



**KENYATTA
UNIVERSITY**

2024 AIR and KU Climate Change Conference



**Theme: Climate Change impacts on
Food Systems and Health**

Venue: International Languages Conference Center (ILCC)
Kenyatta University Main Campus

Date: 24th October 2024 **Time:** 9:00am - 4:30pm

Let's join hands to save our planet

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Acronyms

AIR	American Institutes for Research®
API	Application Programming Interfaces
ASAL	Arid and Semi-arid Lands
BSF	Black Soldier Fly
CC	Climate Change
CCAFS	Climate Change, Agriculture and Food Security
CERES	Research Program on Crop Environment Resource Synthesis
CO ₂	Carbon Dioxide
DOAJ	Directory of Open Access Journals
DSSAT	Decision Support System for Agrotechnology Transfer
EA	Enumeration Area
ECOTRUST	Environmental Conservation Trust
FEWS NET	Famine Early Warning Systems Network
GCM	Global Climate Model
GHG	Greenhouse Gas
IDD	International Development Division
ILRI	International Livestock Research Institute
KACP	Kenya Agriculture Carbon Project
KALRO	Kenya Agricultural and Livestock Research Organisation
KCSAP	Kenya Climate Smart Agricultural Project
KES	Kenyan Shilling
KU	Kenyatta University
LVB	Lake Victoria Basin
MODA	Multiple Overlapping Deprivation Analysis
N ₂ O	Nitrous Oxide
PCN	Potato Cyst Nematode
PMC	PubMed Central
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCPs	Representative Concentration Pathways
RoB	Risk of Bias
SALM	Sustainable Agricultural Land Management
SPSS	Statistical Package for the Social Sciences
WTP	Willingness to Pay

Preface

We are delighted to present the compendium of abstracts for the KU Climate Change Conference, themed “Climate Change impacts on Food Systems and Health: Resilience and Adaptation.” This compendium of abstracts showcases the innovative research and practical solutions presented at this pivotal event, highlighting the urgent need to address climate change and its far-reaching effects. Kenya stands at a critical juncture as it faces the escalating impacts of climate change, which manifest through rising temperatures, unpredictable rainfall patterns, and frequent extreme weather events. These changes significantly affect food security, public health, and community resilience. The urgency of addressing these challenges cannot be overstated. AIR and Kenyatta University are co-hosting this event as part of their broader collaboration framework, which aims to engage in academic partnerships, research, and innovation.

The abstracts in this compendium span a wide range of topics, from resilience, adaptation, and mitigation strategies to the specific impacts of climate change on food systems and health. Our contributors delve into diverse areas such as policy processes in Kenya that enhance resilience and adaptation, as well as the role of comprehensive data platforms like the USAID funded FEWS NET Project, in supporting climate change research. Studies on integrating remote-sensing data with survey data reveal how women’s savings groups can bolster economic empowerment and resilience in Nigeria.

The impact of climate change on maize production in Kenya underscores the necessity of adaptive agricultural practices. Systematic reviews of climate actions in African healthcare institutions and studies on the health impacts of climate change on children in Kenya reveal the critical need for sustainable, climate-resilient strategies in healthcare. Each contribution reflects the latest research and insights, providing a comprehensive overview of the current state of knowledge and the path forward.

We take this opportunity to thank the AIR and Kenyatta University leadership and staff for accepting the responsibility of overseeing the conference planning process.

We hope that this compendium serves as a valuable resource for all attendees and inspires continued efforts to combat climate change. By joining hands and working together, we can develop strategies to build resilience, adapt to changing conditions, and mitigate adverse impacts, ensuring a sustainable future for Kenya.

Let us use this conference as a platform to exchange ideas, forge new partnerships, and commit to actions that will make a difference. Together, we can rise to the challenge and ensure a healthier, more sustainable world for future generations.

Ms. Christine Kiecha-Masasabi

Managing Director—Conference Convenor, AIR Kenya
and Ethiopia Offices

Dr. Kahiga Titus Muhu

Conference Co-convenor, KU

Acknowledgements

The development of this compendium is a collective effort and contribution of many dedicated individuals. We extend our heartfelt gratitude to all the researchers who have not only conducted invaluable work but have also taken the time to come physically and present their findings at this conference. Your rigorous research, insightful analyses, and commitment to advancing knowledge are the foundation upon which this compendium is built. Your presence and active participation have greatly enriched the discussions and outcomes of this event.

We also wish to express our deep appreciation to the organizing committee, whose tireless efforts have made this conference possible. The Climate Change Conference Organizing Committee consisted of the AIR and three schools from KU: the School of Health Sciences; the School of Business, Economics, and Tourism; and the School of Agriculture and Environmental Sciences. Your meticulous planning, coordination, and unwavering dedication have ensured that this event brings together a diverse group of stakeholders, fostering meaningful discussions and collaborations.

We wish to recognise the total commitment and hard work put by the planning co-committee and extend our special thanks to the organizing committee members: Ms. Christine Kiecha-Masasabi, the conference convener, Dr. Emily Mutea, Dr. Sophie Githinji, Ms. Mana Shune, Mr. Eric Muchugu, Mr. Nicholas Yongo, and Mr. Lawrence Kiarie from AIR; Dr. Mwendu Ngei and Prof. Joseph Gweyi-Onyango from the School of Agriculture and Environmental Sciences (KU); Dr. David Kirimi and Dr. Joseph Muniu from the School of Business, Economics, and Tourism (KU); and Dr. Titus Kahiga from the School of Health Sciences (KU), who also served as the co-convenor of the conference.

A special note of thanks goes to the Abstract Review Committee: Dr. Sophie Githinji (AIR), Dr. Emily Mutea (AIR), Dr. Issac Mwanzo (School of Health Sciences, KU), Dr. Solomon Mburung'a (Department of Community Resource Management, KU), and Dr. Erick Odour Otieno (Department of Agricultural Science and Technology, KU).

We would like to thank the executive leadership of AIR and Kenyatta University, Mr. Jonathan Simonetta and Dr. Thomas de Hoop, and the Executive Deans, Prof. Okello Agina, Dr. Perez Onono, and Dr. James Koskei, for their guidance and strategic input.

We are grateful to all the participants for their enthusiasm and commitment to addressing the pressing challenges posed by climate change. Their engagement and contributions during the conference will undoubtedly lead to actionable recommendations and strategies that will shape future initiatives and policies.

Dr. Emily Mutea
Conference Coordinator
AIR Kenya, Division

Dr. David Kirimi
Member of the Climate Change Conference
Organizing Committee, KU

Background and Introduction

Introduction

Climate change poses a significant threat to Kenya, impacting numerous sectors. The urgency of addressing climate change cannot be overstated as the country experiences rising temperatures, unpredictable rainfall patterns, and more frequent extreme weather events. These changes have far-reaching consequences for food security, public health, and the overall resilience of communities as witnessed with the recent floods and climatic changes witnessed in the country.

Climate Change Conference

The upcoming conference on “Climate Change Impacts on Food Systems and Health in Kenya” is both important and timely. As the effects of climate change become increasingly evident, it is crucial to address these challenges head-on. This conference convened by AIR and KU aims to bring together key stakeholders to foster collaboration, strengthen partnerships, and facilitate evidence-based discussions that will lead to actionable recommendations for future initiatives and policies. By convening this conference now, we can develop strategies to build resilience, adapt to changing conditions, and mitigate adverse impacts, ensuring a sustainable future for Kenya.

Climate Change and Food Systems

Climate change has profound effects on food systems, which are critical to the livelihoods and well-being of Kenyan communities. Changes in temperature and precipitation patterns can lead to reduced crop yields, threatening food security and increasing food prices. In addition, warmer temperatures and altered weather patterns can exacerbate the prevalence of pests and diseases, further endangering crops and livestock. Water availability is also impacted, affecting irrigation and the overall productivity of agriculture. These challenges highlight the need for sustainable food systems that can withstand the impacts of climate change.

Climate Change and Health

The health impacts of climate change are equally significant. Rising temperatures can lead to heat stress and heat-related illnesses, particularly amongst vulnerable populations such as older persons and those with preexisting health conditions. Climate change can also expand the range of vectors like mosquitoes, increasing the incidence of vector-borne diseases such as malaria and dengue fever. Furthermore, increased flooding and changes in water quality can result in outbreaks of water-borne diseases like cholera. Food insecurity, driven by climate change, can lead to malnutrition and associated health problems, particularly in children. Addressing these health impacts is crucial for the well-being of Kenyan communities.

Resilience and Adaptation

Building resilience involves developing strategies to enhance the ability of communities and ecosystems to withstand and recover from climate-related shocks. Adapting to change requires identifying and implementing measures that reduce vulnerability and improve the capacity to cope with climate-related challenges. Evidence-based discussions can lead to informed decision-making, ensuring that policies and initiatives are effective and sustainable. Strengthening collaboration and partnerships amongst stakeholders can enhance the effectiveness of climate change responses and ensure a coordinated approach.

Goals, Approach and Expected Outcomes

The primary goals of this conference are to share and learn from recent research on climate change, as well as to facilitate evidence-based discussions and exchanges with Kenyan stakeholders, ultimately increasing collaboration amongst key partnerships in the climate change space. The conference aims to bring together experts, policymakers, and industry leaders to engage in meaningful discussions, explore innovative solutions, and collaborate on strategies to combat the effects of climate change.

A key emphasis of this conference is the need for a multidisciplinary approach in addressing climate change issues. Climate change is a complex and multifaceted problem that impacts various sectors, including agriculture, healthcare, water resources, and infrastructure. By integrating perspectives and expertise from diverse fields, we can develop more comprehensive and effective solutions. This approach ensures that all aspects of the problem are considered, leading to more sustainable and resilient strategies.

The expected outcome is a set of informed, evidence-based recommendations that can guide future initiatives and policies, making a tangible impact on communities and ecosystems. These recommendations will play a crucial role in shaping future strategies to address the challenges posed by climate change in Kenya. Our multidisciplinary approach will enhance the robustness and applicability of these recommendations, ensuring they are well rounded and capable of addressing the diverse challenges posed by climate change.

Conclusion

This conference is a vital step towards addressing the pressing challenges of climate change in Kenya and beyond. By bringing together experts, stakeholders, and policymakers, we can develop comprehensive strategies to build resilience, adapt to changing conditions, and mitigate the impacts on food systems and health. The discussions and recommendations from this conference will be instrumental in shaping future initiatives and policies, ensuring a sustainable and resilient future for Kenya.

Programme

TIME	ACTIVITY	FACILITATORS
OFFICIAL OPENING SESSION AND KEYNOTE ADDRESS		
0900–0910 hrs	Conference overview: <ul style="list-style-type: none"> Ms. Christine Kiecha: Managing Director, AIR Kenya and Ethiopia Offices, IDD, AIR 	Ms. Christine Kiecha—convener, AIR
0910–0940 hrs	Welcoming remarks—30 min <ul style="list-style-type: none"> Mr. Jonathan Simonetta: Vice President, IDD, AIR Dr. James Koskei: Executive Dean, School of Agriculture and Environmental Sciences, KU Prof. Caroline Thoruwa: Deputy Vice - Chancellor (Research, Innovation & Outreach), KU Prof. Waceke Wanjohi: Vice Chancellor, KU 	Dr. Kahiga—co-convenor, KU
0940–1025 hrs	Opening keynote addresses—45 min <ul style="list-style-type: none"> Dr. Thomas de Hoop: Managing Economist and Program Area Lead (Agriculture, Food Security, Nutrition and Climate Change), IDD, AIR Mr. Thomas Lerenten: Climate Change Directorate Dr. Eng. Festus K. Ng’eno: Principal Secretary for Environment and Climate Change 	Ms. Christine Kiecha
1025–1045 hrs	Coffee break	
SCIENTIFIC SESSION 1: OVERARCHING SESSION		
1045–1100 hrs	Exploring policy processes in food and water security in the context of climate change adaptation in Kenya: Prof. Fiona Ngarachu, United States International University—Africa Nairobi, Kenya	<i>Moderator:</i> Prof. Joseph Gweyi-Onyango <i>Monitor:</i> Dr. Sophie Githinji
1100–1115 hrs	FEWSNET as a resource or tool to support climate change research: Ms. Agnes Kyenze, AIR	
1115–1130 hrs	Questions and answers	
SCIENTIFIC SESSION 2: RESILIENCE, ADAPTATION, AND MITIGATION		
1130–1145 hrs	Enhancing waste separation in urban farming for climate resilience: Mr. Zablon Wekesa, African Circular Economy Network	<i>Moderator:</i> Dr. Emily Mutea <i>Monitor:</i> Dr. David Kirimi
1145–1200 hrs	Biochar and liming as soil amendments invariably affect greenhouse gas emissions: Evidence from N fertilisation in smallholder farms in Lake Victoria Basin: Prof. Joseph Gweyi-Onyango, KU	
1200–1215 hrs	Assessment of adoption and impact of management innovations in agriculture carbon project in East Africa: Prof. Ogada Maurice Juma, Taita Taveta University	
1215–1230 hrs	Questions and answers	
1230–1330 hrs	Lunch break	
SCIENTIFIC SESSION 3: CLIMATE CHANGE AND FOOD SYSTEMS SUSTAINABILITY		

TIME	ACTIVITY	FACILITATORS
1330–1345 hrs	Assessing the climate change impacts on maize production and a plausible adaptation practice in Kenya: Mr. Eric Muchugu, AIR	<i>Moderator:</i> Dr. Mwendé Ngie <i>Monitor:</i> Ms. Shune Mana
1345–1400 hrs	Strategic livestock feed management through phases of the drought: Mr. Erick Mwatuni, Garissa County	
1400–1415 hrs	Willingness to pay for climate smart plant health management technologies amongst smallholder farmers in Kenya: Dr. Forah Obebo, KU	
1415–1430 hrs	Questions and answers	
SCIENTIFIC SESSION 4: CLIMATE CHANGE AND HEALTH		
1430–1445 hrs	Climate change and health: A systematic review: Dr. Titus Kahiga, KU	<i>Moderator:</i> Dr. Marlous de Milliano <i>Monitor:</i> Dr. Fransisca Ongecha
1445–1500 Hrs	Exploring multi-dimensional climate risks: The association between heat extremes, drought and an indicator of child health and well-being in Kenya: Ms. Evelyn Shu, AIR	
1500–1515 hrs	The impact of climate change on children in primary health care in Isiolo County, Northern Kenya: Dr. Beatrice Wairimu, KU	
1515–1530 hrs	Questions and answers	
PLENARY SESSION—20 min		
1530–1550 hrs	<ul style="list-style-type: none"> • Opportunity for participants to share their insights, reflections and feedback • Address any remaining questions or concerns 	Dr. Emily Mutea and Dr. Joseph Muniu
CLOSING SESSION		
1550–1600 hrs	Conference outcomes and resolutions Rapporteurs: Ms. Rawiyah Aboud and Dr. Mwendé Ngie	Dr. Mwendé Ngie
1600–1610 hrs	Vote of thanks <ul style="list-style-type: none"> • Managing Director, AIR Kenya and Ethiopia Offices, IDD, AIR and • Executive Dean, School of Health Sciences, KU 	Ms. Christine Kiecha and Prof. Okello Agina
1610–1630 Hrs	Coffee break	
END OF THE CONFERENCE		

Abstracts

Overarching topics

Exploring policy processes in food and water security in the context of climate change adaptation in Kenya

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ABSTRACT: Kenya has several policy frameworks when it comes to climate change, the environment, ASALs, and resilience. With the implementation of devolution starting in 2010, county governments have been politically empowered to lead in the development and implementation of water and food security policies that will ensure successful adaptation to climate change. This process is on-going with county governments like Wajir and Kitui supported by both the national government and local and international organisations to develop policies and bills such as the Wajir County Climate Change Fund Act (2016). The key question that guided this study was how do policies at national and county levels address resilience and adaptation in the context of climate change in Kenya? The secondary question was how are policy actors involved in the policy process? Answering these questions involved a desk review of existing policies related to climate change, specifically food and water security policies, as well as health and environment policies. This review focused on how the documents conceptualised resilience, food security and water security. Semi-structured interviews and focus group discussions with 30 policy actors were also conducted in 2020 and 2021. One key finding was a lack of co-production in the policy process. While stakeholder engagement was conducted at the grassroots level, for example, with the Isiolo water policy, there was no feedback loop once the policy had arrived at the county assembly. There was also a lack of coordination between the sectors; for example, the water department would not harmonise with the land department over a shared policy objective such as climate change. These issues led to a lack of policy coherence. Despite these obstacles, however, the policies at both the national and county levels addressed climate resilience, particularly in the context of empowering communities with climate adaptation financing. Some recommendations from the study are the inclusion and mainstreaming of concepts of co-design and co-production into the policy processes, especially at the county level. Capacity building of policy actors is another recommendation, specifically capacity building that seeks to address normalised behaviour(s) and ways of working such as secondments to other organisations/departments.

Keywords: climate change policy, food security, adaptation, resilience, Kenya policy framework

FEWS NET as a resource or tool to support climate change research

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ABSTRACT: The Famine Early Warning Systems Network (FEWS NET) serves as a crucial resource for climate change research, particularly concerning food security. Originally developed to monitor and forecast global food emergencies, FEWS NET offers comprehensive analyses of various factors contributing to acute food insecurity, including agroclimatology, markets, conflict, and livelihoods. This study focused on the FEWS NET Data Platform, which provides researchers with access to real-time and historical datasets. These datasets cover a range of topics such as climatology, conflict, agriculture, floods, markets and trade, nutrition, and infectious diseases. The platform supports various data formats and offers APIs for integration with other systems, allowing customisation for specific climate change research needs. Agroclimatology data are highlighted as one of FEWS NET's most valuable resources, containing detailed records of climatic variables like precipitation and temperature. This information is essential for modelling the effects of climate change on agricultural productivity, including impacts from drought, changing growing seasons, and shifting weather patterns on crop yields. The FEWS NET data model integrates information from multiple domains, facilitating comprehensive analyses of how climate shifts affect food systems. FEWS NET's extensive data resources are invaluable for climate change researchers addressing food security challenges. By providing insights into the interconnections between climate data, conflict, migration, market trends, and food security metrics, FEWS NET supports risk assessments and informs future interventions.

Keywords: FEWS NET, climate change research, food security

The promise of combining remote sensing and survey data: Evidence on climate shocks and women's economic empowerment in Nigeria

Thomas de Hoop,¹ Jessie Pinchoff,¹ Evelyn Shu,¹ Rosa Castro Zarzur,¹ Garima Siwach,¹ Adria Molotsky,¹ Philomena Panagoulas,¹ Audrey Sacks,² Michael Gboyega Ilesanmi,² and Yetunde Fatogun¹

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ABSTRACT: This study focused on how to combine remote-sensing data with survey data from impact evaluations to generate lessons on how to improve climate change adaptation. Women's savings group programs are an important strategy for advancing women's economic empowerment. Some research suggests savings groups can also increase resiliency to climate change, although empirical evidence remains thin. We combined longitudinal survey data of 6,883 interviews with women and their husbands with surveys of 1,305 women's groups in six states in Nigeria as part of a quasi-experimental study of the Nigeria for Women Project, a large-scale government-supported women's savings group program in Nigeria. Using geographic information, we overlaid satellite derived and remotely sensed measures of drought and precipitation. Our results suggested positive impacts of women's groups on savings and access to credit, as well as some indications for positive impacts on asset ownership after 2.5 years of program implementation. When overlaid with droughts and floods, we found larger impacts on savings during less extreme weather and larger impacts on assets ownership (especially livestock) during more extreme weather. To make savings groups successful, further study of heterogeneous effects related to climate change is critical. This study also showed the potential of combining remote-sensing data with survey data from impact evaluations.

Keywords: *Remote sensing, savings group, resilience, climate shocks, women economic empowerment*

Enhancing waste separation in urban farming for climate resilience

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ABSTRACT: Urban agriculture has potential as a solution to enhance climate change resilience and mitigate its effects on food systems and public health. A key question is whether urban farms can incentivise the sorting of waste at the source. This study focused on the use of urban organic waste, specifically food scraps, by urban farmers and BSF farms, emphasising the importance of waste separation by demonstrating the value of discarded food in urban farming. This research employed a case study approach, with field visits, interviews, and experiments using mini-farm prototypes to assess urban waste sorting and utilisation. The study included 20 households, 18 waste pickers, and 5 waste collection companies as key stakeholders. Techniques for waste sorting and utilisation were explored, with the aim of identifying effective strategies for scaling up urban farming innovations. Preliminary findings from Ngong, Kajiado, Kenya, indicated that households are more likely to segregate waste when they perceive value in waste streams. Integrating urban farming practices, such as mushroom cultivation and BSF farms, into waste management can promote resource circularity. When fully implemented, circular approaches can reduce greenhouse gas emissions by up to 49%.¹ Mini-farm prototypes, modelled after vertical farms, show promise for scaling up to municipal levels. Although currently small scale, they have the potential to raise environmental awareness, increase individual involvement in waste management, and encourage municipalities to create waste treatment facilities, thereby enhancing urban agriculture's role in sustainable development.

Keywords: *urban agriculture, climate change resilience, food systems, health impacts, waste sorting, organic waste, black soldier fly (BSF) farms, waste management, resource circularity, greenhouse gas emissions*

¹ UNEP, UNDP and UNFCCC secretariat. (2023). *Building circularity into nationally determined contributions (NDCs)—A practical toolbox user guide* (p. 2). <https://doi.org/10.59117/20.500.11822/43594>

Biochar and liming as soil amendments invariably affect greenhouse gas emissions: Evidence from N fertilisation in smallholder farms in Lake Victoria Basin

Winnie Ntinyari,¹ Cargele Masso,² and Joseph Gweyi-Onyango³

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²CGIAR, ILRI

³Department of Agricultural Science, KU

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ABSTRACT: Reducing greenhouse gas emissions and increasing agronomic productivity by sustaining soil organic matter and soil fertility have become the main concerns for agricultural stakeholders globally. The benefits from soil amendments have been reported. The soil benefits from these amendments have been variable and inconsistent. The objective of the current work was to evaluate N fluxes from different limed soils under different N sources in LVB. A factorial laboratory incubation experiment to investigate how N fertiliser (0kgNha⁻¹, 12.5 kgNha⁻¹ and 50 kgNha⁻¹) and liming affected GHG emissions and soil N availability was conducted. The focus was on three common acidic soils (two ferralsols and one vertisol) from LVB (Kenya side). After 8 weeks, the most significant increase in cumulative CO₂ and N₂O fluxes compared with the unfertilised control was found for the two ferralsols in the N+lime treatment, with five- to six-folds higher CO₂ fluxes than the control. The δ¹³C signature of soil-emitted CO₂ revealed that for the ferralsols, liming (i.e., the addition of CaCO₃) was the dominant source of CO₂, followed by urea, whereas on CO₂ flux was found for the vertisol. Liming in combination with N fertilisation significantly increased the final nitrate content by 14.5% to 39% compared with N fertilisation alone in all treatment combinations and soils. We conclude that consideration should be given to the GHG budgets of agricultural ferralsols since liming is associated with high liming-induced CO₂ and N₂O emissions. Therefore, use of sources like biochar, which is gaining popularity, is a viable option that can be explored as an alternative to liming to manage the pH and the associated fertility of acidic tropical soils consequently increasing yields. The biochar, apart from having a “liming effect”, can contribute to soil carbon sequestration and improved soil physical properties.

Keywords: *carbon sequestration, global warming potential, isotope signature, nitrous oxide, volatilisation*

Assessment of adoption and impact of management innovations in agriculture carbon project in East Africa

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ABSTRACT: This study focused on the results of an impact assessment of management innovations that were introduced in agricultural carbon projects in East Africa. We evaluated the effect of project design, management, and monitoring transfer of responsibilities to local communities on the performance of agricultural carbon projects. The assessment included the economic, social, and environmental impacts of the projects on the smallholder farmers. The agriculture carbon projects implemented by Vi Agroforestry and ECOTRUST have received a total of 1,951,437 tCO₂e GHG emissions reduction credits from 2010 to 2019. In Vi Agroforestry, 29,500 farm households in 1,725 farmers groups benefited from the implementation of the projects. They received a total of 624,960 tCO₂e GHG reduction credits in the last 10 years. Similarly, approximately 9,000 smallholder farmers participated in the agricultural carbon project managed by ECOTRUST, and they received 1,326,447 tCO₂e worth of verified emissions reduction certificates from 2010 to 2019. Most farmers (~70%) in the agricultural carbon projects were women. This assessment showed that the institutional approach of transferring management authority to local communities, including capacity-building activities and social inclusion, can generate multiple benefits (economic, social, and environmental) for the smallholder farmers. Local institutions (e.g., farmer groups) and intermediaries (e.g., non-governmental organisations) played a leading role in the use of management innovations (e.g., training manuals) for effective design, management, and monitoring of the agricultural carbon projects in Kenya and Uganda.

Keywords: *adoption, mitigation options, carbon credit, impact assessment, smallholders, gender*

Climate change and food systems sustainability

Assessing the climate change impacts on maize production and a plausible adaptation practice in Kenya

Eric Muchugu,¹ James Karanja,² Joan Gathu,¹ Ahmad Mohassel,¹ and Thomas de Hoop¹

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ABSTRACT: Agriculture and the economies of sub-Saharan Africa are highly sensitive to climatic variability. Maize (*Zea mays* L.) is the most widely grown crop in sub-Saharan Africa, and it is a staple food for approximately 50% of the population. Climate change impact assessment along with adaptation measures are essential for reducing the impact of climate change on crop production. In this study, we integrated a decision support system for an agrotechnology transfer (DSSAT) model for maize (CERES-Maize) with four bias-corrected GCMs, namely, EC-EARTH, GFDL-ESM4, HadGEM3-GC31-LL and MIROC6 for two RCPs 4.5 and 8.5 to systematically (a) calibrate and validate DSSAT using a field study conducted in Kenya; (b) evaluate the impacts of climate change on maize productivity and risks using the past climate 1981–2010 and near-term climate change (2021–2040); and (c) quantify potential benefits of adapting drought and heat tolerance maize varieties recently released compared to commonly grown (benchmark) maize varieties across Kenyan maize-growing mega environments. Results indicated that DSSAT-simulated grain yield agreed well with observation. Simulation results indicated that climate change will have a negative impact on maize yield across all maize-producing areas but the degree of the impact varies with location, level of warming and rainfall changes. Mean grain yield varies between –10% and +6% in response to 1°C temperature increase and –10% reduction rainfall below the baseline climate. On the one hand, mean grain yield varies between –6% and +20% in response to 1°C temperature increase and +10% rainfall increase above the baseline climate. The grain production could be maintained to at least the standard of 75% of historical in most cases but with greater risks for achieving a higher threshold (50% of baseline). Overall, the drought tolerance maize increased maize yields 33% to 54% (5.5 – 6.3 t/ha⁻¹) relative to benchmark varieties. The results advocate adoptions of management practice that incorporate early sowing, irrigations at sowing/flowering stages where possible, and adaption of drought and heat tolerance varieties for better sustainability and higher productivity.

Keywords: *climate variability, maize production, sub-Saharan Africa, climate change impact assessment, adaptation measures, DSSAT model, global climate models (GCMs), representative concentration pathways (RCPs), maize yield, drought tolerance, heat tolerance, rainfall*

Strategic livestock feed solutions and management across the drought cycle

Erick Mwatuni, J. Khobondo, D. Yongo, D. Indetie, S. Mutua, J. Muia, and
Paul Katiku

ELRP and KCSAP: Guidelines on sustainable ruminant feeds and nutrition security for
Kenya

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ABSTRACT: The increasing frequency, duration, and severity of droughts, intensified by global climate change, have posed substantial challenges to livestock production in ASALs. Drought conditions reduce feed availability, resulting in poor feeding, decreased productivity, and higher livestock mortality. To tackle these issues, a strategic approach that integrates feed management practices with the stages of the drought cycle is crucial for mitigating impacts, supporting recovery, and building resilience. This study undertook a thorough review of drought cycle management strategies, with a focus on feed interventions during four key phases: mitigation (normal phase), preparedness (alert/alarm phase), relief (emergence phase), and recovery (reconstruction phase). The research utilised case studies from the ASAL areas and expert insights by analysing existing feed management practices and stakeholder involvement at each phase. Each intervention was assessed based on feasibility, impact on livestock health and productivity, and its ability to strengthen resilience against drought. The effectiveness of feed interventions depends on the specific phase of the drought cycle. In the normal phase, strategies such as pasture development, feed storage, and grazing management serve as buffers for future drought events. Early warning systems prompt rotational grazing and supplementary feeding plans during the alert phase. Emergency interventions like feed distribution and destocking help reduce livestock losses. The recovery phase focuses on rangeland restoration, herd restocking, and long-term feed management to ensure sustainability. Success in these interventions is determined by local resource availability, technological advancements in feed production, and effective stakeholder collaboration. Aligning feed interventions with the drought cycle phases is essential for minimising drought impacts on livestock in ASAL regions. Strengthening feed security through conservation practices, rotational grazing, and emergency feeding programs is vital for reducing livestock mortality. Building stakeholder capacity is essential, particularly in feed planning and drought management. Future drought preparedness efforts should prioritise long-term resilience strategies, including sustainable grazing practices, feed production innovations, and enhanced livestock sector policy support.

Keywords: *arid and semi-arid lands (ASALs), livestock production, drought impacts, resilience building, grazing management*

Willingness to pay for climate smart plant health management technologies amongst smallholder farmers in Kenya

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ABSTRACT: The growing demand for healthy, nutritious food, coupled with population growth and the increasing effects of climate change, is putting pressure on current food systems. Agro-ecological transformation is a strategy for enhancing sustainable production and addressing climate change. However, the adoption of such practices by smallholder farmers in sub-Saharan Africa, particularly in Kenya, remains unclear. This study investigated factors influencing the adoption of agroecological practices, specifically the WTP for wrap and plant technology and the use of certified seed amongst smallholder potato farmers in Nyandarua County, Kenya. These technologies target PCNs, which can significantly reduce yields. The study employed a multistage cross-sectional survey of 389 potato-growing households in Nyandarua County. Data were analysed using descriptive statistics and ordered probit regression models to assess the factors influencing WTP for PCN-resistant varieties and wrap and plant technology. The analysis also examined how WTP varied across sub-counties and messaging (loss framed vs. gain framed). The estimated WTP for PCN-resistant varieties was KES 756, and for wrap and plant technology, it was KES 793 above the market price of certified potato seed (KES 3000). The results revealed variations in WTP across sub-counties, with higher WTP where respondents received loss-framed messages compared to gain-framed messages. The probit model identified potato productivity, access to credit, and shorter market distances as strong predictors of higher WTP. The study recommends sensitising farmers on the adoption of PCN-targeting technologies by emphasising the negative impacts of PCN and climate change (loss-framed messaging). Improving access to credit and markets is essential for encouraging smallholder farmers to adopt these agroecological practices.

Keywords: *plant health management, wrap and plant, PCN-resistant varieties, willingness to pay*

Climate change and health: A systematic review

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ABSTRACT: Climate change in Africa poses a significant threat to both human and environmental health. Public health emergencies, such as water, food, and vector-borne diseases, and disruption of critical healthcare delivery systems have been attributed to climate disasters such as flooding. Through the creation of hazardous waste, energy consumption, and air and water pollution, African-based healthcare institutions are amongst the historical and current emitters of greenhouse gases and have a moral obligation to foster sustainable climate-resilient strategies. This review aimed to comprehensively synthesise and analyse existing climate actions in African-based healthcare institutions. A systematic search was conducted across free-to-access electronic databases, including PMC, DOAJ, and grey literature for relevant studies published between 1973 and 2023. Inclusion criteria included study location, year of publication, and specific keywords, while the exclusion criteria included articles published before 1973 and those accessible through paid subscriptions. Quality assessment of included studies that followed PRISMA'S framework was conducted using standardised critical appraisal tools and RoB tools. Data were extracted using a summary findings table. Climatic actions implemented by hospitals in African countries to mitigate adverse effects of climate change included the design of eco-friendly hospitals, establishment of green spaces, water recycling initiatives, effective management of laboratory waste and expired medications, and transition towards utilising wind, solar, and other renewable energy sources. Little scientific evidence exists on climatic actions implemented by healthcare institutions in Africa to mitigate the environmental impacts of healthcare activities despite their moral obligation to reduce their contribution to climate change. This is due to weak climate policy linkages, limited resources, low resilience, and limited adaptive capacities such as promoting sustainable practices, implementing green technologies, and advocating for policies that support human health and environmental sustainability.

Keywords: *climate change, climate action, hospital, healthcare, ethics, Africa*

Exploring multi-dimensional climate risks: The association between climate and an indicator of child health and well-being in Kenya

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ABSTRACT: Child health and well-being are shaped by intersecting factors such as poverty, food insecurity, and environmental conditions. This issue is complex and cannot be measured by income alone. Identifying where vulnerable children live and how compounded deprivations relate to their climate risk is essential. We integrated measures of heat, drought, and precipitation with an indicator of multidimensional child poverty calculated using UNICEF's MODA. MODA has several dimensions, including nutrition, health, education, information, water, sanitation, and housing. MODA was calculated using the 2022 Kenya Demographic and Health Survey at the child level ($n = 17,780$) and was aggregated at the EA ($n = 1,691$) for analysis. For each EA point, we extracted temperature (from the climate hazards infrared stations temperature with stations dataset) and drought (using the Normalised Difference Vegetation Index). We tested for spatial autocorrelation using Moran's I and constructed geographically weighted regression models that accounted for spatial patterns. Nutrition contributes the most to deprivation; 54.8% had poor nutrition in rural versus 43.9% in urban areas. We identified geographic hotspots and investigated the relationships between various climate measures and MODA deprivation counts. For example, we found that for 120 sub-counties, a significant positive relationship existed between drought and higher MODA deprivation counts. Results highlighted how regions with higher child deprivation, signalling more vulnerability, may also be more likely to experience climate shock events. These households will be least able to adapt. Our results can inform the development of targeted policies and programs that address child vulnerability, inequality, and well-being in a changing climate.

Keywords: *climate change, climate impacts, children's well-being, deprivation*

The impact of climate change on children in primary health care in Isiolo County, Northern Kenya

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ABSTRACT: Climate change has an adverse impact on health in eastern Africa. Climate-sensitive diseases pose a threat to the well-being of children. These diseases limit their growth and development and have a negative impact on their overall health. This study examined the impact of climate change on the health of children receiving primary care in Isiolo County, Kenya. The aim was to determine the impact of climate change on children in primary healthcare in Isiolo County, northern Kenya. Utilising convergent mixed-methods research design, quantitative data on climate variability and disease patterns were collected for the last 5 years and analysed via SPSS. These included rainfall and temperature averages, malnutrition, diarrheal diseases, and respiratory disease rates. Qualitative data from 12 interviews of parents with children younger than 5 years and 6 healthcare workers were collected and analysed via atlas-ti. The county experienced climate fluctuation between 2019 and 2023, characterised by reduced rainfall, high temperatures, a low vegetation index, food insecurity, and reduced access to water sources, especially in 2021 and 2022. However, flash floods occurred in 2023. Data on diseases from national databases were insufficient and statistically not significant. From the interviews, the community reported outbreaks of diseases, including malaria, pneumonia, diarrheal diseases, and mental health illnesses. Social disruption related to climate change included child neglect and disruption to educational activities. Healthcare workers noted increased malnutrition, febrile illnesses, and pneumonia. The challenges faced by healthcare workers included limited essential equipment and medical resources, healthcare worker shortages, overcrowding in hospitals and destruction of hospital infrastructure. Climate changes have occurred within Isiolo County in the last 5 years. As a result, children's health in Isiolo County, Kenya, has been impacted through a rise in climate-sensitive diseases. These effects, coupled with inadequate healthcare services, has had a deleterious effect on primary healthcare.

Keywords: *climate change; child health; primary care; Isiolo County, Kenya; mixed methods*



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