tanzania

This study investigates the influence of financial management practices (FMPs) on the performance of agricultural small and medium-sized enterprises (Agri-SMEs) in Tanzania, with a specific focus on the mediating role of subjective financial literacy. Anchored in the Resource-Based View (RBV), the research conceptualizes subjective financial literacy not merely as a personal trait but as a strategic intangible asset that enhances the efficacy of managerial practices. Data were collected from 385 Agri-SME managers and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results demonstrate that while financing practices exert a direct and significant positive impact on firm performance, other practices such as capital budgeting and working capital management influence performance indirectly through the enhancement of subjective financial literacy. Notably, financial reporting exhibited a negative relationship with perceived financial competence and no direct performance contribution, suggesting possible cognitive or contextual misalignments. Mediation analysis confirmed that subjective financial literacy partially mediates the relationship between select FMPs and firm performance. The study contributes theoretically by extending RBV to include subjective behavioral capacities and offers policy guidance for designing integrative interventions that merge financial access with literacy development.

Keywords: Financial Literacy, SME Performance, Agricultural Enterprises, Financial Management Practices

Assessment of sources of nitrate in groundwater and associated health risk in Dar es Salaam Quaternary aquifer by use of dual isotopes of nitrate and Hydrogeochemistry

Patrick Mafwimbo, Offoro N. Kimambo and Ibrahimu Chikira Mjemah
Correspondence: patrickmafwimbo@gmail.com

Department of Geography and Environmental Studies, College of Natural and Applied Sciences, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Groundwater contamination by nitrates is a major global concern because of the harmful health effects that arise when consumed beyond certain concentrations. Elevated nitrate concentrations have been previously reported in Dar es Salaam, Tanzania's Quaternary aquifer, however specific source attribution has not been identified. This study applied an integrated approach, combining groundwater Hydrogeochemistry with dual nitrate isotope analysis ($\delta^{15}N–NO_3^-$ and $\delta^{18}O–NO_3^-$) to characterize the sources of nitrate contamination at various locations and potential health risk. Fifty groundwater samples were collected from various sites in Dar es Salaam City and the Coast Regions in Tanzania. Samples were collected in High-Density Polyethylene (HDPE) bottles for both hydrogeochemical and isotope analysis. All samples were stored in a cool container and shipped to Sokoine University of Agriculture (SUA) for analysis. While Hydrogeochemistry was conducted at SUA, isotope analysis was done at the University of California, Davis Stable Isotope Facility in California, United States of America. Samples for isotopes were filtered, nitrite was removed, and frozen before being brought to the laboratory for analysis. A health risk assessment was conducted using United States Environmental Protection Agency (USEPA) health risk assessment model. The model estimated potential risks to men, women, and children consuming groundwater by oral ingestion and dermal routes. The study found that 36% of groundwater samples exceeded the World Health Organization (WHO) drinking water guideline of 50 mg/L for nitrate. Higher nitrate concentrations were observed in the unconfined aquifer, which could be due to the highly permeable Quaternary sediments that facilitate surface contaminant infiltration. Ionic ratio plots (NO_3^-/Cl^- vs. Cl^-) and isotopic signatures pointed to sewage and manure as the main sources of nitrate. However, considering the limited use of manure in the study area, leaky septic tanks and sewer systems are thought to be the primary contributors. Further, groundwater also showed elevated Na^+ and Cl^- concentrations, indicating seawater intrusion. Isotopic evidence revealed that no signs of denitrification processes are occurring within the aquifer. Both hydrogeochemical and isotopic analyses consistently confirm sewage and manure as the main sources of nitrate contamination in the study area. On the other hand, health risk assessment showed a greater risk to children than to males and females. Groundwater consumers in this area were at greater risk from the oral pathway than from the dermal pathway. This research highlighted the threat level that nitrate poses to the Dar es Salaam quaternary aquifer, with 36% of the sampled wells having nitrate levels greater than the WHO guideline of 50 mg/L. Hydrogeochemistry and isotope analysis found that sewage leakage is the main source of nitrate, with seawater intrusion adding another stress to groundwater quality. Health risk assessment revealed that children are at higher risk, especially when they consume groundwater through oral ingestion. The results imply an immediate need for improvement of groundwater and sanitation systems, well-coordinated groundwater protection, and integration of water quality and land planning in policies. Groundwater recharge areas also have to be protected, while groundwater abstraction has to be set at a sustainable rate to balance recharge and seawater intrusion.

Keywords: Groundwater; Aquifer; Hydrogeochemistry; Isotopes, Health risk

Addressing Nutrient Gaps in Local Diets through Grain Amaranth Integration in Local Food Systems

Victoria F. Gowele and Hadijah A. Mbwana
Correspondence: vgowele@sua.ac.tz

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Majority of smallholder farmers in rural areas rely on foods from their own production which are of low diversity as they comprise mostly of cereal-based staples. Diversifying staple diets by incorporating easy to grow nutrient rich crops into local food systems, can help to improve nutrition and food security across populations. Two varieties of grain amaranth types namely Amaranthus *hypochondriacus* and *Amaranthus cruentus* were introduced in Mkuranga District, Pwani region Tanzania, by FoCo-Active project, in 2024. Amaranth known by a local name ''Mchicha'' is a popular vegetable with a long cultural tradition in Tanzania, East Africa and other regions in Africa. Amaranth is cultivated for its leaves and for its grains depending on the variety. The study involved a total of 80 smallholder farmers and two public primary schools; one from each implementing village where demonstration plots were situated. Additionally, agricultural officers, community health workers, nutritionists, teachers and pupils who received training on the production and various use of grain amaranth were also involved in this study. Three grain amaranth-based food products namely porridge, stiff porridge "ugali" and popped amaranth grains were developed and tested. Results show that grain amaranth is high in protein and contain substantial amount of essential micronutrients particularly calcium, iron and zinc. Findings on the nutritional profile of grain amaranth and its applicability in formulation of acceptable food products highlights the importance of promoting its production and consumption to improve nutrition and food security among communities.

Keywords: Grain amaranth, diets, smallholder farmers, protein, minerals

Spatial Temporal Analysis of Dryness of Lower Mara River Basin with Remote Sensing Data

Lina Friberg, Nickson Tibangayuka, and Eunice Makungu
Correspondence: linafriberg17@gmail.com

Department of Water Resources Engineering, University of Dar es Salaam, United Republic of Tanzania

Hydro-meteorological droughts lead to a significant decline in the ecosystem's services, as well as a decline in the economy of the people, resulting from reduced agricultural productivity, loss of life, and a decrease in tourism due to the loss of flora and fauna. The Lower Mara River Basin (LMRB) has economic importance in increasing the per capita income of its people; however, little is known about the drought trends within the basin, despite reports of increasing peak flows in the Mara wetland during the peak season and decreasing during low flow. This study analyses both spatial and temporal occurrence and severity of dryness trends with the Standardized Precipitation Index while embracing the use of remote sensing data to complement station data; the trends were analyzed by the Man-Kendall non-parametric test, and their magnitude was estimated by Sen's Slope. The significance of the trend was analyzed at $\alpha = 0.5\%$.
While there was no statistically significant trend observed in the Consecutive Dry Days (CDD) for the Serengeti and Mara wetlands, there has been an increase in dry days from 2.4% to 14.5% annually between 2016 and 2022. The basin has maintained a Simple Daily Intensity Index (SDII) ranging from 8 to 11 mm/month. However, the annual trends of dryness within the Mara wetland and Serengeti have indicated a decreasing tendency towards wetness, contrasting with other areas of the basin, which have experienced increased dryness. The results of this study can inform policymakers regarding the effectiveness of ongoing initiatives aimed at ecosystem restoration and guide for expansion of these efforts to ensure long-term sustainability.

Keywords: Drought, ecosystem services, climate change

Rethinking the Contribution of Improved Seeds to Maize and Rice Productivity in Tanzania: A Stochastic Simulation Analysis for Policy Makers

Ibrahim L. Kadigi
Correspondence: ibrahim.kadigi@sua.ac.tz

Department of Business Management, College of Humanities and Business Studies, Mbeya University of Science and Technology, Mbeya, United Republic of Tanzania

Background and Objectives: Agriculture is the backbone of Tanzania's economy, with maize (*Zea mays L.*) and rice (*Oryza sativa*) being the two most critical staple cereals for food security and rural livelihoods. However, national yields remain well below potential due to limited adoption of productivity-enhancing technologies, notably improved seed varieties. This study aimed to evaluate the effectiveness of improved seeds compared to local seeds in reducing yield gaps for maize and rice under a business-as-usual scenario, keeping other production factors constant.
Methodology: The analysis used nationally representative data from the 2019/20 National Sample Census of Agriculture (NSCA). A stochastic simulation framework was employed to model yield probability distributions for local seed users (MZS0, RCS0) and improved seed users (MZS1, RCS1) across Zanzibar, mainland Tanzania, and at the national level. Probabilities of yields below the national average threshold (≤2.0 t/ha), within the mid-range (2.0–4.0 t/ha), and above the potential maximum (≥4.0 t/ha) were compared between the two seed categories.
Key Results or Findings: For maize, improved seeds reduced the probability of low yields from 78–79% to 60–68% and increased high-yield attainment from 2–7% to 6–12%, with notable gains in Zanzibar. For rice, improved seeds reduced the share of low yields from 60–79% to 41–64% and increased high-yield probabilities from 3–11% to 11–21%, with the most significant improvements on the mainland. Across both crops, improved seeds consistently expanded the proportion of farms achieving mid-range yields, reducing production risks and improving output stability.
Conclusion and Implications: Improved seeds are an effective and scalable entry point for narrowing maize and rice yield gaps in Tanzania, contributing to SDG 2 (Zero Hunger) and SDG 13 (Climate Action). However, complementary investments in fertilizers, irrigation, mechanization, and targeted extension are necessary to unlock their full potential. Future research should examine the combined effects of improved seeds and fertilizers across agroecological zones to inform region-specific policy interventions.

Keywords: Improved seeds, maize, rice, yield gap, stochastic simulation, agricultural transformation.

A Probabilistic Framework for Enhancing Water Network Resilience and Recovery Dynamics

Gloria Gadrick Maruchu , John Andrews , Rasa Prescott , and Silvia Tolo
Correspondence: gloriamaruchu@yahoo.com

Civil Engineering, University of Nottingham, Nottingham, United Kingdom of Great Britain and Northern Ireland

Urban water networks face critical challenges in maintaining resilience against disruptions. This research addresses this need by developing probabilistic mathematical models to enhance the resilience of urban water networks. The core objective is to improve the recovery dynamics of water distribution networks after disruptions, enabling more effective resource allocation and proactive incident response. This work contributes to sustainable water solutions and infrastructure resilience at scale. The methodology involves developing probabilistic mathematical models using Python programming to simulate network behavior and evaluate recovery dynamics after a disruption. The framework integrates pressure indicator information and hydraulic simulations. The research leverages hydraulic and hydrologic modeling, statistical and simulation modeling, and uses tools such as EPANET and Python for analysis and decision-making support. The developed methodology has shown promising results, improving system recovery by 13% after failures. This improvement is significant because it has the potential to enhance the operational efficiency and reliability of urban water infrastructure, which is crucial for public health and economic stability. The research provides a robust framework for assessing and improving the resilience of complex water systems under uncertainty. The findings offer a practical and innovative tool for utility managers and policymakers to make data-driven decisions, improving their ability to prepare for, respond to, and recover from network disruptions.

Keywords: Water Network Resilience, Hydraulic Simulation, Probabilistic Modelling, Infrastructure Resilience, Sustainable Water

Omega-3 and Omega-6 Fatty Acid Rich Fish Powders and Nut Butters: A Potential for improving Dietary Diversity for Pregnant and Breastfeeding Women

Sarafina Masanja, Japhet Safiel and Deo Shirima
Correspondence: sarafina.masanja@sua.ac.tz

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Background: Omega-3 and omega-6 polyunsaturated fatty acids play key roles in health and disease prevention for both pregnant and breastfeeding women since these are the most vulnerable segments of a population in terms of nutritional requirements. The present study aimed at formulating fish, seed and nut powders and butters that are rich in omega-3 and omega-6 fatty acids for pregnant and breastfeeding women. Methods: Identification of the frequently used foods that are known to contain omega-3 and omega-6 was done using adapted food frequency questionnaire by randomly selected 318 pregnant and breastfeeding women in Morogoro Municipality, Tanzania. The foods with high frequency of consumption were selected and taken to the laboratory for the analysis of omega-3 and omega-6 content and thereafter the foods with high content were selected to be included in the formulations. Optimization of the recipes was done by linear programming method using Solver function of the Microsoft Excel (Ms Excel, 2016). Affective testing using nine-point hedonic scale was used to measure consumer's responses to the formulated food recipes. One-way analysis of variance (ANOVA) and Tukey's Honest Significant Difference (HSD) test were used to determine the significance of mean differences between variables. Results: A total of twelve formulations in the form of powders and butter were developed. The types of fish that were included in the formulations were red mullet fish (Kibua numbi) which had 9.6g/100 of omega-3 fatty acid, East African Sardinella (Saradini) (6.4g/100g) and Tuna fish (Jodari) (6.7g/100g). The nuts and seeds that were incorporated in the formulations walnuts, groundnuts, almonds, chia seeds and soybeans. Sea moss was added to the butter based on its omega-3 content. A total of 85 panellists participated in the sensory evaluation of the developed recipes. The sensory parameters that were assessed included colour, odour, texture, flavour and general acceptability. In terms of colour, odour and texture; sea moss butter had significantly higher scores when compared to other formulations ($p>0.05$) for both panellists. Lemon containing fish powders had relatively lower mean scores in terms of odour/smell (5.4-6.0) when compared to vinegar and black pepper containing fish powders (5.6-6.8). The overall acceptability was significantly higher in sea moss butter ($p>0.05$). Red mullet fish powder with black pepper had lowest score in terms of general acceptability (5.4±1.8-5.9±1.9). Conclusion: Low-cost high omega-3 and omega-6 fish powders and nut butter can be optimized by linear programming method. The developed products can save as a way of ensuring fish consumption even in areas with limited supply of fish or when the fish are off-season. It can also save as a way of increasing dietary diversity and accessibility to low-cost omega-3 and omega-6 rich products.

Keywords: Species Distribution Modelling, Conservation Prioritization

Secondary School Food environment and Purchase Choices of Adolescents in Mbeya City, Tanzania

Mercy Kamwela, Hadijah Mbwana, and Theresia Jumbe
Correspondence: mercykamwelamk@gmail.com

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Introduction: Increasing levels of overweight and obesity among adolescents are quite alarming worldwide. Among the depicted causes is poor diet; food environment plays a major role in shaping diet. But little is known about adolescents and the school food environment they are exposed to in Tanzania. The aim of this study was to explore secondary school food environment and document food and drink mostly purchased by secondary school adolescents. Methodology: This was a cross-sectional study involving 8 secondary schools in Mbeya City, 384 secondary school adolescents, and 35 food outlets. Aspects of the food environment studied were under two domains: the external domain (availability of food, price, promotion, and policy and guideline) and the internal domain (food preferences and knowledge). Direct observation was used in food outlets with the help of an observation tool adopted from the Nutrition Environment Measure Survey. Structured interviews were done with the school administrators with the help of a questionnaire designed based on the WHO Nutrition Friendly Schools Initiative. Also, with the students by the help of purchasing recall questionnaire. Descriptive statistics and ordinal logistic regression were used to establish prevalence and association between variables. Results: Most available food outlets outside school were retail shops; inside schools were canteens. The most purchased foods among adolescents are sweets, fried snacks, and sugar-sweetened beverages. Cereal-based foods are most available, while fruits and vegetables are least available inside and outside school. Adolescents care most about taste and least about nutrition and weight control while purchasing food and drinks. Conclusion: Secondary schools have weak policy and guidelines on food environment, and they are filled with ultra-processed foods, fried snacks, and sugar-sweetened beverages. This situation calls for effective planning and interventions from the national level to the institutional/school level to ensure a nutrition-enabling environment is created in secondary schools.

Keywords: Food Environment, School Food Environment, Adolescents Nutrition

Health Service Delivery Gaps and Support Systems for Addressing Central Obesity in Women Past the Postpartum Period

Rosela Remigius and Zalia O. Basheikh
Correspondence: roselaremigius@gmail.com

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, United Republic of Tanzania

Introduction: Central obesity is a critical public health issue linked to non- communicable diseases and long-term maternal health risks. Women beyond the postpartum period often face barriers to weight management, yet limited evidence exists on their specific challenges and the role of healthcare systems in addressing them. This study aimed to assess central obesity among women past the postpartum period, focusing on the associated challenges and available health support systems. Methodology: A cross sectional design was employed whereby 120 women (1 to 5 years postpartum), aged 18 - 49 years, attending selected health facilities in Morogoro Urban District participated. Face-to-face interviews using semi-structured questionnaires and waist and hip circumference measurements were conducted. Data were recorded using Kobo digital Toolbox. Results: High prevalence of central obesity, with 68.3% of participants having a waist circumference above normal (≥80 cm) was observed. Although no socio-demographic factor assessed showed a statistically significant association with central obesity, trends indicated higher odds among older, married and higher income women. Lifestyle behaviors such as low physical activity, poor dietary habits, and lack of portion control were prevalent. 57.5% reported lacking information on weight and waist management. Despite attending health care facilities, 94.2% of the women had never received guidance from health providers regarding weight or central obesity management and 95% reported not receiving any form of support such as nutrition counseling or exercise recommendations. Conclusion: The study concludes that central obesity is highly prevalent among past postpartum women and is influenced by poor lifestyle behaviors and inadequate healthcare system support. It recommends integrating weight management strategies into routine postpartum care and strengthening healthcare systems to offer tailored guidance and support to women after childbirth.

Keywords: Central obesity, past postpartum women, lifestyle behaviors, health care support systems

Climate Change and Health: Navigating the Interconnected Challenges for a Resilient Future

Ndirangu Ngunjiri and Anthony Kamau
Correspondence: ndirangungu@gmail.com

Finance and Accounting, University of Nairobi, Kenya

Climate change, a worldwide occurrence propelled by human actions, significantly impacts human health and welfare. This article examines the complex interrelationships between climate change and its ecological consequences on human health, including the escalation of temperatures, severe weather events, alterations in disease patterns, and the subsequent repercussions on air quality, water supplies, food stability, and susceptible populations. The escalating global temperatures exacerbate heat-related ailments and death rates, while the heightened occurrence and severity of severe weather phenomena entail hazards ranging from injuries to large-scale relocation. Climate fluctuations contribute to changes in disease patterns, resulting in a modified prevalence of infectious illnesses such as malaria and dengue. The presence of air pollution worsens respiratory health problems, and the increase in wildfires brings about extra dangers. Water-related health issues develop due to changes in water availability and the connection between severe weather events and illnesses transmitted by water. The influence of climate change on agriculture has a significant effect on food security, perhaps leading to nutritional repercussions for populations who are particularly susceptible. This article examines the uneven impact on youngsters, older people, and low-income populations and emphasizes the necessity for individualized therapies. These issues need adaptation and mitigation strategies, including public health policy and community engagement. This summary summarizes key findings and highlights the need for rapid collaboration to mitigate climate change and maintain public health for future generations.

Keywords: Climate, health, mitigation, population

Strengthening Health System Responsiveness: Perceptions, Barriers, and Uptake of Physiotherapy in Mbeya, Tanzania

Theresia Estomih Nkya and Shabani Majaliwa
Correspondence: theresia.nkya@gmail.com

Department of Parasitology and Entomology, University of Dar es Salaam-Mbeya College of Health and Allied Sciences, Mbeya, United Republic of Tanzania

Background: Physiotherapy is crucial for managing a wide range of health conditions and enhancing functional outcomes. However, utilisation is influenced by socio-demographic, cultural, and systemic factors, which affect equitable access and service effectiveness within health systems. Understanding these factors is critical to inform patient-centered service delivery. Objective: To assess medical conditions associated with physiotherapy use and examine patient perceptions, barriers, and socio-demographic influences at Mbeya Zonal Referral Hospital, with a focus on strengthening health system responsiveness. Methods: A descriptive cross-sectional study was conducted from February to April 2025 among patients receiving physiotherapy. Stratified random sampling selected 325 participants. Data were collected using a structured questionnaire and analyzed in STATA. Descriptive statistics summarized utilization patterns, and logistic regression identified socio-demographic factors associated with perceptions and recommendations for physiotherapy. Results: Fractures were the leading reason for physiotherapy referrals, followed by back pain, stroke, arthritis, and post-surgical rehabilitation. Cultural beliefs influenced perceptions for the majority of participants. Male sex, lower education level, and single marital status were significantly associated with a lower likelihood of recommending physiotherapy ($p < 0.05$). Despite over half of participants having health insurance, many missed sessions due to cost, and few found session times convenient. Conclusions and Implications: Physiotherapy utilisation is largely reactive, influenced by socio-demographic, cultural, and systemic barriers. Interventions to improve health literacy, affordability, and service flexibility can enhance access to care and improve patient outcomes. Findings support strengthening health system responsiveness and designing inclusive rehabilitation services in Tanzania.

Keywords: physiotherapy, health systems, patient perceptions, access barriers, Tanzania

Impact Of Health Literacy Intervention On Health Competence, Dietary Behaviors, And Nutritional Status Among Adults In Selected Rural And Urban Areas Of Tanzania

Victoria Kariathi, Hadijah Mbwana, Constance Rybak, and Safiness Msollo
Correspondence: victoria.kariathi@tfnc.go.tz

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Food illiteracy poses a significant public health challenge amid global malnutrition and the rise of Non-Communicable Diseases (NCDs). While food literacy programs promise to enhance knowledge, skills, and behaviors, few studies have explored how post-program interventions influence food literacy, dietary diversity, and nutrition status. This study assessed the effect of the interdisciplinary health literacy program (IHLP) on food literacy, dietary habits, and nutritional status among adults. Data on food literacy, Dietary Diversity Score (DDS), and Household Dietary Diversity Score (HDDS) were collected through structured questionnaires and validated tools at baseline and endline. Anthropometric measurements were also taken at both points. The IHLP was implemented midway between assessments. Paired t-tests assessed the changes in food literacy, DDS, and HDDS, which followed normal distribution. The Wilcoxon signed-rank test analyzed BMI differences, which did not follow normal distribution. Additionally, the McNemar-Bowker test examined the impact of IHLP on food literacy, HDDS, and BMI categories of the baseline and endline. Results indicated significant improvements in food literacy, DDS, HDDS, and BMI following the intervention. The mean food literacy score increased from 30 to 35, with 40% of participants shifting from lower to higher categories. DDS increased from 3.83 (1.08) to 5.37 (1.30), and HDDS from 6.63 (1.74) to 7.77 (1.72), with 19% advancing to higher diversity groups. Although most participants' BMI increased, 26% experienced a decrease. The IHLP demonstrated positive effects on food literacy, DDS, HDDS, and nutritional status, indicating that it should be integrated into strategies aimed at combating dietary deficiencies and malnutrition.

Keywords: Adults, Dietary diversity, Food literacy, Health literacy, Intervention, Nutritional status

Leveraging Artificial Intelligence for Renewable Energy Forecasting in Kenya : Implications for Sustainable Development

Morara Gartrude Miriam
Correspondence: trudemorara@gmail.com

Library, Aga Khan University, Nairobi, Kenya

Introduction: The intermittent nature of renewable energy sources poses significant reliability and sustainability challenges for Kenya's energy sector. Energy production discrepancies lead to supply-demand variances, causing grid instability and increased reliance on diesel-driven backup systems. Machine learning offers a promising solution by enabling complex computing systems to optimize energy forecasting, storage plant operations, and grid integration. Unlike traditional methods, machine learning models leverage real-time meteorological and grid data for accurate short-term predictions, enhancing dispatch schedules, reducing curtailment, and stabilizing the grid. This study aims to assess the viability of machine learning for renewable energy forecasting in Kenya, aligning with Sustainable Development Goal 7. Methods A systematic review methodology was employed, utilizing data from peer-reviewed articles published between 2023 and 2025, sourced from databases including ScienceDirect, SpringerLink, Emerald Insight, Web of Science, and Wiley Online Library. The study evaluated machine learning approaches for forecasting accuracy, analyzed economic and environmental variables, identified barriers in rural and urban settings, and developed data-driven recommendations for implementation. Results Empirical findings indicate that machine learning significantly reduces prediction errors, fuel consumption, and greenhouse gas emissions. However, barriers include limited access to energy and ICT infrastructure, high implementation costs, and a lack of technical expertise, particularly in rural areas. Conclusions The adoption of machine learning can enhance Kenya's renewable energy forecasting and support its 2030 carbon neutrality goal. Recommended policies include open-access network frameworks and capacity-building initiatives to overcome barriers. Without proactive integration strategies, disparities in energy access will widen, undermining climate objectives.

Keywords: Renewable Energy, Machine Learning, Forecasting Models, Kenya, Sustainable Development Goal 7, Energy Equity, Carbon Neutrality, Digital Infrastructure, Grid Stability

Building Climate Change Resilience in Tanzanian Secondary Schools: Insights from a Co-Creation Approach Using the School Climate Change Resilience Scorecard (SCCS) and a Modified Delphi Method in Ilala Municipal, Dar es Salaam

Minza Simon Muhandagani
Correspondence: Minza.muhandagani@scholar.aku.edu

Institute For Educational Development,East Africa, Aga Khan University, Dar es Salaam, United Republic of Tanzania

This study explores how co-creation strategies can strengthen climate change resilience in a public secondary school located in Ilala Municipal, Dar es Salaam, Tanzania. Climate change poses increasing risks to educational institutions across sub-Saharan Africa, where extreme weather events, flooding, heat stress, and resource constraints disrupt teaching and learning while also threatening the safety of students and staff. Schools are not only learning spaces but also community anchors, meaning that their capacity to adapt to climate shocks has broader implications for social stability and development. Against this background, the study sought to investigate how participatory and co-creative approaches could foster climate-resilient practices that are contextually relevant, inclusive, and sustainable. The research was guided by a participatory action research (PAR) design and used a mixed-methods approach to ensure both depth and breadth of understanding. The School Climate Change Resilience Scorecard (SCCS) was employed as a diagnostic tool to identify vulnerabilities across infrastructure, teaching and learning, health and safety, and community engagement. In parallel, a modified Delphi process was conducted over four iterative rounds, bringing together 52 participants, including students, teachers, parents, school leaders, and district education officials. This design allowed stakeholders to collectively prioritize resilience needs, deliberate on possible interventions, and refine strategies through cycles of consultation and consensus building. Quantitative data from the SCCS were analyzed through descriptive statistics using SPSS, while qualitative inputs from Delphi rounds and semi-structured interviews were coded thematically in NVivo to capture recurring patterns and stakeholder perspectives. Findings demonstrate that when school communities are actively engaged in diagnosing their climate risks and designing solutions, they develop a stronger sense of ownership, agency, and collective responsibility. Three major themes emerged: (1) Enhanced awareness and capacity students and teachers reported greater understanding of local climate risks, enabling them to link environmental knowledge with everyday school practices; (2) Shared ownership and collaboration the participatory process bridged gaps between students, educators, parents, and local officials, fostering a spirit of cooperation and trust; and (3) Locally relevant strategies the co-created action plans reflected community realities, such as water harvesting systems, tree planting initiatives, curriculum integration, and emergency preparedness drills. The study highlights that co-creation is not only an inclusive method but also a catalyst for embedding climate resilience into everyday school life. While challenges such as resource limitations, language barriers, and institutional hesitancy toward external assessments constrained full implementation, the overall process demonstrated.

Keywords: Climate change, Climate Change Resilience, Co-creation, School Climate Change Scorecard, Delphi method, and Participatory Action Research.

Developing a Simple Risk Score for Screening Prediabetes among HIV Adults Receiving Antiretroviral Therapy. A case study in Malawi

Charles Ulere Nyirongo, Safiness Simon Msollo and Akwilina Wendelin Mwanri
Correspondence: charlesnyirongopw@gmail.com

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Morogoro, United Republic of Tanzania

Background and Objective: Prediabetes is a state of impaired glucose regulation when blood glucose is higher than normal but not meeting the diagnostic criteria for diabetes. It represents a significant risk for type 2 diabetes (T2DM) which constitutes over 95% of all diabetes cases worldwide, making its prevention and early detection a critical public health priority. This study aimed to develop a simple risk score for screening prediabetes in HIV adults receiving Antiretroviral Therapy (ART). Methodolody: A cross sectional study was conducted involving adults aged 18 years and above who were HIV positive and receiving ART. Data on sociodemographic characteristics, clinical, anthropometrics measurements, health and behavioural factors were collected using a STEP wise Questionnaire. The risk scores were derived from the beta coefficients of each variable in multivariable logistic regression equation. An individual's risks of prediabetes were calculated using probability scores from the fitted risk model: [Prediabetes risk= exp (person's risk score) ÷ (1+ exp (person' risk score)]. Receiver operating characteristic (ROC)curve analysis was performed to determine sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV). Findings: Of the 105 participants,30(28.6%) had prediabetes. Significant risk factors for prediabetes included low fruit intake, high waist to hip ratio, hypertension and overweight/obesity. At an optimal cut-off score of ≥21, the prediabetes risk score model demonstrated an area under curve (AUC) of 0.846, 95% CI [0.773, 0.918], sensitivity of 84.4%, specificity of 57.0%, PPV of 75.5% and NPV of 67.5% indicating its potential use in clinical settings. Conclusion and implication: The prediabetes risk score model exihibited good performance to distinquish between prediabetic and non-prediabetic. However, the relatively low specificity and NPV indicates that a considerable proportion of those identified as at risk by this model may not actually have prediabetes.

Keywords: Prediabetes risk score, HIV/AIDS, antiretroviral therapy, Screening