UNIVERSITY OF THE GREEN LAND

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Dilla University

2026

BOOK OF ABSTRACTS

15th Annual National Research Conference

Grand Theme:

Action for the Next Horizon: Innovative Research for Tomorrow's Society

April 02 - 03, 2026
Dilla, Ethiopia

Graphic Design and Conference System Developer

Nega Teferra Hailu, Dilla, Ethiopia

Phone: +251 920 06 4352; **Contact**: @negateferra

BOOK OF ABSTRACTS

THE 15th ANNUAL NATIONAL RESEARCH CONFERENCE

UNDER THE GRAND THEME

"ACTION FOR THE NEXT HORIZON: INNOVATIVE RESEARCH FOR TOMORROW'S SOCIETY"

Organized by Research, Publication, Ethics and Dissemination Directorate

UNIVERSITY OF THE GREEN LAND

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Dilla University

April 2 – 3, 2026

Dilla, Ethiopia

ORGANIZING COMMITTEE

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Graphic Design & Conference System Developer
@negateferra

Yusuf Hussen
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@yusufhussen

Seblewongel Yonas
Member
@seblewongel

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Opening Remark from the President of Dilla University

Dear distinguished invited guests of honour, paper presenters, Dilla University staff members, and participants of this conference:

It is with immense pleasure and pride that I welcome you all to Dilla University, the University of Green Land, for our 15th Annual National Research Conference, cantered on the theme: "***Action for the next Horizon: Innovative Research for tomorrow's Society***".

This gathering signifies our collective commitment to harnessing the power of research to effect meaningful change in our society.

Situated in the Southern part of the country, Dilla University stands as a beacon of academic excellence in the areas of Education, Health, Agriculture, and Natural Resources. Our institution is renowned for its focus on agroforestry, leveraging the diverse climatic zones of our region to pioneer sustainable practices that benefit both our local and global communities. In recognition of this, Gedeo Agroforestry is inscribed as a UNESCO world heritage where scholars of Dilla University play significant role not only for its registration by UNESCO but also the recognition it acquires globally. This has, in fact, attracted the attention of researchers, policymakers, and practitioners from different walks of life. In this regard, our dedication to applied research ensures that the knowledge we generate directly addresses real-world challenges, embodying our mission to bridge the gap between theory and practice. To this end, Dilla University is vigorously working to make its vision and mission a reality through collective leadership, trust, and teamwork.

Ladies and gentlemen;

We are also privileged to be located within the catchment area of the famed Yirgacheffie coffee, internationally acclaimed for producing some of the finest coffees in the world. The unique combination of altitude, climate, and rich soil imparts distinctive floral and fruity notes to the Yirgacheffie coffee, making it a cherished brand among coffee connoisseurs globally. This regional treasure not only contributes to Ethiopia's rich cultural heritage but also plays a vital

role in the local economy, reflecting the profound connection between our natural resources and societal well-being. I, therefore, invite you to enjoy world-class coffee brands while you stay here at Dilla University and Dilla town. In the meantime, coffee might be your point of discussion to enrich its production, value-chain and change the livelihood of our society through applied research. In addition, Science and technology, health-related issues, Language and culture, population dynamics, governance and indigenous knowledge could be discussed on. Special to this gathering, we included important sub-theme 'diplomacy of the horn' which could benefit our country's future political, social and economic advantage. These all will significantly contribute to the holistic development that our country demands. I, once again congratulate you as you are part and parcel of this important event both as academicians to sustain the development and the prosperity we aspire for.

Las but not least, I extend my heartfelt gratitude to all our distinguished guests who have honoured us with their presence. Your participation enriches our discourse and inspires us to strive for greater heights.

A special thank also goes to the organizing committee members, whose unwavering dedication and meticulous planning have made this conference possible. Your efforts behind the scenes ensure that we can come together to share knowledge and inspire action. As we embark on this conference, let us remember that the true measure of research lies not only in the knowledge it generates but in the positive transformation it brings to society. May our discussions over the coming days be fruitful, our collaborations be enduring, and our resolve to effect change be unwavering.

With this, I wish you all a nice time for academic discourses, debates, and arguments for the common good of our society and our country at large.

Thank you all,

Elias Alemu (Ph.D.),

President of Dilla University

April 02, 2026

Welcoming Address from the Vice President for Research and Technology Transfer

Universities have historically evolved from teaching institutions to centres of research and, more recently, to hubs of technology transfer focused on practical application. In Ethiopia, although universities are relatively young, the past three decades have been characterized by rapid expansion. Reform initiatives have been introduced, with expansion dominating resource allocation and human capital development.

However, this emphasis has often been criticized for lacking strategic focus. To address these concerns, the government differentiated universities by research capacity, expertise, and local endowments. In 2021, Dilla University (DU) was designated a University of Applied Sciences (UAS), marking a transformative shift in its mission and operations.

DU's Applied Sciences Transformation is guided by four pillars. First, Reforming Internal Policies has involved establishing transparent and efficient governance aligned with UAS goals. Curricula were revised, research and community engagement were thematized, and management systems were automated to achieve paper-free administration. Research calls, evaluations, and incentive mechanisms now ensure accountability, timely completion, and quality outputs. Second, Transforming the Research Landscape has reoriented research toward applied sciences, with a focus on Agriculture, Natural Resources, Health, and Teacher Education. Policies were revised, thematic frameworks developed, and externship programs launched to connect researchers with industries. Emphasis on implementation research and output-based awards has strengthened problem-driven, actionable scholarship. Third, Strengthening Industry Engagement has prioritized demand-driven projects addressing societal challenges through joint funding and collaboration. Annual community and University–Industry Linkage forums evaluate progress and set future priorities, while Science Week showcases innovations to schools, nurturing the next generation of scientists and innovators. Finally, Advancing Recognition and Accreditation has involved a self-assessment and external audit by KPMG, which earned DU a Gold-tier Certificate of Compliance from the African

Academy of Science and Global Grant Community. This recognition of excellence in financial and governance practices made DU the only Ethiopian public university to achieve such a standard, enhancing its credibility and global partnerships. Despite these achievements, applied universities remain a new model in Ethiopia, and to meet international standards, UAS institutions require stronger resource support and sustained backing from executive bodies.

The 15th National Scientific Days Conference, held on April 2–3, 2026, aimed to bring together leading academic scientists, researchers, and scholars to exchange and share their experiences and research results on the role of innovation in sustainable development. The conference provided an interdisciplinary platform for policymakers, top managers, researchers, practitioners, and educators to present and discuss recent innovations, trends, and concerns, as well as practical challenges and solutions across four thematic panels. The discussions centered on linking innovative research with actionable strategies for the next horizon, with particular focus on the region's blue (water) politics. The forum brought together decision-makers, scientists, young researchers, private sector actors, and community representatives to shape future research agendas that strengthen national and regional competitiveness. It also fostered partnerships that build researcher capacity and drive institutional transformation toward internationalization, ensuring innovation delivers meaningful societal impact.

The conference emphasized both the future of research and the development of DU's young faculty, motivating them toward greater engagement. Recognizing that societal and developmental factors shape priorities in natural resources and sustainable development, discussions helped define future research directions. Focused sessions translated and disseminated key scientific results nationwide, clarifying their impact on sustainability. Organizers welcomed feedback to improve future events, particularly the upcoming conference, "Action for the Next Horizon: Innovative Research for Tomorrow's Society."

Welcome to Dilla, the green and productive landscape

Sincerely,

Habtamu Temesgen (Associate, PhD)
Vice President, Research & Technology Transfer
Dilla University

Message from Research Publication Ethics and Dissemination Directorate

In an era where research, innovation and technology govern the world, universities often stand at the epicenter of these vital activities. The fate of the future generation is undoubtedly determined by the research and innovation activities we carry out and technologies we optimize for our collective benefit. Grounded in this conviction, Dilla University is proud to host its 15th National Research Conference with the theme ***"Action for the next Horizon: Innovative Research for Tomorrow's Society".***

This conference is organized under four major themes, including the contemporary diplomacy of the horn, which aims to pave the way for policy dialogue in the best interests of our country. We received applications from 148 scholars and researches from various parts of the country for this prestigious event. Following a rigorous evaluation process, only 20 outstanding research papers were selected. I would like to congratulate these researchers on succeeding in this highly competitive selection and their commitment to sharing scholarly contributions with academia, stakeholders, and decision-makers.

Currently, Dilla universality is experiencing a significant surge in research excellence, publications in internationally reputable journals have grown exponentially over the past few years. Furthermore, our efforts in capacity building, online data management & digitization systems, and dissemination activities have become truly remarkable. I congratulate you once again for being part of this sustained progress.

Finally,I immensely acknowledge Dilla University for sponsoring this conference and timely facilitation of administrative activities. I also appreciate our research organizing committee members for organizing such exceptional and colorful research conference by working around the clock.

I, thank you!

Misganu Legesse Bareke (Ph.D, Associate Professor)

Director, Research, Publication Ethics and Dissemination,

Dilla University Ethiopia

April 2, 2026

Keynote Speech

Water Governance for Northeastern Africa: A Trajectory for Policy and Action

Yacob Arsano, PhD
Associate Professor of Political Science & International Relations
Phone: 251-920 192 191
Email: yarsano17@gmail.com
P.O. Box 31375, Addis Ababa, Ethiopia

Abstract

Northeastern Africa is uniquely situated where numerous rivers emanate from Ethiopia and destined to several countries in the region. In as much as the rivers in Northeastern Africa are connected with the Ethiopian water tower, there is no water governance mechanism, nor is there institutional framework that would guide and regulate the conservation, protection, utilization and management of the shared waters. A three-decade effort of establishing water governance mechanism for the Nile basin has achieved important results through stakeholder dialogue, protracted negotiations that yielded in the signing and ratification of CFA, and the establishment of Nile River Basin Commission-NRBC, despite mush still remains to achieve all-encompassing water governance.

Other trans-boundary rivers in the region including, Wabeshibelle, Ganale-Dawa and Mereb are awaiting ardent attention for transboundary water governance mechanisms. Academia, research community as well as policy sectors have the responsibility as well as opportunity to get involved in the studies and establishment of transboundary water governance in Northeastern Africa. This presentation attempts to synoptically present the compelling rationale for environmental, socioeconomic, institutional and geopolitical imperatives of establishing and operationalizing water governance in Northeastern Africa.

Keynote Speech

Empowering Women in Water Diplomacy: Baseline Study of Ethiopia

Dr. Adanech Yared Jillo

Ethiopian Women in Water Association (EWIWA)

Email: adanech2yared@gmail.com/adanechyared@yahoo.com

Mobile: +251-912081788/+251-909747411/+256-743049609

Abstract

In Ethiopia, transboundary rivers are vital to both national security and development – this baseline research outlines women's role in Ethiopian's water diplomacy.

Fifty-one highly educated individuals from government, academia, and related sectors participated in this online survey and will provide us with information to evaluate the individual's characteristics, roles in the water sector, and level of awareness and understanding and participation in water diplomacy related processes. The results demonstrate a high level of awareness among men (but also a very noticeable gender gap) in terms of both understanding and participation in water diplomacy processes, although the majority of women are located at low or very low levels and are also impacted by cultural, institutional, and capacity barriers. Regardless, all of the interviewed individuals believe that women play an essential role in properly, fairly, and efficiently managing our natural resources. The study recommends targeted capacity-building, strengthening networks such as the Ethiopian Women in Water Association (EWIWA), adopting gender-responsive water governance policies, and deliberately increasing women's roles in negotiations and decision-making to advance inclusive hydro-diplomacy and contribute to SDGs 5 and 6.

Key Words: Women in Water Diplomacy, Gender Equality, Transboundary Water Governance, and Hydro-diplomacy.

Panel 01: Agricultural Productivity and Sustainability

Mitigation of enteric methane emissions in finishing steers: efficacy of anti-methanogenic feed additives without compromising performance

Muhammed Nurye[2,3], Alejandro La Manna[1], Georgett Banchero[1], Daniel Santander[1], Julieta Mariota[1], and Verónica S. Ciganda[1]

[1]National Agricultural Research Institute (INIA), La Estanzuela, Uruguay

[2]School of Animal and Rangeland Sciences, Haramaya University, Dire Dawa, Ethiopia

[3]College of Agriculture, Department of Food Science and Postharvest Technology, Oda Bultum University, Chiro, Ethiopia

Abstract

The objective of this study was to evaluate the effects of feed additives on dry matter intake (DMI), apparent total-tract digestibility, growth performance, and enteric methane (CH_4) emissions of finishing steers in a commercial feedlot. Twenty-eight Angus steers (initial body weight = 500.96 ± 5.15 kg) were assigned to a completely randomized block design, with initial body weight as the blocking factor. Steers were individually housed and randomly assigned to one of four dietary treatments (n = 7 per treatment): monensin (0.16 g/kg DM; control), 3-nitrooxypropanol (3-NOP; 1.0 g/kg DM), a blend of essential oils and tannin (EO + tannin; 0.152 g/kg DM), or tannin alone (0.184 g/kg DM). Following a 21-d adaptation period, steers were fed experimental diets for 77 d. Enteric CH_4 emissions were measured using the sulphur hexafluoride (SF_6) tracer technique for 5 consecutive days during the finishing period. Supplementation with 3-NOP decreased daily CH_4 emissions, CH_4 yield (g/kg DMI), and CH_4 intensity (g/kg average daily gain; ADG) compared with monensin, EO + tannin, and tannin ($P < 0.05$). Relative to monensin, 3-NOP reduced daily CH_4 emissions by 32.4%, CH_4 yield by 34%, and CH_4 intensity by 21%. Methane emissions from steers fed 3-NOP were 40% lower than those fed tannin and 34% lower than those fed EO + tannin. In contrast, EO + tannin and tannin did not differ from monensin for CH_4 emissions ($P > 0.05$). No differences among treatments were observed for DMI, ADG, final body weight, gain-to-feed ratio, or apparent total-tract digestibility ($P > 0.05$). These results indicate that supplementation with 3-NOP in finishing diets reduced enteric methane emissions without affecting intake, nutrient utilization, or growth performance of feedlot steers.

Keywords: beef cattle, greenhouse gas mitigation, feedlot nutrition, 3-nitrooxypropanol (3-NOP), SF_6

Panel 01: Agricultural Productivity and Sustainability

Climate-Smart Agriculture: Adaptation Intensity and Impact on the Resilience of Rural Households to Climate Change in Gubalafto Woreda, Ethiopia

Melkamu Sete Wereta[1],[2] Zemen Ayalew Ayele[3] and Yilebes Adissu Damtie[4]

[1,4]Institute of Disaster Risk Management & Food Security Studies, Bahir Dar University, Bahir Dar, Ethiopia

[2]Department of Rural Development and Agricultural Extension, Collage of Agriculture, Woldia University, Woldia, Ethiopia

[3]Department of Agricultural Economics, Collage of Agriculture, Bahir Dar University, Bahir Dar,Ethiopia

Abstract

Climate change poses significant threats to agriculture and livelihoods, particularly in developing regions where farmers are heavily reliant on rain-fed systems. This study investigates the impacts of the adoption intensity of climate-smart agricultural (CSA) practices on household resilience in Gubalafto Woreda, Ethiopia. The study employed a quasi-experimental research design; data were collected from 355 randomly selected households. Principal component analysis, multinomial endogenous switching regression, and descriptive statistics were employed to analyze the data. The findings revealed that 44% of the households had a low resilience capacity index (RCI), whereas 37% and 19% had medium and high RCIs, respectively, with a mean resilience capacity index of 0.33. About 30% of households did not adopt any climate-smart agricultural practices, while 21.13%, 23%, 15%, and 10% were classified as single, partial, multiple, and full adopters, respectively. The ATT results indicated that household adoption of inorganic fertilizer, improved crop varieties, small-scale irrigation, and agrochemicals increased resilience capacity by 49%, 42%, 21%, and 4%, respectively. Additionally, adopters of partial, multiple, and full practices experienced increases in resilience capacity of 7.4%, 12%, and 17%, respectively. In summary, households that adopted more diverse combinations of CSA practices were more resilient than non-adopters, indicating that increased adoption intensity of CSA is crucial for improving climate resilience. Thus, enhancing adoption levels and capability aspects should be the primary goal of any intervention.

Keywords: climate-smart agriculture, adoption intensity, multinomial endogenous switching regression, resilience capacity

Panel 01: Agricultural Productivity and Sustainability

Microbial Contamination of Cattle Meat and Environmental Surfaces Across the Meat Supply Chain

[1]*Jelalu Kemal and [1]Sitina Kedir

[1]Haramaya University College of Veterinary Medicine, P. O. Box 138, Dire Dawa, Ethiopia.

Abstract

Meat provides a favorable environment for bacterial growth. This study assessed the bacteriological quality of raw beef and contact surfaces and estimated the prevalence of *Salmonella* in butcher shops and abattoirs in eastern Ethiopia. A cross-sectional study was conducted between June 2024 and January 2025 on 128 beef and 196 contact surface samples. Raw beef (250 g) was purchased from each abattoir and butchery. Beef contact swab samples (100 cm^2/contact surface) were collected using swab collection kits. Aerobic bacterial, Enterobacteriaceae, and coliform counts, as well as *Salmonella* detection, were analyzed according to ISO standard techniques. In Haramaya town abattoir, the total mean aerobic bacterial count in the meat samples was 7.84 ± 0.60 log CFU/g. A significant proportion of the beef samples examined in Jigjiga were classified as unacceptable. In Harar abattoir, the mean coliform load of knife swab samples classified as unacceptable (6.10 ± 0.38 log CFU/cm^2) was significantly greater than that of surface swab samples. In Dire Dawa city, the mean aerobic bacterial load on cutting board swab samples from butcher shops (9.39 ± 0.91 log CFU/cm^2) was significantly higher than that on hand swab samples. Among the 324 beef and contact surface samples, 57 were *Salmonella*-positive, with an overall prevalence of 17.6%. *Salmonella* prevalence was significantly higher ($p = 0.034$) in abattoir samples (22.7%) than in butcher samples (13.7%), suggesting that contamination may mainly originate from the meat source or occur during flaying, evisceration, and cutting. In conclusion, significant bacterial loads on beef and contact surface samples, along with the notable prevalence of *Salmonella*, pose a substantial risk of spoilage and foodborne illness to consumers. Practical interventions, such as enforcing hygiene regulations and providing training on sanitation practices, are recommended to reduce bacterial loads on beef and contact surfaces and safeguard public health, along with further detailed research focusing on the characterization of *Salmonella*.

Keywords: Slaughter houses, microbial burden, retail beef houses

Panel 01: Agricultural Productivity and Sustainability

Enhancing Soil Fertility and Tomato Productivity through Integrated Use of Azolla Dry Biomass and Nitrogen Fertilizers under Irrigated Conditions in Hawassa Zuria and Wondo Genet, Southern Ethiopia

Habtamu Alemayehu[1]*, Wassie Haile[2], Alemayehu Kiflu[2], Ashenafi Haile[2]
[1]College of Dry land Agriculture, Samara University, P.O. Box:132, Samara, Ethiopia
[2]School of Plant and Horticultural Sciences, College of Agriculture, Hawassa University, P.O. Box:05, Ethiopia
*Corresponding Author email: habtamualemayehu79@gmail.com
Mobile: +25139515802/+251926077253

Abstract

Low soil fertility and low agricultural productivity constrain Ethiopian farmers. Under irrigation, sustaining soil fertility and increasing yields require the efficient use of both organic and inorganic fertilizers. Integrating *Azolla*, a nitrogen-fixing aquatic fern, with inorganic nitrogen fertilizer is a promising strategy to improve soil health and crop performance; yet limited research has evaluated their combined effects under irrigated conditions. A two-year field experiment (2022/23 and 2023/24) was conducted in Hawassa Zuria and Wondo Genet districts of the Sidama Region to assess the effects of *Azolla* dry biomass and inorganic nitrogen on soil properties and tomato productivity. The study aimed to determine the effects of *Azolla* on soil chemical properties and yield, evaluate its interaction with inorganic nitrogen on yield and yield components, and identify the optimum combination for maximum productivity. Four rates of *Azolla* (0, 5, 10, and 15 t ha^{-1}) and four nitrogen levels (0, 46, 92, and 138 kg N ha^{-1}) were arranged in a factorial RCBD with three replications. Both treatments significantly influenced most parameters ($P < 0.01$). The highest rates (15 t ha^{-1} *Azolla* and 138 kg N ha^{-1}) improved total nitrogen, organic carbon, available P, cation exchange capacity, pH, and marketable yield (23.76 and 26.35 t ha^{-1}). This combination is recommended for improving soil fertility and tomato productivity.

Keywords: Crop productivity, declining soil fertility, improve soil properties, soil pH, organic matter, total nitrogen

Panel 01: Agricultural Productivity and Sustainability

Genome-Wide Association Study in Selected Bread Wheat (*Triticum aestivum* L.) Genotypes for Drought Tolerance Using Agronomic Traits

Birhanu Mecha Sewore[1, 2] Ayodeji Abe[3], and Zerihun Tadesse[4]

[1]Department of Plant Sciences, College of Agricultural Sciences, Wachemo University, Hosanna, Ethiopia

[2]Pan African University Institute of Earth and Life Sciences, including Health and Agriculture, University of Ibadan, Ibadan, Nigeria

[3]Department of Crop and Horticultural Sciences, Faculty of Agriculture, University of Ibadan, Ibadan, Nigeria

[4]International Maize and Wheat Improvement Center (CIMMYT), Texcoco, Mexico

Abstract

Understanding genetic diversity, population structure, and LD in crop germplasm is necessary for achieving genomic prediction and identifying QTLs of desired traits. This study investigated the genetic diversity and population structure of 185 bread wheat genotypes as a prerequisite for GWAS and genomic selection. The genotypes were evaluated under drought-stressed and well-watered conditions. Chromosome-wise genomic SNP distribution, MAF, heterozygosity, and PIC were measured using GBS-based SNP markers. The relationship matrix was determined with the UPGMA module of TASSEL 5.0 to construct dendrograms. The population structure was determined using STRUCTURE 2.3.4. A total of 13,230 high-quality SNPs were identified and distributed across the three wheat genomes, of which 35.7% of the markers were located on the B sub-genome, 34.3% on the A sub-genome, and 30.0% on the D sub-genome. Based on the analysis of population structure, the genotypes were divided into six clusters. The mean MAF, PIC, and genetic diversity of the populations were 0.24, 0.27, and 0.34, respectively. The average LD decay at the individual genome level for significant marker pairs at $r^2 > 0.2$ was 19.5 Mb for the A genome, 23.2 Mb for the B genome, and 24.3 Mb for the D genome. The percentage membership of the genotypes to a specific cluster showed that cluster 6 had the largest membership (22.1% of the population), whereas cluster 3 had the lowest (12.5% of the population). The highest degree of genetic differentiation was detected in cluster 3 (Fst = 0.64), whereas the lowest was observed in cluster 2 (Fst = 0.26). The high genetic diversity identified among the clusters can be used to develop new bread wheat cultivars with desired traits. The moderate to high divergence detected among bread wheat genotypes within clusters suggests that the genotypes could be used for GWAS. A total of 152 significant SNPs were associated with eight traits, with 86 MTAs under well-watered (WW) and 66 under drought-stressed (DS) conditions. Highly significant MTAs were found for traits DH, PH, SL, SPS, NKPS, and TKW under both contrasting environments. The markers 3B|073.218355300|5411850|5411850 for traits DH, DM, PH, SL, and SPS and 5B|130.173057600|1000138|1000138 for traits SPS and KPS showed pleiotropic effects under DS and WW conditions. The identified significant MTAs will be useful in developing drought-tolerant genotypes for moisture-stress environments.

Keywords: bread wheat, genetic diversity, linkage disequilibrium, polymorphic information content, population structure, SNP markers.

Panel 01: Agricultural Productivity and Sustainability

Design and Development of an Integrated Small-Scale Irrigation System Using a Quick-Return Mechanism Hand Pump

Bahiru Belachew Badacho, PhD Candidate

Department of Mechanical Engineering, Wolaita Sodo University, Wolaita Sodo, Ethiopia

Abstract

Hand-operated water pumps remain vital for rural and off-grid water supply; however, conventional reciprocating hand pumps require high operating force and exhibit limited discharge capacity. Despite their widespread use, limited design improvements have been made to address these performance and ergonomic limitations through alternative motion mechanisms. This paper presents the mechanical design and analytical performance evaluation of a hand water pump employing a quick-return crank mechanism to improve pumping efficiency and reduce operator fatigue. The proposed system integrates a crank-and-slotted lever mechanism with a reciprocating piston–cylinder assembly, enabling a longer working stroke and a shorter return stroke to pump water from nearby sources, such as rivers, streams, ponds, lakes, and wells. Design calculations and detailed analytical modeling were carried out for piston–cylinder dimensions, suction pipe flow, frictional losses, operating force, mechanical advantage, and buckling stability of critical components using standard fluid mechanics and machine design principles to determine discharge, total head, force requirement, and structural safety. In addition, the study systematically evaluates the kinematic behavior, force transmission characteristics, and structural safety of the proposed mechanism using established machine design and fluid mechanics principles. Analytical results show that the pump can lift water from a depth of 7 m with an operating force of approximately 184.2 N and a daily discharge capacity of about 1,800 L. The results demonstrate that the quick-return mechanism provides a simple and effective means of enhancing the performance of manual water pumps for rural applications. They also confirm that the proposed design satisfies ergonomic constraints while maintaining structural integrity under repeated manual operation. The pump system is appropriate for use in low-resource rural areas because its mechanism operates with basic functions and uses materials that can be easily found in the vicinity.

Keywords: Hand water pump, quick-return mechanism, reciprocating pump, small-scale irrigation, agricultural mechanization

Panel 02: Natural Resources and Environment

Integrated Machine Learning and Geospatial Approach for Assessing Gully Erosion Susceptibility Modelling in the Tekeze river basin, Northern Ethiopia

Bekalu W. Asres[1], Sentayehu A Abebe[1], and Fasikaw A. Zimale [2]

[1]School of Civil and Water Resource Engineering, Debre Markos Institute of Technology, Debre Markos University, Debre Markos, Ethiopia
[2]Faculty of Civil and Water Resources Engineering, Bahir Dar Institute of Technology, Bahir Dar University, Bahir Dar, Ethiopia
Corresponding Author: beki.manalie19@gmail.com

Abstract

Gully erosion poses severe threats to agriculture and ecosystems in the Ethiopian highlands. This study assesses gully erosion susceptibility (GES) in the Belesa Watershed, Northern Ethiopia, by integrating a field-based gully inventory, geospatial analysis, and machine learning algorithms. Twenty geo-environmental factors were analyzed using Random Forest (RF), Support Vector Machine (SVM), Artificial Neural Network (ANN), XGBoost, and a stacking ensemble method. Multicollinearity analysis confirmed no significant redundancy among predictors (VIF < 10). XGBoost demonstrated superior performance (AUC = 0.99; accuracy = 0.96; kappa = 0.92), followed by RF and the ensemble model (AUC = 0.98). Elevation, fault distance, rainfall, LS factor, and lithology emerged as dominant controls on gully formation. Spatial analysis revealed that 45–53% of the watershed exhibits very low susceptibility, while 0.65–44.45% falls within very high susceptibility, with hotspots along the Belesa River corridor. The ensemble approach provided the most balanced classification. This research demonstrates that integrating field-validated gully inventories with machine learning algorithms produces reliable susceptibility maps for targeted conservation interventions.

Keywords: machine learning, ensemble model, geospatial analysis, gully erosion, susceptibility modeling

Panel 02: Natural Resources and Environment

Modelling and Optimization of Bioethanol Production Yield from Some Fruit Wastes by Co-culture of Thermo-tolerant Wild Yeasts using response surface methodology

Teshome Tadesse[1, 2*], Anbesa Dabassa[2], Degife Dase[2], and Ketema Bacha[2]

[1]Department of Biology, Mattu University, College of Natural Sciences, P.O. Box 318, Ilubabor, Ethiopia

[2]Department of Biology, Jimma University, College of Natural Sciences, P.O Box 378, Jimma, Ethiopia

*Corresponding author: Teshome Tadesse; email: teshome.tadesse28@gmail.com

Abstract

In developing nations like Ethiopia, population growth and industrialization have resulted in higher energy consumption and serious waste disposal issues. The goal of this work is to increase ethanol production from hydrolysates of banana and pineapple peels using co-cultures of thermotolerant wild yeast species, *Saccharomyces cerevisiae* and *Scheffersomyces stipitis*. The process involved fermenting the peels after hydrolyzing them with acid and autoclave steam. Response Surface Methodology (RSM) was used to optimize fermentation conditions, and a digital refractometer and a UV–Vis spectrophotometer were used to quantify the amounts of reducing sugar and ethanol, respectively. Under optimized conditions, co-cultures of *S. cerevisiae* 9Li2 and *S. stipitis* 39L1 enhanced ethanol production by 18.7% (34 g/L to 41.8 g/L) and 17.1% (26 g/L to 31.35 g/L), respectively, from sugar concentrations extracted from banana peel (BP) and pineapple peel (PAP) hydrolysates. With BP hydrolysates, the ethanol yield, productivity, and yield efficiency were 0.5 g/g, 1.16 g/L/h, and 98%, respectively, compared to PAP hydrolysates (0.39 g/g, 0.87 g/L/h, and 76.47%, respectively). It is possible to efficiently transform fruit peel waste into bioethanol, thereby reducing organic waste in the environment and providing an alternative energy source.

Key words: Bioethanol, Wild yeasts, Lignocellulosic substrates, Co-cultures

Panel 02: Natural Resources and Environment

Advancing Integrated, Resilient, and Inclusive Land and Water Management through Gender-Responsive Water Supply Interventions: Evidence for Climate-Resilient Water Security in the Tana Sub-Basin, Ethiopia

Yeshizerf Jember*[1], Derbabaw Fentie*[1]

[1]Departement of Natural Resource management, College of Agriculture and Environmental Sciences, University of Gondar, P.O. Box 196, Gondar,

Corresponding Authors Email: yeshizerf33@gmail.com, and derbabaw.fenetie@uog.edu.et

Abstract

The Tana Sub-Basin in Ethiopia faces critical water challenges, including contamination, scarcity, droughts, and floods, driven by climate variability, land use changes, and pollution. While water supply interventions aim to improve access, the integration of gender, social inclusion, and community engagement with Integrated Water Resources Management (IWRM) principles remains underexplored. This study evaluates how gender equity, social inclusion, and community engagement are integrated into 12 water supply interventions across Dera, Farta, and North Mecha woredas and assesses their alignment with IWRM principles for climate-resilient water security. A mixed-methods approach was employed, using systematic stakeholder mapping, 36 Key Informant Interviews (KIIs) with government workers, implementers, and Water Management Committees, and 12 Focus Group Discussions (FGDs) with 126 community participants, of whom 37% were women. A process-based IWRM evaluation tool assessed performance across 12 indicators spanning equity, participation, environmental sustainability, and governance. Findings reveal strong community engagement during the planning and construction phases, with women actively participating in FGDs and initial consultations. However, this engagement diminished significantly during the operation, maintenance, and management stages, leaving WASHCOs, often with limited female representation, solely responsible. While communities perceived water quality positively, implementers reported ongoing contamination issues, highlighting a disconnect between community perceptions and technical assessments. The study concludes that meaningful integration of gender, social inclusion, and community engagement requires sustained participation throughout the project lifecycle, not only during the planning phase. It recommends: (1) ensuring that women and vulnerable groups have decision-making roles in WASHCOs; (2) establishing feedback mechanisms that bridge community perceptions with technical monitoring; (3) integrating climate resilience measures that protect the most vulnerable; and (4) providing ongoing, inclusive capacity building. These actions are essential for achieving climate-resilient water security through IWRM-aligned interventions.

Keywords: Climate Resilience; Community Engagement; Gender Inclusion; IWRM; Water Security

Panel 02: Natural Resources and Environment

Area Enclosures as a Land Restoration Strategy: Effects on Vegetation, Carbon Storage, and Soil Properties in Ethiopia

Mohammed Seid[1]*, Simon Shibru[2] Serekebirhan Takele[2] Shetie Gatew[2]

[1]Werabe University, College of Agriculture and Natural Resources, P.O.Box 46, Werabe, Ethiopia

[2]Arba Minch University, College of Natural Sciences, P.O. Box 21, Arba Minch, Ethiopia

*Corresponding Author: mamseid11@gmail.com

Abstract

Area enclosure is believed to be an effective approach for restoring degraded areas and improving carbon storage capacity. However, empirical evidence is inadequate to support its contribution to vegetation restoration and carbon storage across geographic and socioeconomic contexts. This study assessed the effectiveness of enclosures on carbon stocks and soil physicochemical properties in the Central Rift Valley, Ethiopia. The study was conducted in eight enclosures. Bilate Watershed was selected for the study, with each enclosure having a corresponding adjacent open land. Data on vegetation, plant litter biomass, and soil were collected using systematic sampling. A total of 160 quadrats (20 m × 20 m) were established along six transects for trees. Sub-quadrats of 5 m × 5 m were used for shrubs, and 1 m × 1 m for herbs, grasses, plant litter biomass, and soil samples. Tree and shrub height and DBH were measured to estimate total carbon stock (t ha^{-1}). Carbon stocks in all pools showed significant differences between enclosures and open lands. The mean total carbon stock was higher in enclosures (87.81 ± 30.63 t/ha) than in open lands (52.95 ± 31.89 t/ha). Aboveground biomass contributed the largest share of carbon in both areas, while plant litter and deadwood contributed little. Bulk density ranged from 0.78–1.01 g/cm^3 in enclosures and 0.91–1.38 g/cm^3 in open lands. Soil organic carbon (SOC) and organic matter differed significantly between enclosures and open lands across all soil depths. Soil particle fractions (sand and silt) also varied between the two areas. Enclosures enhance carbon sequestration and support climate change mitigation, making them an effective restoration practice.

Keywords: Enclosure, Carbon stock, Organic soil, Restoration, Soil texture

Panel 03: Health and Wellbeing

Persistent mental health challenge prediction and risk factor understanding among adult populations in Ethiopia

Addisalem Workie *[1], Esubalew Tesfahun[1], Solomon Seyife Alemu[2], Hailemariam Atsibha[3]

[1]Debre Berhan University, [2]Madda Walabu University, [3]Mekelle University

***Corresponding author:** Email: adddisalemworkie599@gmail.com

Abstract

The adult population faces persistent mental health challenges across the world. Approximately 300 million people experience mental health depression globally, of which 80% of the burden is found in low-resource settings. Nearly 5% of individuals struggle with mental health depression in Ethiopia. Thus, this study aimed to leverage machine learning algorithms to predict persistent mental health challenges and understand risk factors among adult populations in Ethiopia. A total of 9,232 adults from the World Health Organization data repository were included. Nine machine learning algorithms were used to build and compare models. Eighty percent and 20% of the dataset were allocated to the training and testing sets, respectively. Confusion matrix elements were used for comparison, and 10-fold cross-validation was applied to enhance model performance. Important libraries such as Pandas, Seaborn, and NumPy were used in Python. A heatmap was used for correlation analysis, and a feature importance score was used to identify the most important predictors of persistent mental health challenges. The results showed that 39.3% of the population faced persistent mental health challenges, and the XG Boost algorithm was the best-performing model for predicting persistent mental health challenges and understanding risk factors. The majority of the adult population is predicted to have persistent mental health challenges. Age, marital status, work status, family size, and time spent at school were identified as the top five important predictors of persistent mental health challenges. The findings indicate that a substantial proportion of the adult population experiences persistent mental health challenges. The XGBoost algorithm demonstrated high performance. Thus, policymakers are recommended to design tailored and context-specific interventions based on the identified predictors.

Keywords: Mental health, Persistent, Challenges, Prediction, Adult Population

Panel 03: Health and Wellbeing

Effectiveness of breastfeeding educational interventions during pregnancy on breastfeeding practices in rural Central Ethiopia: Cluster Randomized Controlled Trial

Belayneh Hamdela Jena1*, Tsedeke Lambore Gemecho2, Ermias Abera Turuse1, Biruk Assefa Kebede3, Zehara Ahmed Adem4, Lamesginew Mossie Melaku5, Kassahun Alemu Gelaye6

***Corresponding author**: Belayneh Hamdela Jena, PhD, Email: bhamdela@gmail.com

Department of Epidemiology, school of public health, college of medicine and health sciences, Wachemo University, Hossana, Ethiopia.

Abstract

Despite its well-established benefits, breastfeeding practices differ across communities, and many women exhibit suboptimal practices due to cultural influences and limited access to accurate information. Nulliparous pregnant women, in particular, lack prior breastfeeding experience and are often strongly influenced by family members such as mothers-in-law. However, there is limited evidence on whether involving these influential family members in breastfeeding education can improve breastfeeding practices. This study evaluated the effectiveness of breastfeeding education interventions delivered to pregnant women together with their mothers-in-law, compared with pregnant women alone and those receiving routine care in rural Central Ethiopia. A community-based, three-arm, cluster-randomized controlled trial was conducted among 510 pregnant women enrolled before 16 weeks of gestation. The study arms were: (1) pregnant women with their mothers-in-law, (2) pregnant women alone, and (3) a control group receiving routine care. Fifty-one non-adjacent clusters were randomly assigned using simple randomization. The intervention consisted of eight home-based educational sessions: six during pregnancy and two postpartum. Outcomes included pre-lacteal feeding, colostrum feeding, early initiation of breastfeeding, and exclusive breastfeeding. Breastfeeding education in both intervention groups had a significant positive effect on key breastfeeding practices. Compared to the control group, mothers in the intervention arms were more likely to avoid pre-lacteal feeding [RR = 2.17, 95% CI: 1.19–3.85 and RR = 1.79, 95% CI: 1.06–2.86], practice colostrum feeding [RR = 1.14, 95% CI: 1.01–1.29 and RR = 1.11, 95% CI: 1.01–1.23], initiate breastfeeding early [RR = 1.51, 95% CI: 1.14–1.99 and RR = 1.36, 95% CI: 1.02–1.82], and exclusively breastfeed [RR = 2.08, 95% CI: 1.43–3.03 and RR = 1.56, 95% CI: 1.05–2.33]. Involving mothers-in-law in breastfeeding education, in addition to providing interventions to pregnant women alone, has broader practical implications for improving recommended breastfeeding practices. The protocol was registered at ClinicalTrials.gov identifier: NCT06236412 (January 23, 2024).

Key words: Null-para; Breastfeeding practice; Educational intervention; pregnant women

Panel 03: Health and Wellbeing

Drivers of concurrent anthropometric failures among under-5 children in Sub-Saharan Africa: Application of multilevel mixed-effects negative binomial regression modelling

Amare Muche[1], Mulugeta Ashagrie Bekahagn[2], Fekadeselassie Belege Getaneh[3], Mulugeta Desalegn Kasaye[4], Dagnachew Melak[1], Eyob Tilahun Abeje[1], Aznamariam Ayres[1*]

[1]Department of Epidemiology and Biostatistics, School of Public Health, College of Medicine and Health Sciences, Wollo University, Dessie, Ethiopia.

[2]School of Medicine, College of Medicine and Health Sciences, Debre Tabor University, Debre Tabor, Ethiopia.

[3]Department of pediatrics and child health nursing, College of Medicine and Health Sciences, Wollo University, Dessie, Ethiopia.

[4]Department of Health Informatics, School of Public Health, College of Medicine and Health Sciences, Wollo University, Dessie, Ethiopia.

*Corresponding author: E-mail: aznamariamayres@gmail.com

Abstract

Childhood malnutrition remains a major public health concern in Sub-Saharan Africa (SSA). Conventional indicators (stunting, wasting, overweight/obesity, and underweight) often underestimate the burden because they fail to capture children experiencing multiple anthropometric failures simultaneously. This study aimed to identify the individual-, household-, and community-level drivers of concurrent anthropometric failures (CAFs) using the extended composite index of anthropometric failure (ECIAF) among under-five children in 27 SSA countries. This study used the most recent Demographic and Health Survey (DHS) data collected between 2016 and 2024 from 27 SSA countries, employing a two-stage stratified cluster sampling design to ensure national representativeness. Pooled data from 168,236 under-five children were extracted. Considering the hierarchical nature of DHS data and overdispersion of the outcome variable, a multilevel mixed-effects negative binomial regression model was fitted using STATA version 17 to identify individual- and community-level drivers. Adjusted incidence rate ratios (AIRR) with 95% confidence intervals were used to determine statistical significance at $p < 0.05$. Older children had a higher risk of CAF (AIRR: 1.02; 95% CI: 1.02–1.03), while female children were less likely to experience CAF (AIRR: 0.77; 95% CI: 0.75–0.79). Multiple births showed a higher incidence (AIRR: 1.74; 95% CI: 1.61–1.88), whereas birth intervals ≥24 months were protective (AIRR: 0.91; 95% CI: 0.87–0.95). Average (AIRR: 1.20) and small birth size (AIRR: 1.66) and comorbid illness (AIRR: 1.11) increased CAF risk. Maternal education reduced risk: primary (AIRR: 0.90), secondary (AIRR: 0.83), and higher (AIRR: 0.71). Children from poorer households and households with more under-five children had higher CAF risk. CAF among under-five children in SSA is influenced by child, maternal, and household factors. Strengthening maternal education, improving access to antenatal and delivery services, and addressing household socioeconomic inequalities are essential to reduce CAF and improve child nutrition outcomes.

Keywords: Under-5 Children, ECIAF, Sub-Saharan Africa, DHS, Negative binomial regression

Panel 03: Health and Wellbeing

Antibacterial Activity Evaluation of Different Solvent Leaf Extracts of Four Traditional Medicinal Plants Against Salmonella

Jelalu Kemal[1]* and Frederick T Tabit[2]

[1]Haramaya University College of Veterinary Medicine, P. O. Box 138, Dire Dawa, Ethiopia.

[2]University of South Africa Department of Life and Consumer Sciences, Florida, 1710, South Africa.

*Corresponding author (PhD Candidate): Email: jelaluk@gmail.com;

Abstract

Medicinal plants have been used for various purposes, including treating infections, due to their antimicrobial potential. The purpose of this study was to evaluate the antibacterial activity of the leaf extracts of four traditional medicinal plants and determine the minimum inhibitory concentrations (MICs) and minimum bactericidal concentrations (MBCs) of these plants against *Salmonella*. Leaves of *Vernonia amygdalina*, *Aloe arborescens*, *Artemisia absinthium*, and *Croton macrostachyus* were evaluated against *Salmonella* at concentrations of 55, 110, and 220 mg/mL. The combined effects of the plant extracts against *Salmonella* were also evaluated. The diameter of the zone of inhibition ranged from 5.33 ± 0.58 mm (at 55 mg/mL) to 19.67 ± 0.58 mm (at 220 mg/mL) for the individual plant extracts, and from 7.67 ± 0.58 to 23.33 ± 0.58 mm for the combined extracts. The mean MICs of the individual plant extracts ranged from 1.43 ± 0.49 mg/mL (methanol extract of *V. amygdalina*) to 27.50 ± 0.00 mg/mL (aqueous extract of *A. absinthium*) against the retail beef-derived *Salmonella* isolate, and from 1.14 ± 0.49 mg/mL (methanol extract of *V. amygdalina*) to 27.50 ± 0.00 mg/mL (aqueous extract of *A. absinthium*) against the reference *Salmonella* strain. The MICs of different solvent extracts combined with plant extracts ranged from 0.86 ± 0.00 mg/mL (methanolic extract of *C. macrostachyus* + *V. amygdalina* against the standard *Salmonella* strain) to 55.00 ± 0.00 mg/mL (*A. arborescens* + *A. absinthium* against the retail beef-derived *Salmonella* isolate). Methanolic extracts of *V. amygdalina*, used individually and in combination with other extracts, exhibited strong antibacterial activity. Future investigations are needed to assess the safety of these plants and to study the synergistic effects of combining plant extracts to enhance their antibacterial potency.

Keywords: Antibacterial activity; MBC; Medicinal plants; MIC; Phytochemical

Panel 03: Health and Wellbeing

Machine Learning-Driven Prediction of Pediatric Weight Trajectories and Malnutrition Risk Thresholds: Implications for RMNCH Policy in Ethiopia

Alemayehu Siffir Argawu (PhD, MBA)
Department of Statistics, Ambo University, Ethiopia
Corresponding author Email**:** alex089973@gmail.com

Abstract

Childhood malnutrition remains a critical barrier to human capital development and societal resilience. While traditional monitoring relies on linear averages, the complex, dynamic nature of pediatric growth requires advanced biostatistical tools for early detection. This study utilized longitudinal data from the Young Lives study, encompassing 7,140 children (35,700 observations) in Ethiopia, India, Peru, and Vietnam. Three machine learning algorithms—Random Forest (RF), Support Vector Regression (SVR), and Gradient Boosting Machines (GBM)—were evaluated to predict weight trajectories and identify actionable clinical thresholds. SVR demonstrated superior predictive precision ($R^2 = 0.998$), proving its efficacy in non-linear growth mapping. RF analysis identified biological factors, specifically growth rate (75.44% IncMSE) and lagged weight, as the primary predictors, while highlighting significant geographical disparities. Decision tree analysis isolated a critical intervention benchmark of <16 kg for children aged 3–5 years. Crucially, the model identified rural Ethiopian and Indian children under age three as the highest-risk subgroup, with average weights (≤ 8.3 kg) significantly lower than those of their urban counterparts. Transitioning from reactive care to proactive, data-driven nutritional intervention is essential for structural transformation in health delivery. By integrating ML-derived thresholds into Reproductive, Maternal, Neonatal, and Child Health (RMNCH) protocols, policymakers can better protect vulnerable populations. This framework provides a scalable toolkit for precision public health, directly contributing to sustainable development and the realization of SDG 2.2.

Keywords: Machine Learning; Pediatric Growth; Human Nutrition; Ethiopia; Support Vector Regression; Human Capital; SDG 2.2; RMNCH.

Panel 03: Health and Wellbeing

A comparative insight on Generative Artificial Intelligence and Mental Health Among University Students in the Middle East and Africa: Evidence Gaps and Implications for Ethiopia

Mekuriaw Nibret Aweke*[1], Yalalem assefa[2]

[1]Department of Human Nutrition, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia.

[2]Department of Lifelong Learning and Community Development, Woldia University, Woldiya, Ethiopia

Abstract

Mental health disorders are common among university students, with 43.3% reporting depressive symptoms and 58.4% experiencing insomnia. Emerging technologies like generative artificial intelligence (GenAI) may influence mental health, but evidence from the Middle East and Africa (MEA), including Ethiopia, is limited. No studies were found from Ethiopia examining this relationship. This systematic review and meta-analysis aimed to synthesize evidence on the association between GenAI use and mental health outcomes among university students in MEA and to identify research gaps in Ethiopia. We searched PubMed, ScienceDirect, HINARI, Scopus, DOAJ, Cochrane, Google, and Google Scholar for studies on GenAI use and mental health among university students, without language or date restrictions. Study quality was assessed using the Newcastle–Ottawa Scale. Heterogeneity was evaluated using Cochrane's Q and I^2, and publication bias was assessed using Egger's test. Pooled associations were estimated using a random-effects model. Thirty-eight studies, including 15,619 students from MEA, were reviewed, most of which were of high quality (Newcastle–Ottawa scores of 6–8). GenAI use was linked to reduced anxiety, stress, and academic workload, and improved confidence, motivation, emotional well-being, AI literacy, and access to mental health support. However, overreliance increased anxiety, stress, and depression. The meta-analysis showed a small positive association between GenAI use and mental health symptoms ($r = 0.24$, 95% CI: 0.08–0.40), with high heterogeneity ($I^2 = 98.24\%$, $p < 0.001$). GenAI use has both benefits and risks for university students' mental health. While it can reduce academic stress and improve access to support, excessive use may worsen anxiety, stress, and depression. The lack of evidence from Ethiopia highlights a critical gap. Primary studies in Ethiopian universities are urgently needed to guide the safe and effective integration of GenAI into academic and support systems.

Keywords: Generative Artificial Intelligence, Mental Health, University Students, Middle East, Africa, Ethiopia

Panel 04-A: Transdisciplinary research

Artificial Intelligence and Cybersecurity Integration to Enhance National Interest and Economic Stability Through Collaborative Policies

Hussen Asefa Musa

Information Network Security Administration (INSA), Addis Ababa, Ethiopia

Abstract

This study investigates the critical intersection of cybersecurity and artificial intelligence (AI), analyzing how AI technologies are reshaping cybersecurity practices while introducing new vulnerabilities. A systematic literature review of 53 primary studies, selected from 2,758 search records in academic databases such as IEEE Xplore and ScienceDirect, explores these dynamics from 2016 to February 2025. The research highlights how AI enhances cybersecurity measures, focusing on technologies such as machine learning, deep learning, large language models, and generative AI. Applications in threat detection, network intrusion detection, vulnerability management, and data center security are examined, revealing opportunities for improved threat detection accuracy ranging from 94% to 99% and operational efficiency gains. Simultaneously, the study addresses ethical dilemmas and challenges, such as the 2.8 million unfilled cybersecurity positions globally and emerging adversarial AI threats. It assesses the economic impact of national strategies, policies, and initiatives across various regions, including the USA, EU, China, UAE, and Africa, with particular attention to Ethiopia's Digital Ethiopia 2025 strategy. The study addresses policy implications at national, economic, and international levels, along with implementation frameworks such as Zero Trust architecture and SOAR automation. Additionally, it outlines 2026 cybersecurity trends and offers strategic recommendations for organizations and policymakers to enhance digital resilience in an increasingly complex cybersecurity landscape. The study underscores the necessity for coordinated efforts to bridge the skills gap and ensure robust cybersecurity frameworks amid rapid technological advancements.

Keywords: Cybersecurity, Artificial Intelligence, Machine Learning, Deep Learning, National Security, Policy, Ethiopia, Digital Transformation

Panel 04-A: Transdisciplinary research

Safeguarding the Jefore/Yegordena Mocha Cultural Green Grass Corridor System for Sustainable Tourism Development in East Guraghe and Guraghe Zones, Ethiopia

Melese Moareta[1*] and Abera Aboset[1](PhD)

[1]Department of Biodiversity and Ecotourism Management, Wolkite University, P.O. Box: 07, Walkite, Ethiopia

*Corresponding Author: Email: melesemoareta@wku.edu.et

Abstract

The aim of the study is to examine the living cultural landscape of the Jefore/Yegordena Mocha Cultural Green Grass Corridor System located in the East Gurage and Gurage Zones of Ethiopia, with special emphasis on the corridor's potential for sustainable development of tourism and cultural heritage conservation. The Jefore/Yegordena Mocha Cultural Green Grass Corridor System is a traditional road that is tree-lined and has grass along the sides. These corridors have demonstrated a high sense of cultural identity, biodiversity, and control of the microclimate. However, the corridors, with their cultural heritage and tourism potential, are facing new threats from agriculture, urbanization, infrastructure development, and the loss of traditional custodianship. The study used a mixed research design, and data were collected from twelve woredas in Ethiopia, involving 48 focus group discussions, 48 in-depth interviews, and 390 surveyed households. The quantitative data were analyzed using descriptive statistics, reliability tests, t-tests, chi-square tests, ANOVA, correlation, and multiple regression analyses. The study revealed a high level of community consensus on the importance of the corridor for cultural identity and tourism development, with a mean score of 4.9 and above on a five-point Likert scale, and no significant differences across gender, age, or education level. The results indicated a high level of inclusivity within the community. Correlation analysis showed a positive relationship between cultural identity and tourism benefits, as well as between cultural identity and participation in tourism. The study concludes that the Jefore/Yegordena Mocha Cultural Green Grass Corridor System is a heritage site under threat and a promising platform for sustainable tourism development.

Keywords: Jefore/Yegordena Mocha Cultural Green Corridor, cultural landscape, sustainable tourism, heritage management, community participation, Ethiopia

Panel 04-A: Transdisciplinary research

Women in the Gig Economy: A Study on the Experiences, Challenges, and Opportunities of Female Drivers in Ethiopia's 'Sergela' Ride-Sharing Platform

Bimer Eyayu Enyew (Assistant Professor)

Department of Gender and Development Studies, College of Social Science and Humanities, University of Gondar, Ethiopia

E-mail: bimeyayu27@gmail.com, Phone: +251 913 34 05 73

Abstract

Despite the recent emergence of ride-sharing services in Ethiopia—particularly in Addis Ababa—there remains a significant gap in scholarly literature addressing the lived experiences, challenges, and opportunities associated with these services. This study examines the experiences of female drivers within the Seregela ride-sharing platform, with a focus on the multifaceted challenges they face and the opportunities available to them. The study employed a qualitative research design, using in-depth interviews as the primary data collection method. Eleven participants were selected through snowball sampling to provide rich, narrative-based insights into their experiences. The findings reveal that women were primarily motivated to join Seregela due to a combination of childhood aspirations, financial necessity, and prior work experiences. However, female drivers encountered a range of obstacles, including societal stigma, economic hardship, health concerns, and organizational challenges within the platform. Despite these barriers, participation in Seregela provided opportunities for personal and professional development, such as improved interpersonal skills, increased visibility as role models, and the creation of employment opportunities for others. The study concludes that female participation in Ethiopia's ride-sharing sector plays a crucial role in challenging entrenched gender norms and promoting economic inclusion. The insights generated can inform policy interventions aimed at fostering gender equality and sustainable development. It is recommended that Seregela, in collaboration with municipal authorities, implement targeted initiatives to empower women drivers, promote gender equality, and reduce harmful societal stereotypes, thereby creating a more inclusive and supportive environment within the ride-sharing industry.

Key Words: *Gig economy, Women drivers, Challenges, Opportunities, Seregela, Ethiopia*

Panel 04-A: Transdisciplinary research

Development and Performance Evaluation of Waste-Fabric Reinforced Bio-Composite Sandwich Structures for Sustainable Housing Applications in Ethiopia

Melese Shiferaw Kebede[1]*, Hussen Agegnehu Ali[1], & Asmamaw Tegegne Abebe[2]

[1]Departments of Mechanical Engineering, Institute of Technology, University of Gondar, Gondar, P.O Box 196, Ethiopia.

[2]Federal Technical and Vocational Education and Training Institute, Addis Ababa, Ethiopia.

*Corresponding Author: melese.sh07@gmail.com

Abstract

The construction industry is one of the largest consumers of natural resources and a major contributor to environmental pollution. In response to these challenges, the development of sustainable construction materials using recycled waste resources has gained increasing attention. This study focuses on the development and characterization of eco-friendly composite materials produced from recycled fabric waste and a polyester resin matrix for potential construction applications in Ethiopia. Fabric scraps collected from garment industry waste were used as reinforcement materials and categorized into sandwich, chopped, and laminated configurations. Composite specimens were fabricated using the hand lay-up technique with different reinforcing-to-matrix weight ratios ranging from 10/90 to 60/40. The developed composite materials were evaluated through mechanical, thermal, microstructural, water absorption, and color coating property analyses. The experimental results indicated that the composite plates exhibited improved mechanical performance, with the highest tensile, flexural, and impact strengths observed at a 40/60 reinforcing-to-matrix ratio. Among the reinforcement structures, the chopped fiber configuration demonstrated superior mechanical properties due to improved fiber dispersion and interfacial bonding. Thermal analysis showed moderate thermal stability at elevated temperatures, while microstructural observations confirmed strong fiber–matrix interaction. The composites also showed low moisture absorption and acceptable paintability after surface polishing. Overall, the study concludes that recycled fabric–reinforced polyester composites have strong potential as sustainable materials for non-load-bearing construction components and architectural applications, contributing to waste reduction and environmentally friendly construction practices.

Keywords: Sustainable construction materials; Recycled fabric waste; Bio-based composites; Circular economy; Materials characterization.

Panel 04-B: Current Issues (Global Diplomacy)

BRICS' Influence on Global Development Finance: Assessing Opportunities and Challenges for Economic Growth and Sustainable Development in Africa

Tsalafo Chaka Chame (PhD Candidate)[1]*

[1]Dilla University, Dilla, Ethiopia

Abstract

BRICS (Brazil, Russia, India, China, South Africa) has emerged as a significant non-Western actor in global development finance, primarily through the New Development Bank (NDB) and related financial mechanisms. Established to mobilize resources for infrastructure and sustainable development projects in emerging and developing economies, the NDB addresses funding gaps often unmet by traditional multilateral institutions. This study employs a mixed-methods approach, including document analysis of NDB and BRICS policy reports, quantitative assessment of development finance flows, and semi-structured interviews with African policymakers and development practitioners. The results indicate that BRICS development finance provides significant opportunities for African countries, including infrastructure development, climate resilience projects, and diversification of funding sources. However, challenges persist, particularly governance, transparency, and debt sustainability concerns. The study concludes that while BRICS finance can support Africa's economic growth and sustainable development, maximizing its impact requires strengthening institutional capacity, aligning projects with national priorities, and enhancing accountability mechanisms.

Keywords: BRICS, New Development Bank, development finance, Africa, sustainable development, infrastructure, governance

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