2nd DRY LAND AGRICULTURE & FOOD SYSTEMS IN THE FACE OF CLIMATE CHANGE CONFERENCE

LUKENYA UNIVERSITY

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POST-EVENT REPORT

17th–18th June 2025
ILRI - NAIROBI, KENYA

SUPPORTED BY:

Ministry of Agriculture

The Food and Land Use Coalition

AGRA
Sustainably Growing Africa's Food Systems

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INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

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AATF Prosperity through Technology

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LUKENYA UNIVERSITY

Lukenya University, a leading institution of higher learning in Kenya, stands at the forefront of research, innovation, and community engagement in sustainable agriculture and environmental stewardship. With a strong focus on dryland ecosystems, the university integrates academic excellence with real-world solutions to address pressing challenges in food security and climate resilience. Through its School of Agriculture, Technical Studies, and Natural Sciences, Lukenya University empowers students and researchers with cutting-edge knowledge and practical skills aimed at transforming arid and semi-arid lands into productive, sustainable, and climate-resilient systems.

As an organizing partner for the Dryland Agriculture & Food Systems in the Face of Climate Change conference, Lukenya University brings valuable expertise and grassroots experience in dryland research, policy dialogue, and community-based adaptation strategies. The university's commitment to collaborative innovation makes it a critical bridge between academia, policy, and practice, fostering multi-stakeholder engagement for impactful outcomes. By co-hosting this landmark event, Lukenya University reinforces its role as a hub for thought leadership, promoting inclusive and science-driven solutions to the challenges facing dryland agriculture under a changing climate.

EdSource AFRICA

Connecting for Growth

EdSource Africa is a knowledge-driven, impact-focused platform that champions inclusive development through education, research, and innovation. We specialize in convening thought leaders, practitioners, and communities to tackle Africa's most urgent development challenges, especially those rooted in climate, agriculture, and equity.

Our Role in Dryland Agriculture:
As co-founders and co-conveners of the Dryland Agriculture and Food Systems in the Face of Climate Change Conference, we are leading a regional movement to spotlight the potential of drylands as critical zones for climate resilience and food security.

Through multi-sector collaboration, policy engagement, and local innovation, we help drive sustainable solutions that work for dryland farmers, ecosystems, and economies.

Organizing Committee

Dr. Judith Wafula
DVC Academics, Research and Students Affairs,
Lukenya University

Priscilla Kerebi
CEO
Edsource Africa

Kennedy Anahinga,
State Department for Agriculture, MOA

Michael Onchabo
Country Director, Food and Land Use Coalition

Dr. Jeremiah Rogito
AGRA

Prof. Ibrahim Haji Deputy Vice Chancellor - Finance, Administration and Planning
Lukenya University

Dr. Paul Mwania
Ag.Vice Chancellor
Lukenya University

Dr. Virginia Mwanzia,
Dean School of Agriculture Technical Studies and Natural Sciences
Lukenya University

Prof. Tilahun Amede
Keynote Speaker, AGRA

Dr. Abednego Kiwia
Keynote Speaker, AGRA

Yen Nguyen
Certified Trainer:
Social Entrepreneurship
Vietnam

Esther Muli
Deputy Director Research
Lukenya University

Manei Naanyu - Head of Programmes at Participatory Ecological Land Use Management (PELUM)

Martin Nyakego
Edsource Africa

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Dr. Judith Wafula

Deputy Vice Chancellor,
Lukenya University

It is with great honor and anticipation that I welcome you to the 2nd National Conference on Dryland Agriculture in the Face of Climate Change, held under the theme "Innovating Dryland Agriculture for Resilience, Sustainability, and Climate-Responsive Food Security.

This conference brings together leading scholars, practitioners, policy makers, development partners, and community leaders to reflect on innovative solutions tailored to the realities of Kenya's arid and semi-arid lands (ASALs). As climate change continues to reshape our ecological and agricultural landscapes, this gathering offers a timely platform for sharing cutting-edge research, indigenous knowledge, and inclusive strategies that can transform the future of dryland farming.

I am particularly proud of the commitment shown by participating institutions and the dynamic engagement of our youth, women, and local communities. The insights and partnerships formed here will be critical in shaping a more food-secure and climate-resilient Kenya.

On behalf of the organizing committee, I extend my sincere appreciation to our partners Ministry of Agriculture and Livestock Development, the Alliance for a Green Revolution Africa (AGRA), Food and land use Coalition (FOLU), PELUM Kenya, ILRI, Wofa AK, TARDA, KEFRI, South Eastern Kenya University (SEKU), Kenyatta University among other partners.

Thank you, to all presenters, exhibitors, and delegates. I also appreciate our sponsors Ministry of Agriculture and Livestock Development, AGRA, Food and land use Coalition (FOLU), PELUM Kenya and ILRI to mention but a few, and well-wishers. May this conference inspire action, inform policy, and deepen collaboration across sectors.
Dr. Judith Adikinyi Wafula

Convener, 2nd National Dryland Agriculture Conference
Deputy Vice Chancellor (Academic, Research and Student Affairs)
Lukenya University

Priscilla Kerebi

CEO, Edsource Africa
Co-Convenor - Dryland Agriculture and Food Systems in the Face of Climate Change Conference

A very warm welcome to the 2nd Dryland Agriculture and Food Systems in the Face of Climate Change Conference. It is a true honour to convene such an important gathering here at the International Livestock Research Institute (ILRI), as we collectively reflect, share, and collaborate towards resilient food systems for arid and semi-arid lands.

As we begin this two-day dialogue, I would like to extend our heartfelt appreciation to all our partners and supporters who made this convening possible. Special thanks to the Ministry of Agriculture and Livestock Development, whose leadership and presence underscore the importance of advancing dryland agriculture on our national development agenda. We also sincerely appreciate the support of Food and Land Use Coalition (FOLU), AGRA, PELUM Kenya, and our gracious hosts and partner ILRI for their collaborative spirit and commitment.

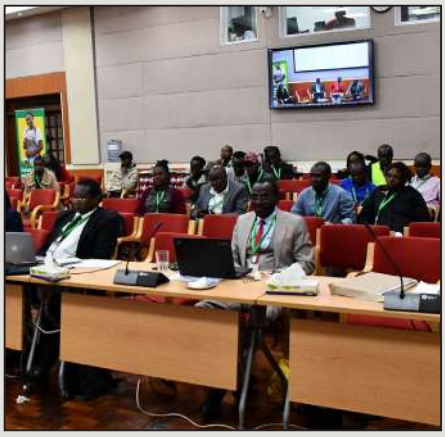
This conference has brought together distinguished speakers and panelists, research institutions, farmer organizations, civil society, development partners, and private sector actors, each of you playing a vital role in shaping sustainable, inclusive, and climate-resilient agricultural systems. Your insights will guide not only knowledge exchange but also practical actions and partnerships moving forward.

Our agenda covers key thematic areas including regenerative agriculture, livestock and pastoralist development, youth engagement, private sector innovations, and research utilization. We are also honoured to align this convening with the World Day to Combat Desertification and Drought on 17th June, amplifying global calls to restore and safeguard our dryland ecosystems.

We welcome you to open dialogue, bold ideas, and renewed partnerships, for catalytic change to ensure that dryland communities are not left behind but are empowered to thrive amid the climate crisis.

Thank you, and I wish you a productive and inspiring conference.

Delegates take part in a group picture during conference break at ILRI headquarters, Nairobi



Re-cap:

1st Dryland Agriculture and Food Systems in the Face of Climate Change Conference

RECAP REPORT by Esther Muli: Deputy Director Research Lukenya UNIVERSITY

Conference Title: 1st Dryland Agriculture and Food Systems in the Face of Climate Change Conference

Theme: Building Resilient Food Systems for a Sustainable Future

Date: 27th - 28th June 2024

Venue: ILRI Nairobi, Kenya

Organizers: Lukenya University & Edsource Africa Ltd

Rapporteur: Ms. Esther Kinyua, Ms Chrstine Okiru, Mr. Anthony Mwendwa, Mr. Roy Mwaka

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Introduction:

2Nd Dryland Agriculture And Food Systems In The Face Of Climate Change Conference

Aligned with the World Day to Combat Desertification and Drought

Theme: Theme: Innovating Dry Land Agriculture for Resilience, Sustainability, and Climate-Responsive Food Security

Date: 17th and 18th June 2025

Venue: International Livestock Research Institution (ILRI)

Organisers Partners: Lukenya University, Edsource Africa Ltd, Ministry of Agriculture and Livestock Development, Food and Land Use Coalition (FOLU) and the Alliance for a Green Revolution in Africa (AGRA)

Dr. Shirley Tarawal - Assistant Director General, International Livestock Research Institute (ILRI)

Welcome Remarks

Dr. Tarawali opened by warmly welcoming all participants and congratulated the organizers and partners for convening a timely conference. She underscored the theme's urgency as climate change intensifies in Kenya's ASALs and highlighted ILRI/CGIAR's commitment to delivering science based solutions:

Climate Leadership Opportunity
ASAL regions, long marginalized, now present a pivotal opportunity to lead on climate resilient agriculture.

ILRI/CGIAR Footprint in Kenya
Every CGIAR integrated research program has on the ground activities in Kenya, many hosted by ILRI in Nairobi—offering multiple avenues for engagement.

Focus on Livestock Systems
With ASALs supplying ~70 % of Kenya's meat, strengthening feed markets and value chains is critical to justify and enhance this production.

Science to Policy Engagement
ILRI works across research, market analysis, and policy dialogue to shape resilient food system policies at county and national levels.

Partnerships & Capacity Building
Emphasized collaboration with universities, NGOs, government agencies, and farmer cooperatives to build local capacity and scale innovations.

Next Steps & Follow Up
- ILRI stands ready to partner with farmers, extension services, and policymakers to translate insights into tangible outcomes on the ground.
- Mentioned Dr. Jason Sircely to share further details on ILRI's rangeland and livestock resilience initiatives later.

Dr. Tarawali closed by reiterating ILRI's commitment to support Kenya's dryland communities—through research, partnerships, and sustained engagement—to build truly resilient livestock based food systems.

CAMILLA RAVNSBORG ASCHJEM - Royal Norwegian Embassy (Lead – Cooperation Division)

Remarks

Ms. Camilla reflects on a personal and professional perspective shaped by experiences in both rural Norway and Nairobi, emphasizing the importance of inclusive, resilient food systems. She challenges outdated views of Kenya's ASALs, highlighting their untapped potential and the urgent need to address soil health, food security, and infrastructure gaps like storage. Drawing from Norway's success in sustainable agriculture through research and market access, she underscored the importance of implementation, not just funding. Stressing persistent partnerships and co-creation, she reaffirmed Norway's commitment to cross-border collaboration, innovation, and shared accountability to strengthen food systems in Kenya and globally.

Key Points

Background and Perspective

- Grew up partly on a farm in Norway and partly in Nairobi, where her parents were involved in establishing coffee cooperatives.
- Her lived experiences provide her with a deep understanding of both rural livelihoods and agricultural systems in different contexts.

Key Observations and Reflections

1. Perceptions vs. Reality in ASALs

Emphasized the need to challenge outdated perceptions of Kenya's ASALs and focus on their economic and ecological potential.

2. Soil Health and Food Security

Highlighted the link between soil degradation and threats to food security, calling for more attention to restorative land management.

3. Food Systems for All – Including Refugees

Advocated for inclusive food systems that serve entire communities, including refugees and vulnerable populations.

4. Building Storage and Resilience

Stressed the importance of investing in storage infrastructure to reduce post-harvest losses and enhance resilience to climate shocks.

5. Norway's Experience and Model

Shared that Norway has built resilient food systems through:

- Crop rotation
- Soil and crop health research
- Market access improvements

These systems enhance the sustainability and value of commodities.

6. Implementation Focus

Reaffirmed that Norway is not only a funder but is also actively engaged in implementation in the agriculture sector.

Partnership and Collaboration Messages

- Persistence in Partnerships is key — Norway remains aligned with CGIAR, One Health, and other global system-level frameworks.
- Funding and resource availability is shrinking, making collaboration and co-creation across borders more critical than ever.
- The day's conference was seen as an opportunity to strengthen partnerships and deepen cooperation.

Commitments and Recommendations

- Norway reaffirms its commitment to working with the entire food systems community in Kenya and beyond.
- Calls for:

o Cross-border collaboration
o Leveraging science and innovation
o Aligning with agencies that enhance access to nutrition

- Emphasized the importance of shared learning, persistence, and mutual accountability to build long-term agricultural resilience.

MR. MICHAEL ONCHABO, Director, Food and Land Use Coalition (FOLU) Kenya

Remarks

Mr. Onchabo opened by framing regenerative agriculture in drylands as a national principle, not merely a boutique practice, but a foundational approach to restore ecosystems, secure diets, and strengthen food systems.

Holistic Systems Perspective:
FOLU's work; funded by partners such as the Norwegian Embassy, embraces the full diversity of dryland sectors (crop, livestock, forestry, value chains), ensuring interventions are gender and youth inclusive.

Regenerative Practices for Health and Nutrition:
He underscored the need to go beyond yields, integrating dietary supplements, nutrient dense crops, and biodiversity conservation so that regeneration of soils translates into real nutrition gains.

Evidence and Experimentation:
While experiential knowledge from local practitioners remains invaluable, Mr. Onchabo called for rigorous evidence generation—monitoring impacts of regenerative pilots, capturing carbon fluxes, and quantifying co benefits for health, livelihoods, and ecosystem services.

Scaling National Ambitions:
He argued that Kenya's national food system goals must explicitly incorporate dryland targets: soil health indices, landscape restoration budgets, and measures of equitable access to nutritious foods.

Practical Pathways for Impact:
Practical examples—such as cover cropping with local legumes, integrated agroforestry, and community managed seed banks—demonstrate how on the ground practices can be rapidly scaled through policy incentives, public–private partnerships, and community co investment.

Call to Action:
Closing on an optimistic note, Mr. Onchabo encouraged delegates to use the conference's networking opportunities to forge cross sector alliances, harness local innovators, and secure multi stakeholder funding—so that regenerative agriculture in Kenya's drylands moves swiftly from principle to widespread practice.

PROF. TILAHUN AMEDE, Director of Climate Adaptation, Sustainable Agriculture and Resilience, AGRA

KEYNOTE SPEAKER: Insights on Global Best Practices in Sustainable Land Use and Food Systems Transformation

Prof. Amede opened by emphasizing that inclusive food system transformation in Africa must tackle interconnected challenges—hunger, malnutrition, poverty, and climate risk—through diverse, resilient, and market oriented agriculture. Drawing on global evidence, he demonstrated that nations achieving rapid agricultural transformation see concurrent declines in hunger and poverty, alongside gains in nutrition.

The speaker proceeded to frame Africa's agenda under the CAADP Strategy & Action Plan (2026–2035), whose six strategic objectives are to:

1. Intensify sustainable food production, agro industrialization, and trade
2. Boost investment and financing across agri food systems
3. Ensure continent wide food and nutrition security
4. Advance inclusivity and equitable livelihoods
5. Build resilient systems that withstand shocks and stressors
6. Strengthen agri food system governance

Prof. Amede highlighted that drylands—which cover over two thirds of Africa—are on the frontline of climate change. Key risks include:

- Climate & environmental extremes (rainfall variability, water scarcity)
- Land degradation (soil decline, rangeland loss, deforestation)
- Production, marketing, financial, and policy/legal vulnerabilities

These pressures drive down crop and livestock productivity, reduce farm incomes, and exacerbate food insecurity and poverty.

To counter these trends, he outlined a suite of adaptation strategies grounded in both science and centuries old local knowledge:

- Rainwater and surface water management (micro catchments, ponds, terraces)
- Enhanced ecosystem services (agroforestry, soil conservation, carbon sequestration)
- Resource efficient intensification (climate smart crop varieties, precision inputs)
- Forest protection and controlled grazing to curb encroachment
- System adjustments (crop rotations, intercropping, livestock diversification) to moderate climate impacts
- Leveraging new opportunities in digital extension, weather insurance, and green finance

The Professor closed by stressing that successful transformation hinges on aligning public policy, private investment, and community engagement—a triple helix approach that puts smallholder farmers at the center. Only by combining robust governance with innovative financing and inclusive capacity building can Africa unlock the full potential of its "sleeping giant" drylands.

MR. JAMES WANJOHI - Ministry of Agriculture

SUMMARY: Remarks on Behalf of Dr. Kiprono Paul Ronoh, CBS Principal Secretary, State Department for Agriculture, Ministry of Agriculture and Livestock Development

Mr. Wanjohi conveyed Dr. Ronoh's deep appreciation to Lukenya University, Edsource Africa and all partners for convening this vital forum. He underscored that, as the hottest year on record intensifies pressure on dryland livelihoods, Kenya must accelerate its shift toward truly climate smart agriculture.

1. Building Resilience on the Ground

- The Ministry is rolling out subsidy programmes for drought tolerant seeds and inputs.
- Agro entrepreneurs, especially women, will receive targeted support through training, mentorship, and market linkages.

2. Financial Inclusion & Risk Management

- Plans to facilitate access to finance—low interest loans, micro credit, and credit guarantees—for smallholders and cooperatives.
- Piloting agricultural insurance schemes to buffer farmers against climate shocks (drought, floods, pest outbreaks).

3. Knowledge Transfer & Bridging Gaps

- Emphasis on knowledge transfer via expanded extension services, digital advisory platforms, and farmer field schools.
- Commitment to bridge the gap between research and practice by scaling up successful dryland pilot projects and demonstration plots.

4. Partnerships & Development Programmes

- The Ministry thanks development partners for co funding critical programmes that link communities to innovations.
- Invited further regional exchanges, recognizing that time to co create robust agri food systems is now.

5. Policy & Financing for Climate Action

- Pledged to embed climate adaptation into all agricultural policy instruments.
- Called for deliberate climate financing models—blended finance, green bonds, and results based grants—to mobilize new resources.

6. Ongoing Initiatives

- Highlighted the BREFONS Food Systems Resilience Project in ASAL counties, which establishes community feed banks and market aggregation hubs.
- Noted expanded veterinary outreach, water harvesting grants, and support for farmer managed natural regeneration.

Dr. Ronoh's closing appeal was clear: by harnessing subsidies, finance, insurance, knowledge exchange, and inclusive policy, Kenya can transform its drylands into models of resilient, equitable, and sustainable agriculture.

DR. JUDITH ADIKINYI WAFULA – DVC (ARSA) Lukenya University

Innovating Dryland Agriculture for Resilience, Sustainability, and Climate-Responsive Food Security

This presentation showcases Lukenya University's impactful response to climate challenges in Kenya's Arid and Semi-Arid Lands (ASALs) through research, innovation, and community engagement. Central to its efforts is the 10 Million Tree Initiative, which has planted over 600,000 dryland-adapted trees with widespread community involvement. Research highlights include improved soil fertility through Acacia agroforestry, the success of drought-resilient crops like cassava and dryland cereals, and enhanced forage biomass with organic inputs.

Key Points

Context and Institutional Response

- Kenya's Arid and Semi-Arid Lands (ASALs) cover 80% of the country and face extreme climate-related challenges.
- Lukenya University has responded with research, innovation, and community outreach targeting food security and environmental resilience.

10 Million Tree Initiative

- Over 600,000 dryland-adapted trees planted.
- Significant carbon sequestration (COe) benefits recorded.
- Community-led initiative involving:

o 20+ local nursery groups

o Ward administrators, chiefs, assistant chiefs, and Nyumba Kumi leaders.

- Trees distributed to schools, churches, mosques, market centers, and farmers.
- Slogan/Principle: "Take the number you can nurture to maturity."

Research Highlights

- Acacia agroforestry increased soil fertility by 23%.
- Cassava (Kasukari variety) shown to outperform traditional crops in drought-prone areas; highly accepted by local farmers.
- Promotion of climate-resilient dryland cereals: sorghum, finger millet, and pearl millet.
- Tested forage species (Brachiaria, Cenchrus ciliaris, Chloris gayana) show biomass increases with organic inputs, crucial for livestock feed in drylands.

Policy Recommendations

1. Establish ASAL-focused Agroecology Hubs

Set up innovation centers in ASAL-based universities to support context-specific agricultural research and practice.

2. Support Youth-Led Agri-Innovation Incubators

Provide funding and infrastructure for youth-driven solutions in agriculture within ASAL counties and institutions.

3. Scale Water Harvesting Technologies

Expand access to affordable solutions like Azolla hydropan systems to enhance water use efficiency.

4. Include Forage Planning in County Development Plans

Integrate dry-season livestock feed support into official county policies and resource allocation frameworks.

Conclusion

- Lukenya University's evidence-driven, community-based model for dryland agriculture has demonstrated strong impact.
- The model is scalable nationally, aligning with goals for:
  - o Food security
  - o Youth empowerment
  - o Climate adaptation and mitigation

JOSEPH ODHIAMBO - Lukenya University

Feature Extraction Using Deep Learning Techniques to Identify Microplastics in Open Sewer Systems

This presentation explores the identification of microplastics—specifically foam particles—in open sewer systems using image-based analysis. By applying the Scale-Invariant Feature Transform (SIFT) algorithm, researchers extracted robust visual features from 1,000 images of foam to classify microplastic types despite variations in scale, rotation, and lighting. The study highlights the advantages of combining SIFT with deep learning for detecting complex textures and recommends expanding datasets, diversifying algorithms, and building predictive models to support environmental and public health monitoring through AI-driven sanitation systems.

Key Points

- **Definition and Concern:**
  - o Microplastics are particles <5mm in size, commonly originating from the breakdown of larger plastics or direct disposal.
  - o Present in open water systems (e.g., oceans, lakes, rivers, and sewer systems), they pose serious threats to aquatic life and human health.
- **Research Objective:**
  - o To identify distinct physical characteristics of microplastics (especially foam) from images taken in open sewer systems.
  - o Focus on feature extraction using the Scale-Invariant Feature Transform (SIFT) algorithm.
- **Physical Characteristics Identified:**
  - o Microplastics appear as fibres, spheres, foam, sheets, fragments, beads, and films.
  - o Foam, generated from degraded plastics or detergent waste, was used as a primary focus in image collection.
- **Dataset & Methodology:**
  - o Collected 1,000 foam images from sewer locations.
  - o Extracted visual descriptors (e.g., keypoints, orientation, and 128 feature descriptors per image) stored in CSV format.
  - o Features are designed to be resistant to scale, rotation, and lighting variations, ensuring robustness.
- **Related Work:**
  - o Other studies used different methods like YOLOv5, Label-Studio, and Electrical Impedance Spectroscopy (EIS) enhanced by SVMs.
- **Advantages of SIFT + Deep Learning:**
  - o Effective for detecting complex textures and patterns in environmental images.
  - o Enables reliable classification and monitoring of microplastics under varying visual conditions.

Recommendations

1. Use Deep Learning with Feature Extraction:
Combine SIFT-based feature extraction with deep learning for accurate detection of microplastics in sewer systems.

2. Dataset Expansion:
Collect images from diverse environments beyond the current locations to improve the dataset's generalizability.

3. Algorithm Diversification:
Explore alternative feature extraction techniques to complement or improve upon SIFT's performance.

4. Model Building:
Develop a predictive classification model using the current feature dataset for automated detection of microplastics.

5. Public Health and Environmental Monitoring:
Integrate such AI-driven tools in urban sanitation monitoring systems for better environmental management.

DR. ROBERT MBECHE – Director, Food Programs, World Resources Institute (Lead Insight)

The Sleeping Giant: Unlocking Sustainable Agricultural Opportunities in Drylands Using Data and Evidence

The panel discussion highlighted Kenya's drylands as a "sleeping giant," noting their vast untapped agricultural potential despite being severely degraded—over 60% of land is impacted, with ASAL regions suffering the most. Speakers emphasized the urgent need for reliable data to guide interventions, introducing a high-resolution Land Degradation Index that combines remote sensing with local socioeconomic data. This index enables targeted restoration, tracks impacts, and promotes transparency. Participatory approaches involving farmers were praised, alongside integrated strategies for soil health, livestock management, and crop yield monitoring. The panel concluded with nine actionable recommendations to scale regenerative practices, empower local actors, enhance monitoring, mobilize finance, and foster inclusive partnerships to build resilient, equitable, and sustainable food systems in Kenya.

Key Points

1. Drylands as a "Sleeping Giant"

Two thirds of Kenya's landmass is classified as arid or semi arid (ASAL), yet these regions hold vast untapped agricultural potential.

2. Severity of Land Degradation

- Over 60% of Kenya's land is degraded, driving declining soil health, low yields, food insecurity, biodiversity loss, and worsening climate change.
- ASALs bear the brunt: extreme erosion, deforestation, and annual soil losses often exceeding 15 t·ha□¹·yr□¹ (tolerable is ≤10) in the central and southern Great Rift Valley.
- The Mau Forest Complex lost 21% of its cover (1986–2020), 81% of which was cleared for agriculture.

3. Data Gaps and the Need for Evidence

Existing information on land degradation and its impacts is inconsistent and incomplete, hampering effective intervention planning.

4. Innovative Assessment Methodology

- High resolution remote sensing + socio economic data + local validation → a farm and landscape scale Land Degradation Index.
- Index computed via the Universal Soil Loss Equation factors:
  - R (rainfall erosivity)
  - K (soil erodibility)
  - LS (slope length × steepness)
  - C (cover management)
  - P (support practices)

5. Application of the Degradation Index

- Targeting: Pinpoint areas in greatest need of restoration or regenerative agriculture interventions.
- Impact Analysis: Quantify effects on yields, soil carbon loss, GHG emissions, and biodiversity decline.
- Transparency over Time: Track improvements as regenerative practices are adopted.

6. Participatory Intervention Design

- Engaged farmers through surveys and interviews to validate drivers and co design solutions.
- Example interventions for soil health: conservation agriculture, cover cropping, crop rotation, intercropping, FMNR, composting, bio fertilizers, mulching, and soil amendments (lime, biochar).

7. Expanded Livestock & Nutrition Management

- Adaptive forage species, emergency fodder banks, rotational grazing, water harvesting, boreholes, and oasis protection.
- Livestock health: vaccination, invasive species control, climate adapted breeds, insurance schemes, and early warning use.

CONTINUED...

"The Sleeping Giant: Unlocking Sustainable Agricultural Opportunities in Drylands Using Data and Evidence"

8. Crop Yield Monitoring
Adapted crop models (CST, World Bank) with satellite time series (Sentinel, Landsat, MODIS) + ground yields → annual crop type maps, diversified yield stats, NDVI/biomass indicators, and degradation overlays to diagnose yield gaps.

9. Six Levers for Sustainable Food Systems
1. Research, data & evidence
2. Policies & incentives
3. Capacity building
4. Innovative finance & markets
5. Gender & social equity
6. Partnerships & systems integration

Recommendations
1. Scale the Land Degradation Index
Roll out the index nationwide to guide regenerative agriculture investments and policy support.

2. Empower Local Actors
Provide decision support tools (maps, dashboards) to farmer groups for selecting context appropriate sustainable practices.

3. Strengthen Monitoring Systems
Institutionalize satellite based yield and degradation monitoring within county agricultural offices.

4. Integrate Regenerative Practices into Policy
Embed conservation agriculture, FMNR, cover cropping, and soil amendments into ASAL county development plans and national extension curricula.

5. Mobilize Innovative Finance
Develop financial instruments (micro loans, insurance premiums linked to land health metrics) to incentivize adoption of sustainable practices.

6. Foster Multi Stakeholder Partnerships
Deepen collaboration between WRI, CGIAR, government, NGOs, private sector, and civil society to align data driven evidence with on the ground action.

7. Promote Gender and Equity
Ensure women and youth have equal access to data tools, financing, training, and markets.

8. Build Resilience Through Diversification
Encourage crop and livestock diversification, paired with adaptive management strategies (rotational grazing, drought tolerant varieties, fodder banks).

9. Enhance Transparency and Accountability
Publicly report annual land health and productivity indicators to track progress against Kenya's food security and land restoration goals.

PURITY MUTHEU - Moderator, Lead Insight - Dr. Robert Mbeche: Panelists: Eng. Kennedy Makudiuh and Dr. Gilbert Muthee

Panel Discussion: Climate Smart Innovations for Dryland Agriculture - *Scaling Drought Resistant Crops and Technologies for Dryland Farmers*

1. Dr. Robert Mbeche (World Resources Institute)
Q1: What lessons can we draw from global and regional best practices in scaling drought resilient technologies in arid and semi arid regions?
A1:
"We must first map and understand local and regional practices—what works, where, and why. Only by grounding interventions in the realities of each community can we scale technologies that are both practical and sustainable."

2. Eng. Kennedy Makudiuh (BREFONS)
Q1: From an engineering and systems design perspective, what infrastructure or mechanization innovations most support smallholder uptake of climate smart technologies?
A1:
"Engineering must be an enabler of production. In ASALs, in situ water harvesting (rock catchments, water pans) and community driven conservation are critical. Any machinery we introduce must be affordable, environmentally sound, and culturally acceptable to rural users."
Q2: What challenges and opportunities have you observed in facilitating farmer uptake of smart irrigation, soil moisture retention, or solar powered tools in drylands?
A2:
"The main challenge is technology dissemination—bridging the gap between researchers and field-level extension. We need clear, hands on demonstrations and stronger linkages with community leaders, so that farmers see tangible, local benefits before adopting new tools."

3. Dr. Gilbert Muthee (Climate Smart Technologies Unit, State Department of Agriculture)
Q1: What steps is the Ministry taking to promote adoption and scale up of drought resistant crops and climate resilient technologies among smallholders?
A1:
"We've launched a national Climate Smart Agriculture Strategy, built agripreneur training programs, and strengthened extension by deploying 7–10 officers per ward. Extension teams now map value chains and guide farmers to appropriate inputs—backed by subsidies and agri financing schemes."
Q2: How can government led extension services be better equipped or restructured to support dissemination and enhance uptake in ASALs?
A2:
"Since integrating fresh graduates into our ranks, we've filled critical gaps in technical capacity. Under our County Food Resilience Programme, extension officers work directly with farmer groups—linking them to markets, feeding real time field data into policy discussions, and ensuring that innovations reach every corner."

4. Generic Question
Q: What bold steps must we take—across research, policy, and grassroots levels—to ensure climate smart innovations for drylands become mainstream and inclusive for all farmers, especially women and youth?
A:
"We need a concerted push on three fronts:
1. Data & Evidence: Expand community validated monitoring (soil health, yields) to inform both policy and private investment.
2. Inclusive Extension: Triple down on youth and women led agripreneur incubators, paired with digital decision support tools in local languages.
3. Cross Border Partnerships: Leverage CGIAR, development agencies, and local cooperatives to finance scalable pilot projects—and rapidly share what works."

MAGDALENE MAKAU - Model Farmer

Empowering Rural Farmers Through Tree Planting and Sustainable Agriculture

Ms. Makau, a model farmer and active member of a Self Help Group, exemplifies how community-led sustainable agriculture can drive both environmental restoration and socio-economic development. Through a partnership with Lukenya University, farmers engage in tree planting—each required to plant at least 20 trees such as Melia volkensii and pixie orange—as part of a broader 10 Million Tree Planting Initiative. The university supports farmers by purchasing seedlings, offering training, and promoting cassava as an alternative income source. Income from tree and cassava sales has helped families afford secondary education, while youth participation in nursery work imparts valuable skills and earnings. Practical techniques like using wood ash to reduce soil salinity and the collaborative construction of water-harvesting hydropans highlight the power of simple, locally adapted solutions. The initiative underscores that partnerships, community action, and youth engagement are key to building climate-resilient, empowered rural communities.

Key Points

1. Magdalene Profile

- Active member of a Self Help Group engaged in sustainable agriculture.
- Collaborates with Lukenya University on the 10 Million Tree Planting Initiative.

2. Tree Planting and Reforestation

- Farmers plant various trees including Melia volkensii and pixie orange trees (at least 20 per farmer).
- Tree planting is a requirement for joining the Self Help Group—each member must plant at least 20 trees.

3. Partnership with Lukenya University

- Buys the tree seedlings from farmers.
- Provides agricultural training to farmers.
- Supports cassava farming as an alternative income source.

4. Socio-Economic Impact

Income from tree and cassava sales is used to pay school fees, allowing children who had previously only studied up to Class 8 to continue with their education.

5. Soil and Nursery Management

- Farmers are taught to reduce soil salinity using wood ash to improve seedling growth in nurseries.
- Training includes making effective tree nursery beds

6. Hydropan Construction and Support

- Farmers collaboratively build hydropans (water harvesting structures).
- 15 farmers have benefited so far; 5 are awaiting construction.

7. Youth and Skills Development

- Younger siblings are involved in potting seedlings into transplanting nylon papers.
- This provides them with hands-on agricultural skills and a source of income.

Take-Home Messages

- Collaboration enhances sustainability – Partnerships like the one with Lukenya University uplift entire communities.
- Tree planting is more than conservation – It's a source of income, education, and empowerment.
- Community-based efforts work – Self Help Groups are effective in achieving shared agricultural goals.
- Youth involvement is vital – Skills passed on to younger generations ensure continuity and resilience.
- Simple innovations like using wood ash can make a big difference in soil health and productivity.
- Water harvesting infrastructure (hydropans) is key to sustaining tree growth in dry areas.

DR. ABEDNEGO KIWIA MAVUTHU - Lead Insight, MR. BERNARD KIVYATU - Moderator, Panelists: Dr. David Ojwang, Ms. Maram Makhamreh and Ms. Irene Ndavi

PANEL DISCUSSION 2: Regenerative Agriculture: Restoring Ecosystems for Climate-Resilient Food Production

The panel discussion highlighted Kenya's agricultural importance and vulnerability to climate change, emphasizing that agriculture employs a significant rural workforce and contributes heavily to GDP and exports, yet food insecurity and undernourishment persist. AGRA's regional approach spans multiple economic blocs, implementing initiatives such as the STRAK project, which promotes Regenerative Agriculture (RA) through five core principles focused on soil health, biodiversity, and resilience. With over 120,000 farmers reached and 1.3 million trees planted, RA practices have shown promising results, though challenges like water scarcity, limited access to inputs, and weak extension systems remain. Key recommendations include investing in water solutions, expanding and supporting Village-Based Advisors (VBAs), subsidizing inputs, tailoring RA practices to local conditions, enhancing policy support, deepening capacity building, and establishing robust monitoring systems. Dr. Mavuthu concluded that context-specific, systems-based RA models—grounded in strong partnerships and practical innovation—can transform Kenya's dryland agriculture into a climate-resilient and sustainable food system.

Key Points:

1. Kenya's Agricultural Profile & Vulnerability

- Employment & GDP: Agriculture employs ~ 20% of the rural populace, contributes 20% directly (27% indirectly) to GDP, and accounts for 48% of national exports.
- Food Security & Nutrition: 67% of households are food secure; still, 25% of Kenyans remain undernourished.
- Climate Risk: Over 70% of Kenya's disasters stem from extreme weather. Without action, drought driven poverty could push an extra 1.1 million people below the poverty line by 2050.

2. AGRA's Regional Approach

- Working across three economic blocks, reaching > 3 million households:

i) Lake Region (Vihiga, Kakamega, Kisumu)
ii) Southeastern Kenya (Kitui, Makueni, Machakos)
iii) Mt. Kenya & Aberdares (Laikipia, Nyandarua, Meru, Tharaka Nithi, Embu, Kirinyaga)

3. Major AGRA Led Initiatives

- Sustainable Land Management (2017–2023): GEF/UNEP project in Kakamega, Vihiga & Nandi with 10+ partners.
- Fertilizer Systems & Extension Systems: BMGF funded projects in 14 countries and Kiambu/Embu.
- Policy Advocacy & State Capability: Seven policy reforms via BMGF.
- LISTEN (Food & Water Nexus): Netherlands funded resilience work in Laikipia, Isiolo & Samburu.
- STRAK (2020–2025): IKEA Foundation project in Embu, Tharaka Nithi, Kitui & Makueni promoting Regenerative Agriculture (RA).

4. STRAK Project & RA Principles

Five Core Principles:

1. Minimize soil disturbance
2. Keep soil covered year round
3. Maintain living roots in soil
4. Increase on farm biodiversity
5. Integrate livestock

- Outcomes: Enhanced productivity, biodiversity, soil/water/carbon retention, and resilience.
- Scale: 120 060 farmers and 635 VBAs trained; 35 000 "baby demos"; 115 on farm trials; 56 056 home gardens; ~ 1.3 million trees planted.

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PANEL DISCUSSION 2: Regenerative Agriculture: Restoring Ecosystems for Climate-Resilient Food Production

5. Context Specific Adoption

- Best Bet Practices: Manure + microdosing + mulching delivered the strongest agronomic and economic returns.
- Customization: Practices must be tailored by region, crop, and resource context to balance short and long term benefits.

6. Challenges Identified

- Water scarcity undermines home gardens and field trials.
- Extreme weather (droughts, floods) still disrupts production, though RA farmers fare better.
- Limited VBA capacity: Insufficient extension agents stretched across vast areas.
- Input access: Certified seeds, bio fertilizers, and RA tools remain costly or scarce.
- Market & financing hurdles: Farmers lack working capital; VBAs compete with input retailers.

Take Home Recommendations

1. Strengthen Water Solutions

Invest in community water harvesting (rock catchments, ponds) and drip irrigation to sustain kitchen gardens and field plots.

2. Expand & Support VBAs

Scale the Village-Based Advisor (VBA) model via private sector partnerships and multiple income streams, ensuring adequate training, remuneration, and digital record keeping tools.

3. Subsidize Key Inputs

Reduce the cost of organic manure by ≥ 50% and subsidize certified seeds and bio fertilizers to encourage widespread RA adoption.

4. Tailor Practices Locally

Use a context specific framework—matching crop, climate, and market demands—to optimize RA packages for each county.

5. Enhance Policy & Financing

Advocate for county RA strategies and climate finance mechanisms (blended finance, green bonds) to underwrite RA investments.

6. Deepen Capacity Building

Integrate RA modules into extension curricula, engage youth through digital platforms (4K Clubs), and leverage existing phone networks for real time advisories.

7. Monitor & Document Impact

Establish cost effective M&E systems (e.g., remote sensing + farmer data) to track soil health, yield gains, and ecosystem services—feeding insights back into policy and practice.

Conclusion:

Dr. Mavuthu's systems based RA model demonstrates that, when underpinned by five core principles, strong partnerships, and contextual adaptation, Regenerative Agriculture can restore Kenya's dryland ecosystems—secure rural livelihoods, bolster climate resilience, and drive sustainable food production for future generations.

DR. ABEDNEGO KIWIA MAVUTHU - Lead Insight, MR. BERNARD KIVYATU - Moderator, Panelists: Dr. David Ojwang, Ms. Maram Makhamreh and Ms. Irene Ndavi

PANEL DISCUSSION 2: Regenerative Agriculture: Restoring Ecosystems for Climate-Resilient Food Production

Dr. Abednego Kiwia Mavuthu (AGRA)
Focus: Soil health & agroecological transition
1. Question: How can regenerative agriculture be scaled among smallholders while ensuring productivity and income security?
Answer: "Scaling RA requires dedicated financing to help farmers invest in new practices and inputs. Equally important is strengthening farmer ownership—ensuring they understand, trust, and ultimately purchase regenerative inputs themselves. At the county level, we're seeing real progress: for example, Kitui and Makueni counties have enacted policies that formally recognize regenerative agriculture, creating a supportive regulatory environment. This combination of funding, farmer buy in, and enabling policy is key to maintaining both productivity and income security as RA expands."

2. Question 2: How is AGRA restoring soil health, and which policies or partnerships are most effective?
Answer: "We are restoring soil health through strong partnerships with relevant stakeholders, including county governments and farmer organizations. AGRA works with universities like Egerton University and research institutions to build systems of learning, develop agroecology-aligned policies, and strengthen community-led implementation.

Evidence from on-farm trials and multi-stakeholder collaborations is used to support both policy development and practice. These policies—grounded in real data—are what both government and partners need to scale regenerative agriculture in Kenya's drylands."

Dr. David Ojwang (SNV Kenya & Burundi)
Focus: Market systems & local value chains
1. Question: How are you integrating agroforestry into regenerative farming models to boost resilience and food systems?
Answer-: "Since 2020, SNV has worked through the IKEA Foundation to address soil depletion in Western and Central Kenya. We equip farmers with organic fertilizer technologies and partner with groups like the Bogoma Water Tree Planting Association to establish 'food forests.' These combine economic tree species—avocado, papaya—with beekeeping and seedling nurseries, creating a cyclic system that enriches soil, supplies livestock feed, and generates new income streams."

2. Question: How can development organizations support community led, youth inclusive innovations in regenerative agriculture?
Answer: "At SNV, we adopt a double nexus approach that connects agrifood systems, water, and energy, with a strong emphasis on community ownership and youth inclusion. It begins with recognizing and investing in local innovation. We establish systems of learning and empowerment by partnering with institutions such as Egerton University, and supporting participatory research that helps identify opportunities for young people.

Through tailored training in areas like nursery management, apiculture, and export market linkages, we equip youth agripreneurs to actively lead value addition in regenerative agriculture. For instance, regeneratively grown seedlings are now being sourced by overseas buyers—creating global linkages from local ecosystems.

We co-design market-aligned, finance-generating interventions, while also supporting policy development that reflects youth voices. By building innovation ecosystems around high-value trees, honey, and climate-smart practices, we promote resilient, inclusive, and sustainable food systems—owned and led by the very communities they serve."

Ms. Maram Makhamreh (Embassy of Jordan)
Focus: International cooperation & innovation exchange

DR. ABEDNEGO KIWIA MAVUTHU - Lead Insight, MR. BERNARD KIVYATU - Moderator, Panelists: Dr. David Ojwang, Ms. Maram Makhamreh and Ms. Irene Ndavi

PANEL DISCUSSION 2: Regenerative Agriculture: Restoring Ecosystems for Climate-Resilient Food Production

1. Question: What Jordanian regenerative technologies could Kenya adapt for water efficiency and productivity?
Answer: "Jordan is one of the world's most water scarce countries, averaging just 200 mm of rain annually. Over decades, we've built strict water use legislation—for instance, heavy fines on inefficient uses like washing cars with open hoses or filling private pools. These regulatory measures complement innovations such as solar powered drip irrigation, roof rainwater harvesting, and community led aquifer recharge.

"Our 'My Land' initiative under Vision 2030 demonstrates impact: over 34 000 households have benefited, generating 12 000 new jobs by linking herb, vegetable, and fruit producers to export markets. The cross sector approach—uniting farmers, trade bodies, and agroforestry organizations—ensures that producers not only grow but also market their crops effectively.

"Finally, we've learned the importance of starting early education: teaching children about water wise farming and RA in school. Kenya could adapt these policy frameworks, combine them with smart irrigation pilots, and foster community training to rapidly improve water efficiency and productivity in its drylands."

Question 2: How can Kenya–Jordan partnerships strengthen knowledge exchange in climate-resilient agriculture?
Answer: "Kenya and Jordan have much to gain from each other. We can strengthen our ties through joint ventures, technical partnerships, and research collaborations—borrowing, adapting, and adding value to innovations from both sides.

Where Jordan has strong experience in water governance and smart irrigation, Kenya has strengths in community-based adaptation and regenerative farming techniques. By complementing rather than competing, our countries can co-develop solutions and support farmers with technologies and policies tailored to arid and semi-arid conditions."

Irene Ndavi (TARDA)
Focus: Water conservation & regional development
Question 1: Which integrated water and land management models does TARDA promote that align with regenerative agriculture?
Answer: "TARDA was established in the 1970s with a mandate for regional development across 19 counties, focusing on the Tana and Athi River basins. These regions experience both flooding downstream every 4–5 years and increasing water scarcity upstream, requiring integrated land and water management strategies.

Our approach includes:

- Catchment management programmes to reduce erosion and sedimentation
- Water harvesting and storage infrastructure such as large dams (e.g., Masinga, Kiambere), pans, tanks, and boreholes
- Irrigation support through the 7 Forks Dam System, with 5 of the 7 dams already functional
- Restoration of degraded ecosystems through community nurseries, fruit tree planting (e.g., mangoes, citrus), and partnerships with churches, youth groups, schools, and CBOs

If properly managed, Tana River alone could irrigate 200 000 hectares, impacting nearly 50% of the country. But success depends on policy alignment and legislation that matches what farmers are actually doing on the ground.

Our critical waste and water management programmes are being implemented with an emphasis on social equity, ensuring that irrigation serves domestic, municipal, and agricultural needs. By investing in infrastructure and community-led seedling production, we're aligning TARDA's work with the core principles of regenerative agriculture—namely, restoration, sustainability, and resilience."

DR. ABEDNEGO KIWIA MAVUTHU - Lead Insight, MR. BERNARD KIVYATU - Moderator, Panelists: Dr. David Ojwang, Ms. Maram Makhamreh and Ms. Irene Ndavi

PANEL DISCUSSION 2: Regenerative Agriculture: Restoring Ecosystems for Climate-Resilient Food Production

Question 2: How can agencies like TARDA collaborate with grassroots actors to restore degraded lands?
Answer: TARDA collaborates with grassroots actors through training and capacity building, particularly in tree and fruit tree production, often in partnership with like-minded institutions such as the Kenya Forest Service and other environmental agencies.

We are working to create 'one-stop-shops' for farmer support, where smallholders can access technical assistance, input packages, and crop advisory services tailored to livestock, crops, and agroforestry.

To address market mismatches, we aim to partner with the private sector to build a broad value chain foundation that ensures farmers are not only producing but also accessing appropriate markets.

For example, while rice seeders are yielding high outputs in other countries due to subsidy schemes, Kenyan farmers still face yield gaps due to limited support structures. TARDA steps in to close these gaps by offering targeted input mechanisms, advisory services, and subsidy-informed support packages—helping farmers move toward optimal productivity and sustainable land use."

Audience Question:

What are the current levels of siltation in the 7 Forks Dams, and how can sustainable water levels be maintained in the face of ongoing land degradation?
Panelist Response – Maram (Jordan Context):

Maram highlighted that Jordan faces a similar challenge of water resource degradation due to siltation and deforestation. To address this, the Jordanian government launched a National Sustainable Plan aimed at:

- Planting trees, especially deep-rooted species that can serve dual purposes, such as productive trees like olive trees and trees for agricultural fencing.
- Constructing artificial rock walls on mountain slopes to slow down erosion and siltation.
- Restoring forest cover using specific tree species tailored to local conditions.
- Reviving soil health as a foundation for modernized, sustainable agriculture.
- Mainstreaming environmental education by integrating sustainability topics into school and university curricula, as well as into community awareness programs.

Panelist Response – Irene (Kenyan Context):
Irene responded by noting that Kenya, particularly the Aberdare region, suffers from a lack of coordinated soil conservation practices. She observed that:

- Food systems are highly corrosive, contributing to land degradation and siltation.
- There is minimal adoption of soil conservation measures, despite the importance of these practices for maintaining healthy catchments.
- Agricultural extension services are not sufficiently leveraged to promote conservation agriculture or educate farmers about soil and water management.

FARID WANGARA – Lead Insight, Chief Operations Officer & Principal Officer, Acre Africa

De-Risking Agriculture and Leveraging Insurance for Resilience and Sustainability

The panel discussion highlighted the urgent need to transform agriculture in dryland regions by de-risking farming systems to build resilience against climate and market shocks. With drylands covering 40% of the world's land and supporting over 2 billion people, the discussion underscored their critical role in food security—especially in Africa—while acknowledging growing risks from droughts, erratic rainfall, and pest outbreaks. Experts emphasized a three-pronged approach to de-risking: risk reduction (e.g., climate-smart practices), risk transfer (e.g., agricultural insurance), and risk coping (e.g., credit and savings). ACRE Africa's data-driven insurance models and the use of digital platforms were showcased as scalable solutions to protect farmers and promote sustainable livelihoods. The panel called for strong public–private partnerships, localized innovation, and supportive policy frameworks to integrate insurance into climate-smart strategies and empower dryland communities, particularly smallholders, youth, and women.

Key Points

1. Why Drylands Matter

- 40% of the world's land is classified as dryland, sustaining over 2 billion people globally.
- In Africa, drylands are vital for food security and rural livelihoods, but face intensifying threats including droughts, desertification, and water scarcity.

2. Understanding the Risk Landscape in Agriculture

- Agriculture in drylands is increasingly vulnerable to irregular rainfall, prolonged droughts, and pest infestations.
- Smallholder farmers lack adequate safety nets, often leading to poverty traps when crops fail.
- Crop failure results in income loss, food insecurity, and a stall in rural development.

3. What is De-risking Agriculture?

- De-risking is a strategic buffer that helps farmers withstand climate and market shocks.
- Involves a three-pronged approach:
  - o Risk Reduction: Climate-smart seeds, water-saving practices
  - o Risk Transfer: Agricultural insurance
  - o Risk Coping: Savings, credit, and emergency funds
- These approaches ensure stability, continuity, and recovery for farmers and ecosystems.

4. Role of Insurance in Building Resilience

- Insurance acts as a financial safety net:
  - o Enables replanting after crop loss
  - o Unlocks access to agricultural credit
  - o Encourages adoption of certified, quality inputs
- Public–private partnerships are essential to lower costs and scale access.

5. ACRE Africa's Model

- Designs data-driven insurance products covering:
  - o Drought, excess rainfall, pests, yield shortfalls, and livestock losses
- Delivery is done through:
  - o Micro level: Village champions
  - o Meso level: Banks, MFIs, agro-dealers, off-takers
  - o Macro level: Government insurance schemes
- Over 5 million farmers insured through 10+ tailored products across Africa.

Digitalisation in Agriculture Insurance

Why Digital Infrastructure Matters

- Scalability: Digital platforms (e.g., DigiBima) make it cost-effective to reach millions of farmers.
- Efficiency: Seamless integration of data flow among stakeholders—farmers, insurers, financial institutions.
- Accuracy: Use of satellite data, weather stations, and AI improves climate risk assessment and reduces basis risk.
- Service Delivery: Supports full insurance cycle:
  - o Farmer onboarding and monitoring
  - o Pricing and claim management
  - o Payment portals and real-time communication

CONTINUED... FARID WANGARA

De-Risking Agriculture and Leveraging Insurance for Resilience and Sustainability

Relevance to Dryland Resilience:

Why It Matters for Drylands

- Helps build resilience in fragile ecosystems and supports smallholder and pastoralist livelihoods.
- Promotes sustainable agricultural practices with financial protection.
- Reduces over-reliance on humanitarian aid by fostering self-reliant recovery systems.

Scaling Through Partnerships

- To scale impact in drylands:
  - o Leverage USSD, mobile apps, and localized tools for access
  - o Provide subsidies and incentives to lower cost of insurance
  - o Invest in community awareness and trust-building
  - o Utilize weather stations and remote sensing for local data accuracy

Policy and Systems Recommendations

- Embed insurance within national climate-smart agriculture strategies
- Supportive policy frameworks should include:
  - o Risk layering strategies
  - o Regulatory clarity for insurers and partners
  - o Subsidy models for premium support
- Integrate de-risking into public investments and development programs
- Align with Agriculture 4.0 (use of big data, AI, sensors)
- Promote youth- and pastoralist-focused products
- Advance regional cooperation and localized innovation ecosystems

Vision for Dryland Resilience – Expected Outcomes

- Resilient livelihoods for smallholders and pastoralists
- Reduced humanitarian aid dependency
- Sustainable land-use planning
- Empowered youth and women through risk-managed agribusiness
- Reliable food production systems in climate-challenged ecosystems

Take-Home Messages

- Agricultural insurance is not just a safety net—it is a development tool for climate resilience.
- Digital innovation, local engagement, and policy integration are essential for scaling access.
- De-risking agriculture through insurance and integrated services is crucial to the transformation of dryland food systems.

FARID WANGARA – Lead Insight, Chief Operations Officer & Principal Officer, Acre Africa,
Panelists: Maurice Ouma and Kennedy Anahinga

De-Risking Agriculture and Leveraging Insurance for Resilience and Sustainability

Objective:
To explore the role of agricultural insurance and other risk-transfer tools in helping smallholder farmers adapt to climate risks, stabilize incomes, and invest in productivity.

Farid Wangara – Chief Insurance & Principal Officer, Acre Africa
Expertise: Index insurance, climate risk modeling, insurance innovations for smallholders
1. What innovative models is Acre Africa using to improve access and affordability of agricultural insurance for dryland farmers?
Answer:
"At ACRE Africa, we've developed the Bima Pima Coordinated Insurance Model—an innovative, farmer-centered solution tailored to smallholders, especially in dryland regions. This model offers basic agricultural insurance that covers both the cost of production and the cost of yield, ensuring that farmers are protected from loss of input investment and expected harvest in the event of adverse weather.

One of the unique features of this model is its flexibility—farmers are allowed to choose their own premium levels, making the insurance more accessible and affordable. This approach shifts insurance from being an abstract financial product to something tangible and relevant to farmers' daily realities.

To enhance adoption, we work with Village Champions—local farmer leaders who are trained not only in promoting insurance but also in spreading good agronomic practices. These champions play a key role in trust-building and information dissemination within their communities.

Furthermore, we integrate technology for real-time monitoring, using smartphone-based picture tools that allow agronomists to track crop performance and provide personalized advice throughout the growing season. This tech-enabled feedback loop ensures farmers receive timely support, increasing both productivity and trust in the insurance product.

Overall, the Bima Pima model exemplifies how affordable, localized, and digitally supported insurance solutions can drive resilience in dryland agriculture."

2. How can we close the knowledge and accessibility gap among smallholder farmers regarding agricultural insurance products?
Maurice Ouma (DRIVE Project Coordinator)

1. How is the DRIVE project approaching risk mitigation in fragile dryland contexts, particularly for pastoralists transitioning into diversified livelihoods like aquaponics?
Answer:
Mr. Ouma explained that the DRIVE project (De-Risking, Inclusion, and Value Enhancement of Pastoral Economies in the Horn of Africa) adopts a multi-layered risk mitigation strategy centered around financial inclusion and resilience building for pastoralist communities.
Key elements of the DRIVE approach include:

- Financial Integration for Risk Mitigation: The project promotes inclusive financial services such as insurance and savings, tailored to the needs of pastoralists. This enables them to better absorb shocks and transition toward diversified livelihoods, including innovative ventures like aquaponics.
- Insurance and Savings Culture: DRIVE incorporates a layered insurance model that combines asset protection (e.g., for livestock) with savings incentives. Pastoralists are encouraged to develop a strong savings culture through matched savings schemes — for example, a $50 contribution is rewarded with a 15% bonus to boost financial discipline and resilience.
- Livelihood Diversification and Value Chains: The project supports livestock offtake programs that ensure animals are sold when still in good condition.

CONTINUED...

De-risking Agriculture and Leveraging Insurance for Resilience and Sustainability.
Focus: Innovations in Agricultural Insurance for Smallholder Farmers

Innovative models like grain-to-goat exchange rates are introduced to stabilize household food security and income. Additionally, efforts are made to strengthen trade and build sustainable value chains relevant to pastoral economies.

- Asset Protection through Insurance: Insurance products are designed not only to protect assets (like livestock) from climate risks but also to enable pastoralists to reinvest in productive, sustainable livelihoods.

In summary, the DRIVE project integrates financial tools, behavioral incentives, and market-oriented strategies to support pastoralists in adapting to climate risks, improving their economic resilience, and embracing new livelihood opportunities.

2. What data-driven tools or innovations is DRIVE using to assess risk and enable appropriate insurance design for small-scale producers?

Kennedy Anahinga– State Department for Agriculture
Expertise: Government policy, agricultural resilience frameworks

1. What national frameworks or initiatives are in place to promote inclusive agricultural insurance for smallholders?

Mr. Anahinga highlighted that Kenya has taken significant policy and structural steps to promote inclusive agricultural insurance, especially in response to the increasing frequency and severity of climate-related disasters such as drought.

Key points from his response include:

- Policy Response to Crisis:

The devastating impacts of prolonged drought, which led to massive livestock losses valued at over KSh 700 billion, served as a critical wake-up call for the government. This led to a comprehensive analysis and development of insurance schemes targeting both livestock and crop farming.

- Insurance Schemes Established:

o Crop Insurance Scheme: Initiated in 2015, in collaboration with 55 insurance and private sector players.

o Livestock Insurance Scheme: Designed to cushion pastoralists against losses from drought and disease.

- Institutional Frameworks:

o The Kenya Agricultural Insurance and Management Information System (KIAMIS) has been established as a digital platform to maintain a comprehensive database of farmers across counties. This tool enables the government and insurance providers to track farmer demographics, coverage levels, and regional distribution.

- Agricultural Insurance Act:

o The Agricultural Insurance Act currently outlines 13 classes of insurance relevant to agriculture.

o The government is actively working on developing specific regulations and policies under this Act to strengthen the legal framework and improve implementation at both national and county levels.

- Public Awareness and Outreach:

o The government is using platforms such as the Kenya Agricultural Shows to educate farmers about available insurance products and to address prevailing challenges and misconceptions related to agricultural insurance.

In conclusion, Mr. Anahinga emphasized that Kenya is moving towards a more structured, data-driven, and inclusive approach to agricultural insurance, underpinned by strong policy support and collaborative engagement with the private sector.

2. How is the State Department working with counties and the private sector to integrate risk management and insurance into broader agricultural development plans?

3. How can the government support adoption of integrated farming models through risk management tools such as input insurance, weather index insurance, or credit guarantees?

Generic Question for All Panelists

"What is one critical enabler—whether policy, technology, or partnership—that will help unlock the potential of agricultural insurance for Kenya's most vulnerable smallholder farmers?"

CONTINUED...

De-risking Agriculture and Leveraging Insurance for Resilience and Sustainability.

Focus: Innovations in Agricultural Insurance for Smallholder Farmers

Farmers' Questions & Answers on Insurance
Q1: How can I be insured in case of theft?
A1: Currently, theft insurance is being introduced as a new feature. It will cover areas insured before the end of the planting season.
Q2: Why doesn't the insurance cover hailstorm destruction?
A2: Hailstorm damage is covered under a comprehensive agricultural insurance scheme, which is designed to protect against such weather-related risks.
Q3: Why is insurance not available across the entire nation?
A3: All counties are covered by the insurance program, but not all areas within every county are insured yet. Expansion is ongoing to cover more areas gradually.

Farmer Question to the Panel:
"How easy is it for farmers to access insurance, particularly health insurance? Many of us feel left out when it comes to our own health coverage. Can insurance be made more accessible and practical for farmers?" Response by Kennedy Anahinga – State Department for Agriculture:
Mr. Anahinga acknowledged the challenge of marketing agricultural insurance as a standalone product, particularly in rural settings where uptake remains low. He emphasized the need for complementarity in insurance offerings:

- Insurance should not be isolated but rather bundled with other farmer support services, such as those from the Agricultural Development Fund.
- There is a need to design complete insurance packages that combine agriculture and health coverage, making the offering more appealing and valuable to farmers.
- For such packages to be effective, they must be socially acceptable and well-integrated into community practices, promoting trust and inclusivity.

Response by Farida Wangara – SHA Representative:
Farida highlighted the evolving landscape of health insurance for farmers through the Social Health Authority (SHA) framework:

- SHA has begun addressing gaps in access by offering co-payment or top-up models.
- Farmers can top up their premiums, and in return, receive additional liquidity or benefits in the event of illness.
- This integrated approach allows farmers to access both essential health services and financial support during critical periods, increasing resilience.

Response by Maurice Ouma – DRIVE Project Coordinator: Mr. Ouma focused on the behavioral and practical barriers to insurance uptake:

- Many farmers are willing to consider insurance, but face difficulties understanding complex policy documents and coverage terms.
- There is a need to simplify agricultural insurance policies—clearly outlining what is covered and what the farmer's responsibilities are.
- While farmers are aware of the risks they face, insurance is often not among their top five priorities due to immediate needs like inputs or food.
- However, bundling insurance with credit, last expense cover, or other practical financial tools makes it more meaningful and increases adoption.

Summary:
The panel agreed that for health and agricultural insurance to be effective and accessible for farmers:

- Products must be bundled and holistic, combining agricultural, health, and financial services.
- Policies must be simplified and demystified for easier comprehension.
- Community-based models and trust-building mechanisms are essential.
- Complementary funding, such as from the Agricultural Development Fund, can drive inclusion and resilience.

DR. GEORGE MUTHIKE, Deputy Director – Forest Products & Entrepreneurship Development (FPED), KEFRI

Achieving Sustainable Land Use Through Agroforestry and Reforestation Initiatives

The presentation showcased KEFRI's (Kenya Forestry Research Institute) strategic leadership in promoting sustainable land use through science-based innovations in agroforestry, reforestation, and ecosystem restoration. By integrating trees with crops and livestock across diverse systems, KEFRI addresses deforestation, climate change, and land degradation while supporting livelihoods through forestry-based enterprises and value-added non-timber products. The institute leverages digital tools, biotechnology, drone technology, and nature-based solutions to enhance land productivity and resilience. Through multi-stakeholder partnerships, capacity building, and incubation programs—particularly targeting women and youth—KEFRI links reforestation with economic empowerment and national development goals. Its initiatives contribute directly to achieving the SDGs by fostering food security, poverty reduction, climate adaptation, and green urbanization, positioning agroforestry as a cornerstone of Kenya's sustainable development agenda.

Key Points

1. KEFRI's Strategic Role in Sustainable Land Use

- KEFRI (Kenya Forestry Research Institute) is at the forefront of generating technologies for tree planting, forest management, and rehabilitation of degraded ecosystems.
- It provides high-quality germplasm for priority species, develops climate adaptation technologies, and promotes forestry-based enterprises for improved livelihoods.

2. Agroforestry and Reforestation Systems

- Agroforestry integrates trees with crops and/or livestock across three systems:
  - o Agrisilvicultural: Trees + Crops
  - o Silvopastoral: Trees + Livestock
  - o Agrosilvopastoral: Trees + Crops + Livestock
- These systems can serve commercial, subsistence, or hybrid purposes and support land restoration, climate resilience, and community livelihoods.

3. Why Agroforestry Matters for Sustainable Land Use

- Addresses deforestation, biodiversity loss, climate change, and erosion of indigenous knowledge.
- Supports supply of wood and non-timber forest products (NTFPs), promotes value addition, and boosts green construction and climate-smart urban planning.

4. KEFRI Technologies Driving Sustainable Land Use

- Digital tools: KEFRI App for species-site matching, KEFRI Tree Valuation app.
- Biotech & agronomy: High-quality seeds/seedlings (Melia, Pines, Fruit trees), soil-enhancing products like KEFRI FIX.
- Aerial technologies: Drone-based seeding, surveillance, mapping.
- Nature-based solutions: Payments for Ecosystem Services (PES), ecotourism integration.

5. Implementation Models for Sustainable Land Use

- Inventory & Landscape Analysis: Mapping target areas and appropriate technologies.
- Stakeholder Engagement: Partnership with counties, CBOs, CSOs, and private sector e.g, Lukenya University for implementation.
- Capacity Building: Zoning eco-regions, training farmers, developing model farms, and creating demonstration plots.
- Asset & Benefit Sharing Mechanisms: Public-private partnerships, value capture, intellectual property protection, and benefit-sharing frameworks.

Take-Home Recommendations

A. Critical Success Factors

- High domestic demand for wood and NTFPs—growing

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Achieving Sustainable Land Use Through Agroforestry and Reforestation Initiatives

at 4.4% annually—offers huge opportunities for reforestation-based businesses.
- International market access, favorable climate conditions, and a well-educated, trainable workforce make Kenya ideal for forestry investment.
- Government support through policies like the 15 Billion Tree Initiative and National Forest Programme 2016–2030 underpins long-term sustainability.

B. Training, Incubation, and Technology Transfer
- KEFRI's short- and long-term incubation programs (1 week–6 months) support women and youth in timber and non-timber product development.
- Community-focused models promote CSR-based commercialization and contracted incubation, which enhances local economic empowerment.
- Indigenous fruit processing (e.g., baobab, tamarind) and gum/resin value chains create new income streams and nutrition solutions.

C. Link to Sustainable Development Goals (SDGs)
- SDG 1 & 2: Poverty reduction, food and nutrition security
- SDG 11: Greening cities and inclusive urban development
- SDG 13 & 15: Combat climate change and restore ecosystems

Broader Impacts & Vision
- Agroforestry and reforestation form the nexus between land use and national development:
  - o Food security through diversified land systems
  - o Industrialization via value chains in wood, fruit, and NTFPs
  - o Water security by restoring key water towers
  - o Urban resilience through green buildings and riverside reforestation
  - o Reviving traditional agriculture by embracing organic farming and indigenous species

Summary: Key Takeaways
- Agroforestry and reforestation are multi-benefit solutions for Kenya's land degradation, economic development, and climate adaptation goals.
- Technology, policy, partnerships, and community empowerment are essential to scale sustainable land use.
- KEFRI's innovation ecosystem offers scalable, science-driven solutions with proven socioeconomic and ecological impacts.

DR SHAPHAN CHIA, Research Scientist International Centre of Insect Physiology and Ecology (ICIPE)

The Pivotal Role of Organizations in Research Utilization for Advancing Dryland Agriculture, Livestock Development, and Food Systems Amid Climate Change

About ICIPE

- A Pan-African Centre of Excellence in insect science and its application in agriculture, health, and environmental sustainability.
- Established over 50 years ago, with operations guided by 13 African countries.
- Hosts 150–180 graduate students annually and employs over 571 staff from 30+ nationalities, emphasizing research and capacity building.

1. Why Drylands Matter
- Drylands cover over 40% of the Earth's surface and are home to more than 2 billion people.
- They are highly vulnerable to climate change, land degradation, and biodiversity loss.
- Desertification is a global crisis, affecting over 1 billion people in more than 100 countries.
- Up to 60% of soil organic carbon in drylands has been lost, increasing greenhouse gas emissions and undermining productivity.

2. The Role of Organizations as Catalysts of Change
- Align research priorities with ecosystem and community needs.
- Facilitate partnerships between scientists, farmers, governments, and private sector actors.
- Lead policy advocacy and institutional capacity building.
- Ensure that research transitions from theoretical frameworks to practical application.

3. Enabling Research-to-Action Pathways
- Promote co-creation with communities and multi-stakeholders.
- Use strategic communication to translate scientific findings into actionable knowledge.
- Integrate science, policy, and practice through inclusive and interdisciplinary approaches.

4. Barriers to Research Utilization
- Weak extension systems hinder technology transfer.
- Limited collaboration with the private sector affects scalability.
- A disconnect between policy formulation and grassroots implementation.
- Inadequate support for upscaling proven innovations.

5. Turning Research into Resilience
- Move beyond data collection to scaling climate-smart innovations.
- Strengthen institutional and community capacities for sustained adoption.
- Support cross-sectoral collaboration and policy integration.
- Use evidence-based approaches to build resilient dryland food systems.

The ICIPE Model: Applied Science with Impact

1. Insects as a Resource in Dryland Systems
- Insect farming for food and feed: Projects in Laikipia, Isiolo, Samburu, and Marsabit.
- Cricket farming improves nutrition, gut health, and household income.
- Development of insect-based fertilizers which enhance plant yield and soil health.
- Livelihood support through insect-derived feed products and push-pull pest control technology.

2. Circular Bioeconomy & One Health Approach
- Integrates insect science, livestock production, and environmental health.
- Combines sustainable farming, animal health, and human nutrition to promote holistic resilience.
- Aligns with Africa's Agenda 2063 and the UN SDGs, especially SDG 2 (Zero Hunger) and SDG 13 (Climate Action).

3. Policy, Standards, and Certification
- ICIPE supports the development of agricultural standards through organizations like the African Organisation for Standardisation (ARSO).
- Drives policy dialogues to embed insect-based

innovations, IPM, and regenerative farming into national and regional frameworks.

Take-Home Messages

- Research must be practical, inclusive, and linked to real outcomes.

Organizations like ICIPE are essential bridges between science and field-level impact.

- Dryland agriculture needs context-specific, nature-based solutions like insect farming, IPM, and circular bioeconomy models.
- Collaboration is key: Partnerships with farmers, local governments, universities, private sector, and donors are vital to scale success.
- To address climate threats, research must evolve into resilient systems that boost yields, improve soil health, enhance nutrition, and empower communities.
- With the right policy support, digital tools, and knowledge exchange, dryland communities can lead in climate adaptation, food system transformation, and sustainable development.

DR. SHAPHAN CHIA: LEAD INSIGHT, PANELISTS: DR. GEORGE MUTHIKE, DR SEGO KIPRONOH, DR. VIRGINIA MWANZIA: MODERATOR

Panel Discussion: To explore how institutions are turning research into real-world solutions that are transforming dryland agriculture and livestock systems—improving productivity, resilience, and sustainability.

Dr. Shaphan Chia – International Centre of Insect Physiology and Ecology (ICIPE)

Q1: What lessons has ICIPE learned about transferring research on pest control or insect-based innovations to dryland farming systems?

Answer (Dr. Chia):

Dr. Chia reflected on ICIPE's journey from 2012 to 2014 when insect farming was not well appreciated or understood in Africa. However, with growing sensitization and awareness campaigns, the perception has shifted. He emphasized:

- Insect farming is not new, but adoption has increased through training and demonstrations.
- The key lesson is that behavioral change and awareness are as important as the science itself.
- Today, insect products are commercially viable, and digital platforms are aiding in marketing and knowledge dissemination.

Q2: How can research organizations better collaborate with local communities to ensure solutions are context-specific, scalable, and adopted by dryland farmers?

Answer (Muthike – General Response):

Muthike stressed that effective collaboration requires substance, not symbolic partnerships.

Key points included:

- Government and NGO partnerships must be complementary, leveraging each party's strengths in deployment and specialization.
- Memorandums of Understanding (MoUs) should have clear, practical outcomes—not just ceremonial value.
- Collaboration should be needs-based, ensuring that research institutions bring actionable, context-relevant solutions to farmers.

Dr. Sego Kipronoh – Mifugo ni Mali / Kenya Livestock Breeders Association

Q1: How can research institutions and livestock breeding associations collaborate to enhance the productivity of livestock under dryland conditions?

Answer (Dr. Sego):

Dr. Sego emphasized:

- Focus on the value chain — from feed conversion abilities and genetics to market-ready livestock.
- Promote climate-smart breeds, such as the Boran, selected based on data including size, adaptability, and productivity.
- Collaboration should prioritize affordable, easy-to-use technologies that offer value for money to livestock keepers.

CONTINUED...

Panel Discussion: To explore how institutions are turning research into real-world solutions that are transforming dryland agriculture and livestock systems—improving productivity, resilience, and sustainability.

Q2: What are the biggest barriers to translating research on livestock improvement into practical outcomes for pastoralists and livestock keepers?

Answer (Dr. Sego – continued):

- Challenges include limited access to appropriate technologies, lack of policy support, and weak marketing systems for livestock products.
- He called for government policy interventions that promote both quality and quantity in dryland livestock markets.

General Panel Question:
In your experience, what must change in Kenya's research-to-practice ecosystem to accelerate adoption of innovations that strengthen dryland agriculture and livestock systems?

General Themes from All Panelists:

- Strengthen community education and sensitization, especially around unfamiliar technologies like insect farming.
- Ensure MoUs between research institutions and partners are meaningful, with clearly defined outcomes.
- Align technology development with real farmer needs, focusing on affordability, simplicity, and local relevance.
- Promote multi-stakeholder partnerships that are mutually beneficial and grounded in shared value.

Q: What needs to change in our agricultural policies, research, and approach to food importation?
Muthike's Perspective: Focus on Technology & Youth Engagement

- Challenge: The new generation is not continuing from where the older one left off. They are digital natives, and traditional methods don't attract them.
- Solution:
  - Embrace ICT and digital tools in agriculture.
  - Integrate digital technologies into agricultural research and extension (e.g., Jaza Miti and other tech-based platforms).
  - Make all agricultural technologies accessible via digital platforms to meet young people's interests and capacities.

Chai's Perspective: Rethinking the Purpose of Research

- Challenge: There's a need to redefine why we conduct agricultural research—it must respond to today's realities.
- Solution:
  - Shift to demand-driven and localized research that addresses the actual needs of farmers and communities.
  - Accept that we live in a different era—modern challenges need modern, adaptive, and sustainable solutions.
  - Create an enabling environment for farmers and institutions to adopt innovations.
  - Ensure policies are not only top-down but also responsive to the current situation on the ground.

Key Takeaways for Policy and Practice:

1. Modernize Research & Policy:
Policies must reflect the digital age and be shaped by data and demand from farmers.

2. Youth Inclusion:
Engage the next generation using the tools and languages they understand (mobile apps, social media, smart agriculture tools).

3. Reduce Reliance on Food Imports:
Invest in locally adaptive research and production systems to increase food self-sufficiency.

4. Localization & Sustainability:
Solutions must be context-specific, scalable, and maintainable by local farmers and institutions.

ANGELA WAENI - MSc student, Lukenya University

Revitalizing Indigenous Seed Systems for Resilient Dryland Agriculture: Lessons from Eastern Kenya

The masters student emphasizes the vital role of indigenous seed systems in enhancing climate resilience for smallholder farmers in Kenya's dryland regions like Kitui and Makueni, where erratic rainfall and drought threaten food security. Traditional seed varieties, better adapted to local conditions, are being lost due to the dominance of commercial hybrids and unsupportive policies. Revitalization strategies such as community seed banks, women-led initiatives, and participatory breeding are helping to preserve agrobiodiversity and empower communities.

Key Points

1. Introduction: Challenges in Dryland Agriculture

- Regions like Kitui and Makueni in Eastern Kenya face:
  - Irregular rainfall patterns
  - Frequent and prolonged droughts
  - Soil degradation
- These challenges put smallholder farmers' food security and livelihoods at high risk—worsened further by climate change.

2. Importance of Indigenous Seed Systems

Traditional seed varieties (e.g., Nyayo, Kakunzu, Kamenzele, Mbikamba, Makueni maize):

  - Are well-adapted to local conditions.
  - Hold cultural value and contribute to agrobiodiversity conservation.
- In contrast, commercial hybrid seeds:
  - Are less resilient, often costly, and ill-suited for semi-arid smallholder systems.

3. Causes of Decline

Growing adoption of commercial seed varieties has led to:

  - Loss of local seed diversity
  - Policy and institutional biases against traditional systems
  - Erosion of indigenous knowledge on seed saving, storage, and exchange
  - Increased vulnerability to climate extremes

4. Revitalization Strategies

- Community Seed Banks:
  - Provide secure access to diverse, climate-resilient seeds.
  - Reduce farmer dependence on external seed markets.
  - Enhance climate adaptation capacity.
- Women's Groups:
  - Often manage seed banks, promoting community empowerment and institutional resilience.
- Participatory Breeding:
  - Involves farmers in selecting and improving local varieties.
  - Combines scientific innovation with traditional knowledge for climate-smart agriculture.

5. Case Lessons from Kitui and Makueni

- Resilience through diversity: Planting multiple indigenous varieties buffers crops against climate shocks.
- Empowerment and knowledge retention: Seed conservation activities enhance community capacity.
- Traditional + Modern Integration: Merging local practices with research-based approaches results in better outcomes.
- Policy advocacy is vital: Farmer seed rights must be recognized and protected through legal reform.

6. Policy and Legal Implications

- Kenya's Seeds and Plant Varieties Act (Cap. 326):
  - Restricts traditional seed sharing and undermines indigenous systems.
- Current seed policies favor certified commercial seed enterprises.
- Ongoing advocacy efforts by:
  - Seed Savers Network Kenya
  - International Seed Federation (ISF)
  - International Institute for Environment and Development (IIED)
- Aim to amend policies, enhance farmer participation, and provide technical and financial support.

EUNICE MUTUA – Msc Student; Lukenya University

The Role of Silicon in Improving Agricultural Productivity in ASALs

The presentation highlighted the potential of Silicon (Si) as a climate-smart solution to enhance crop resilience in arid and semi-arid lands (ASALs). Though not classified as an essential nutrient, Si significantly boosts plant defense against drought, nutrient deficiencies, pests, and diseases through mechanisms such as strengthening cell walls, improving water use efficiency, enhancing photosynthesis, and increasing nutrient uptake. A case study on two bean varieties explored innovative Si application methods and drought response metrics.

Key Points

1. Overview and Rationale

- Silicon (Si), while not classified as an essential plant nutrient, plays a crucial role in enhancing plant resilience to both abiotic (e.g., drought, nutrient deficiency) and biotic (e.g., pests, diseases) stresses.
- With increasing climatic challenges in arid and semi-arid lands (ASALs), Silicon is positioned as a climate-smart solution for improving productivity and sustainability.

2. Functions and Mechanisms of Silicon in Crops

a) Structural Reinforcement

- Si forms silica-cellulose double layers in cell walls, enhancing stem strength and resistance to lodging, pests, and fungal invasion.
- Example: Si-treated cucumbers show reduced powdery mildew incidence.

b) Drought Tolerance & Water Use Efficiency

- Si reduces water loss by minimizing cuticular transpiration and improves root water absorption.
- Increases soil water-holding capacity through amorphous silica (ASi), shown to improve crop yield (e.g., maize, rice) under drought conditions.

c) Photosynthesis & Oxidative Stress Mitigation

- Si protects chloroplast membranes, boosts photosynthetic efficiency, and enhances antioxidant activity (e.g., SOD, CAT enzymes), helping reduce ROS damage.
- In drought-stressed wheat, Si boosts chlorophyll content by up to 30%.

d) Nutrient Uptake and Soil Health

- Si improves phosphorus availability in depleted soils and detoxifies heavy metals like aluminum, improving root health in acidic soils.

e) Biotic Stress Resistance

- Si triggers systemic acquired resistance (SAR) by inducing defense proteins and phytoalexins.
- Example: Si-treated tomatoes show increased jasmonic acid signaling, suppressing bacterial wilt.

3. Experimental Focus on Beans (Phaseolus vulgaris)

- Selected two bean varieties, Kakunzu and Nyota, known for iron stress susceptibility.
- Beans are Si-excluders, offering a unique model to explore innovative Si application methods.

Experimental Approach:

- Treatment methods: Foliar spray, soil drench, or hydroponic systems.
- Assess:
  - Si uptake efficiency (e.g., nanoparticles vs. silicates).
  - Drought response: stomatal conductance, proline levels, biomass.
  - Molecular markers: gene expression of ABA-related pathways and aquaporins.

4. Conclusion & Research Gaps

- Silicon is a promising “miracle element” for climate-resilient, resource-efficient agriculture, especially in ASAL regions.
- Its integration can reduce reliance on synthetic inputs (fertilizers, pesticides) while improving yields and stress tolerance.

Identified Research Gaps:

1. Species-specific mechanisms in Si “excluders” like beans remain underexplored.
2. Standardization needed for optimal Si formulations, dosage, and timing.
3. Long-term impacts on soil microbiome and silica cycling are unknown.
4. Molecular mechanisms, especially Si’s interaction with phytohormones and epigenetics, are insufficiently studied.

IRENE NGANGA, RESEARCH OFFICER ILRI

Participatory Rangeland Management (PRM)

Ms. Irene introduced Participatory Rangeland Management (PRM) as a community-led approach that empowers pastoralist communities to sustainably manage rangelands, enhance tenure security, and restore degraded ecosystems. PRM supports biodiversity conservation and resilient livestock-based livelihoods through techniques like rotational grazing, invasive species control, and community seed production. It emphasizes inclusivity, peace-building, and alignment with policy frameworks, while also integrating health considerations through trained rangeland health workers.

Key Points

1. What is PRM?
- A step-by-step participatory process that empowers pastoralist communities to manage rangelands and natural resources.
- Communities lead the process, with strengthened or newly established rangeland management institutions.
- Aims to promote tenure security through mapping, documentation, and formal agreements.

2. Role in Restoration
- PRM supports sustainable rangeland use, biodiversity conservation, and resilient livestock-based livelihoods.
- Restoration techniques include:
  - o Short and rotational resting (can include reseeding),
  - o Invasive species control,
  - o Prescribed fire (in years with surplus forage),
  - o Community grass seed production.

3. Scaling Up Restoration
- Four pillars:
  - a. Planning (objectives and options),
  - b. Low-cost, effective methods,
  - c. Local capacity building,
  - d. Trial and refinement before scaling.

4. Challenges
- Weak land tenure,
- Exclusionary practices,
- Conflicts over restored resources,
- Slow, expensive restoration efforts,
- Land fragmentation due to cropping; urgent need for land use planning.

5. Cross-Cutting Themes
- Gender & Social Equity: Ensuring inclusivity of women, youth, and minorities in planning and decision-making.
- Peace-building: PRM strengthens social cohesion and governance, helping prevent and resolve conflicts.
- Policy & Legislation:
  - o PRM's long-term benefits require enabling policies.
  - o Collaboration with government ministries and regional bodies like IGAD.
  - o Support from Kenya's MoALD and integration into national initiatives (e.g., mapping livestock routes).

6. Rangeland Health for One Health

Trained Community Rangeland Health Workers support PRM by:
- o Facilitating restoration,
- o Using HEAL tools,
- o Connecting rangeland degradation to health issues (e.g., tick- and worm-borne diseases).

7. PRM Learning Tools

Multiple resources (videos, cartoons, dialogue cards) are available to support training and awareness:
- o Animated explainer: https://www.youtube.com/watch?v=RJ9lJgzqWTQ
- o Cartoons: https://hdl.handle.net/10568/136023
- o Dialogue cards: https://hdl.handle.net/10568/128186
- o PRRA Video: https://youtu.be/-JfFw18-22Y

Take-Home Message

Participatory Rangeland Management (PRM) is a community-driven approach that promotes sustainable land use, livelihood resilience, and conflict resolution in dryland areas. By empowering local communities, integrating gender and equity considerations, and aligning with national policies, PRM provides a robust model for addressing climate-related challenges and enhancing One Health outcomes. However, scaling and institutional support are critical for its long-term success.

Dr. Guyo Roba – Head of Dryland Development Unit, IGAD Center for Pastoral Areas and Livestock Development (ICPALD)

Navigating Challenges and Harnessing Pathways for Sustainability and Development of Pastoralist Communities

Pastoralism in the IGAD region is not merely a livelihood—it is a sophisticated, adaptive system deeply rooted in culture, ecology, and economy. Spanning vast arid and semi-arid landscapes, this mobile way of life has enabled communities to thrive in some of Africa's harshest environments through communal land use and indigenous knowledge. Today, pastoralism sustains millions and contributes significantly to agricultural GDP, yet its full potential remains untapped amid growing urban demand, abundant rangeland resources, and underutilized markets. This presentation explores the critical role of pastoralism in the region, the challenges it faces, and the transformative shifts needed to move from marginalization to resilience and sustainable development.

Key Points

1. Understanding Pastoralism

- Pastoralism is more than a livelihood; it's a way of life, a production system, and a mobility strategy adapted to harsh, variable environments.
- It relies on communal land tenure, which is ecologically necessary for sustainable resource use and mobility.
- Indigenous knowledge systems of pastoralists are essential for ecosystem management and resilience.

2. The Role of Livestock in the IGAD Region

- IGAD region holds over 472 million ruminants, accounting for 70% of all livestock in ASALs (Arid and Semi-Arid Lands).
- Livestock contributes 57% to the Agricultural GDP in IGAD countries.
- Covers 5.2 million km², or 40% of Africa's landmass.

3. Opportunities in Pastoral Livelihoods

- High demand for livestock and products due to urbanization and population growth.
- Vast rangelands remain underutilized – offer opportunities in carbon sequestration, ecosystem services, and non-livestock resources (e.g., gums, resins, honey, minerals).
- Smallholder producers (95% of producers) present a massive untapped potential for poverty reduction and food security.

4. Key Challenges / Shocks and Stresses

- Climate change (droughts, variability)
- Land tenure insecurity (encroachment, land grabs)
- Animal diseases and pest outbreaks
- Trade barriers and shifting markets
- Policy changes affecting land and water access
- Resource-based conflicts and livestock raids

5. Pathways to Sustainable Pastoralism

- Recognition and protection of land rights and communal resources
- Fodder security and improved rangeland management
- Inclusive value chains and market access
- Empowering local institutions and governance systems
- Climate adaptation strategies
- Supportive and flexible policy frameworks

6. Needed Paradigm Shifts

- Shift from crisis management to resilience building
- Move from neglect to policy attention and regional coordination
- Focus on sustainable production systems, not emergency relief
- Promote inclusive and context-sensitive development for pastoralist areas

Take-Home Message

Pastoralism is a viable, dynamic system that supports millions in the IGAD region, contributes significantly to regional economies, and holds untapped potential for development, climate mitigation, and ecological sustainability. However, it faces mounting pressures from climate change, insecurity, and policy neglect. To ensure its future, we must shift from reactive to proactive strategies by securing land rights, supporting local knowledge and institutions, improving markets, and embedding pastoralism into inclusive policy and development frameworks.

DR. GUYO ROBA - Lead Insight, Panelists: Guyo Roba, Irene Nganga, Moderator: Michael Odhiambo

Panel Discussion 5: Sustainable Livestock Management and the Role of Dairy and Livestock Value Chains in Pastoral Development

Dr. Guyo Roba – Head, Dryland Development Unit, IGAD (ICPALD)

Question 1:

In what ways are regional approaches—such as those driven by IGAD—strengthening the resilience of pastoralist communities in the Horn of Africa? How can regional cooperation help address the shared challenges faced by pastoralist communities across borders in the Horn of Africa?

Answer:

"8 member states of IGAD with ecological connection despite political boundaries face shared issues like climate change, border conflicts, animal diseases, and feed/fodder security. Regional protocols like transhumance frameworks, centralized surveillance and diagnostics, and cross-border market systems help tackle these challenges."

Irene Nganga – ILRI (International Livestock Research Institute)

Question 1:

How is ILRI working to ensure that innovations in livestock management (e.g., disease control, feed, genetics) reach pastoralist producers in remote areas?

Answer:

"Digital tools like the Agri-Data Hub and AI-powered extension services are enabling delivery of innovations. Government entities and open-access learning materials, alongside Training of Trainers (ToT) using visual context, are used to reach and engage remote pastoralists."

Question 2:

How are research institutions collaborating with local communities and governments to ensure dryland innovations are adopted and scaled?

Answer:

by engaging through digital platforms, partnerships with government institutions, and community-based trainer programs.

General Panel Question for All:

How can we reframe the narrative around pastoralism as a climate-smart, economically viable, and culturally embedded way of life?

Answers (Synthesized Insight from Panel):

- Dr. Guyo Roba: Emphasized the ecological and economic interconnectedness across IGAD states, reinforcing the viability of pastoralism as a cross-border, adaptive system.
- Irene Nganga: Advocated for innovation delivery using digital tools and inclusive training approaches to empower communities and highlight the value of pastoralist knowledge.

Audience Question 1 (Directed to Panel):

Institutions like KALRO have done significant research on pasture grasses native to the highlands, such as Star Grass and others. However, there appears to be little to no research on the management protocols of these grasses—particularly how to sustainably utilize and improve them. Can institutions like Lukenya University take the lead in researching management strategies for these species to support livestock productivity in these areas?

Audience Question 2 (Raised by KEFRI):

Land tenure is a critical issue in drylands. Are there any success stories of land management or land use planning where institutions have worked closely with communities to develop sustainable systems? Additionally, browsing livestock often damage trees, especially in community-managed lands. How can this be addressed within rangeland management frameworks?

Response (Irene Nganga – ILRI):

Research on dryland grasses has been conducted, but overall investment in drylands is still much lower compared to the highlands. ILRI and partners have promoted several grass species suitable for dryland environments, and institutions like University of Nairobi (UoN) have also contributed to this body of research. However, one key issue is limited knowledge sharing among institutions.

In terms of field success, Kajiado has seen more promising results than Wajir, largely due to better rainfall conditions. For example, in Kajiado, there was a noticeable increase in biomass in targeted areas, whereas Wajir faced constraints due to its low rainfall and harsh conditions

RAPHAEL V. M. OTAKWA, HERRICK OTHIENO, ANDREW A. ODUOR

Harnessing Agriculture for Climate Action: Sustainable Biomass Briquetting in Kenya

This presentation highlights bio-briquetting as a sustainable solution to the growing problem of biomass waste and energy insecurity, particularly in Kenya. By converting agricultural residues like maize cobs, cassava stalks, and sugarcane bagasse into clean-burning briquettes, the approach offers low-emission, renewable fuel alternatives that support circular economies and local livelihoods. Field studies across several counties demonstrated strong feedstock availability and high calorific values, reinforcing the feasibility of community-based production. The presentation emphasized the importance of localized strategies, community engagement, and policy integration to scale bio-briquetting as a viable climate and energy solution.

Key Points

1. The Problem

- Biomass waste from agricultural residues is a major global emission source.
- Inefficient use of organic waste contributes to air pollution, GHG emissions, and energy insecurity.

2. The Solution: Bio-Briquetting

Bio-briquettes are compact blocks made by compressing agricultural residues and organic waste into a clean-burning, renewable fuel.

Benefits include:

- o Low emissions, cleaner alternative to firewood or charcoal
- o Waste reduction and improved energy efficiency
- o Circular economy promotion and livelihood creation

3. Where & How (Study Design)

Study locations: Wajir, Vihiga, Kitui/Makueni, Kajiado

Methods used:

- o M1: Participant observation
- o M2: Focus group discussions
- o M3: Laboratory testing of briquette feedstocks

4. Raw Materials Identified

- Feedstocks included: maize cobs, cassava stalks/peels, cotton stalks, sugarcane bagasse, mango seeds, groundnut shells, wheat straw, etc.
- Calorific values of briquettes ranged from ~2870 to ~4694 kcal/kg, indicating strong potential for efficient combustion.

5. Key Outcomes

- Localized feedstock mapping shows widespread availability of viable biomass across counties.
- High calorific value of materials such as cassava stalks, cotton stalks, and sugarcane bagasse underscores feasibility.
- Encouraged community-level production models for sustainability and ownership.

Take-Home Messages

1. Local Use = Lower Emissions

Promoting localized production reduces transportation-related emissions and enhances adoption.

2. Community Engagement is Crucial

Community-based briquette production improves livelihood opportunities and ensures sustainable biomass use.

3. Need for Region-Specific Strategies

Tailored approaches to resource management can optimize feedstock use and maximize energy efficiency.

4. Policy Integration Required

Biomass briquetting must be integrated into national climate action and energy access policies for greater impact.

PURITY MUTHEU, PROF. REUBEN MUASYA, DR. HEZEKIAH KORIR- LUKENYA UNIVERSITY, SEKU, IITA

Transforming African Food Systems for Climate Resilience and Sustainability: A Review of Current Policies, Practices, and Pathways in Dryland Agriculture

The review underscores the urgent need to transform African food systems by addressing historical inequities, gender and youth exclusion, underinvestment in R&D, and fragmented governance, while leveraging agroecology, indigenous knowledge, digital innovations, and inclusive policies to build resilient, nutrition-sensitive, and sustainable food futures.

Key Points

1. Why Focus on African Food Systems?
- Population growth (2.5%/year) puts pressure on already strained food systems.
- Nutrition paradox: Coexistence of stunting (30% of children) and rising obesity.
- Gender inequity: Women contribute 50% of farm labor but own <20% of land.
- Opportunities exist in innovation (drought-tolerant crops, ICT) and policy frameworks (e.g., CAADP, Agenda 2063).

2. Historical and Policy Context

a) Colonial legacies: Cash crop monocultures, land dispossession.

b) SAPs (1980s–90s): Deregulation and subsidy cuts worsened food insecurity.

c) Modern initiatives:
- CAADP: 6% ag growth target, 10% budget commitment
- Agenda 2063: Continental vision for sustainable development.

3. Institutional Investment in R&D
- Growth in agricultural research and innovation across Africa
- CGIAR centers (e.g., IITA, ILRI) and AGRA drive climate-smart, nutrient-rich crop innovations.
- CAADP and NEPAD champion science-based approaches

4. Agroecology & Nutrition

Agroecological intensification integrates biodiversity, local knowledge, and low-input techniques.

Examples: Intercropping (Senegal, Uganda), Pfumvudza in Zimbabwe.
- Tackles the "triple burden": undernutrition, micronutrient deficiencies, obesity.
- Indigenous crops (e.g., millet, amaranth) and biofortification are key to improved nutrition.

5. Technology & ICT Innovations
- Platforms like iShamba, DigiFarm (Kenya) and Esoko (Ghana) support smallholders.
- Challenges: Digital illiteracy, poor infrastructure, gender gaps in access.

6. Policy and Governance Barriers
- Most African countries invest <1% of ag GDP in R&D.
- Fragmented policy frameworks hinder coordination.
- Donor-driven agendas can undercut local ownership.
- Multi-stakeholder platforms offer promise for inclusive food governance.

7. Equity: Gender and Youth Inclusion
- Women face structural inequalities in land, inputs, and income control.
- Gender-transformative approaches must address deep-rooted power dynamics.
- Youth exclusion due to lack of land/capital, despite being a growing demographic.
- Support needed for rural agripreneurship and youth-led food innovations.

8. Research Gaps and Future Directions

a) Overreliance on short-term studies—need for longitudinal, systems-level research.

b) Indigenous knowledge, informal markets, food safety—underexplored areas.

c) Emerging priorities:
- o Nutrient-sensitive agriculture
- o Circular food economy
- o Real-time data & digital tools
- o Food environment diagnostics
- o Transdisciplinary, co-created research

Take-Home Message

1. Adopt a systems-thinking approach

Food systems are ecological, economic, and social—interventions must be integrated.

2. Bridge science and indigenous knowledge

Combine modern R&D with local practices for climate resilience and community ownership.

3. Foster inclusive governance

Amplify voices of women and youth; empower farmers in decision-making.

4. Invest in long-term, context-specific innovation

Support transdisciplinary research, robust data systems, and targeted policy design.

5. Realign policies to local needs

Reduce donor dependency, harmonize national strategies with AU frameworks like CAADP and Agenda 2063.

JOSHUA LAIZER - Regenerative Grazing Associate– AfriScout

Transforming Pastoral Livelihood with CB Rangeland Management & Digital Tools: Roles of AfriScout in Transforming Agricultural Practices in Africa

The presentation explores how digital innovations like AfriScout are transforming pastoral livelihoods in Africa's drylands by enhancing climate resilience, promoting regenerative grazing, and fostering inclusive, community-based rangeland management.

Key Points

1. Importance of Building Resilience in Pastoral Livelihoods

- Pastoralism supports over 250 million Africans, especially in arid/semi-arid regions.
- Climate change is exacerbating challenges: increased drought frequency (+30% in 20 years), floods, disease outbreaks, and conflicts over resources.
- Pastoral meat trade contributes significantly to GDP (Ethiopia 19%, Kenya 13%).

2. Challenges Facing Pastoralists

- Declining herd sizes and economic vulnerability due to unpredictable weather.
- Limited access to accurate climate and environmental data, reliance on increasingly unreliable Indigenous knowledge.
- Conflicts and degradation due to overgrazing and misinformation about pasture and water availability.

3. AfriScout Innovations

a) AfriScout Steward App:

- Maps over 57 million hectares of rangelands.
- Provides 10-day updates on vegetation and surface water detection.
- Enables peer-to-peer grazing alerts and terrain analysis.
- Enhances inclusive decision-making at household level (including women).
- Reduces livestock loss and conflicts through informed grazing decisions.

b) AfriScout Regen Platform:

- Promotes regenerative grazing: rotational grazing, "virtual paddocks", and grass rationing.
- Emphasizes soil and ecosystem health via livestock movement and rest periods.
- Collective governance over rangeland with improved flora, fauna, and water quality.
- 1.2 million hectares are under active project management in Ethiopia.

4. Impact and Achievements

- Improved rangeland health and biodiversity restoration.
- Increased livestock productivity and improved household incomes.
- Enhanced food security, reduced stress, and better water availability.
- Conflict reduction due to communal resource planning and local bylaws.
- Women and youth inclusion in household and community decisions.
- Cost saving by eliminating the need for traditional scouting.

Take-Home Message

- Digital tools like AfriScout are revolutionizing pastoral systems by bridging indigenous knowledge with real-time data for climate-resilient decisions.
- Community-Based Rangeland Management enhances both ecological and socioeconomic outcomes—restoring degraded lands and improving livelihoods.
- Regenerative grazing and collective planning lead to more equitable access to resources, reduced migration pressure, and conflict mitigation.
- Inclusivity (gender, youth) and local governance are critical pillars for sustainability in dryland pastoral systems.
- Scale-up and integration of such technologies into national pastoral policies can accelerate resilience and food security across Africa's drylands.

PROF. GEORGE KARUKU & ESTHER NTHENYA MULI | PRESENTER: ESTHER NTHENYA MULI

Environmental, Economic and Social Impact Assessment of Coal Mining in the Mui Basin – Kitui County, Kenya

Key Points

1. Background and Context

- Mui Basin, located in Kitui County, holds an estimated 400+ million tons of coal.
- Despite discovery in the early 1990s, progress has stalled due to governance, environmental, and community resistance.
- The research aims to evaluate environmental, economic, and social impacts and provide evidence-based mitigation and policy recommendations.

2. Methodology

- Employed a systematic review of literature, government and NGO reports, and global case comparisons.
- Emphasized thematic analysis of environmental, economic, and social domains.

3. Environmental Impact Assessment

a) Major risks include:

- Land degradation, biodiversity loss, air and water pollution, and acid mine drainage.
- Climate concerns from carbon emissions.

b) Semi-arid region with fragile ecosystems highly susceptible to disruption.

4. Economic Impact Assessment

a) Potential benefits: energy generation, job creation, infrastructure development, and state revenue.

b) Challenges:

- Short lifespan of coal (30–50 years).
- Global shift away from coal in favor of renewables.
- Risk to agriculture-dependent livelihoods.

5. Social Impact Assessment

Anticipated issues:

- Displacement, land tenure disputes, and loss of cultural heritage.
- Public health hazards and gender-specific burdens (especially on women).
- Disruption of community cohesion.

6. Global Case Studies – Lessons Learned

- South Africa: Long-term pollution and weak reclamation efforts.
- India: Community resistance reshaped policy but environmental damage persists.
- USA (Appalachia): Economic decline post-mining, despite reclamation innovation.

7. Stakeholder Analysis

- Multiple actors with unequal power and limited community voice.
- Government, companies, communities, and civil society often operate in silos.
- Need for inclusive, transparent, and accountable engagement frameworks.

8. Mitigation and Rehabilitation Strategies

- Environmental: Progressive reclamation, native species planting, water and waste management.
- Socioeconomic: Alternative livelihoods, benefit-sharing, skill training, and independent oversight.

9. Recommendations

1. Strengthen environmental regulation and monitoring.
2. Secure financial guarantees for site rehabilitation.
3. Adopt integrated land and water use planning.
4. Reform community consultation and revenue sharing mechanisms.
5. Plan for economic diversification and climate adaptation.
6. Ensure independent community-involved monitoring.

10. Research Gaps Identified

- Lack of baseline ecological and hydrological data.
- Health risk assessments remain incomplete.
- Need for comparative energy options and locally adapted restoration models.

Take-Home Message

- The Mui Basin coal project sits at a crossroads between potential development and ecological risk.
- Governance quality, transparency, and public participation will determine whether the project benefits or harms local communities.
- Global case studies warn of lasting environmental and economic costs if planning is not holistic.
- Kenya has a chance to design a sustainable path informed by science, equity, and long-term wellbeing.

BAKARI DAUDI DAVID - Farmer

Farmer-Led Innovation and Resilience in Dryland Agriculture

This presentation highlights the inspiring journey of Farmer Bakari, who began farming in the drylands in 2013 with limited resources and low-yield cassava crops. A transformative partnership with Lukenya University in 2022 introduced integrated farming, orchard cultivation, and water-saving innovations like bottle drip irrigation and rainwater harvesting pits. Through these efforts, Bakari significantly improved yields, restored food security, and inspired his community to adopt sustainable practices such as kitchen gardening and tree planting under the 10 Million Tree Initiative. Blending traditional wisdom with modern techniques, his work emphasizes the power of resilience, innovation, and youth involvement in transforming dryland agriculture.

Key Points

1. Background and Journey

- Farmer Bakari Daudi David began his farming journey in early 2013 in the drylands, facing the harsh realities of an arid environment with limited resources.
- Initially started with cassava farming, a crop suited to tough climates but with limited income returns.

2. Turning Point – Collaboration with LU

- A major transformation came in 2022 after partnering with Lukenya university that introduced integrated livestock and crop farming practices.
- This partnership catalyzed orchard farming despite continued water scarcity.

3. Innovation and Water Management

- Implemented a “bottle drip” system
- Even with minimal water, the farm began to yield results, including Pixis fruits.
- Inspired the community by demonstrating success, prompting a shift to kitchen/vegetable gardening.

4. Impact of the 10 Million Tree Initiative

- The LU-led 10 Million Tree Initiative transformed environmental consciousness and agricultural practice in the area.
- Bakari adopted tree planting based on advice from indigenous ancestors, blending traditional knowledge with modern techniques.

5. From Destruction to Construction

- Historically, locals burned granaries due to poor harvests and pests.
- With increased yields, communities have rebuilt granaries, a sign of restored food security and changing attitudes toward farming.

6. Manure and Water Harvesting Techniques

- Actively uses cow and goat manure to enrich soils.
- Harvests rainwater by digging pits, lining them with polythene, and layering organic manure to create moisture-retentive planting basins.
- These pits support the growth of crops like maize, leading to improved yields.

7. Community Education and Youth Involvement

- Strongly emphasized hard work and the importance of instilling farming knowledge in children from a young age.
- Advocated for education through participation, urging families to involve the youth early in sustainable agriculture.

Take-Home Messages

- Resilience, innovation, and collaboration are critical to transforming dryland farming.
- Even with scarce water, appropriate technologies like bottle drip irrigation and water harvesting pits can significantly boost productivity.
- Integrating indigenous knowledge, manure management, and tree planting contributes to both environmental restoration and food security.
- Community empowerment and involving young generations are key to sustaining agricultural transformation

MR. KAVINGA - Seed Expert

Traditional Farming Knowledge Champion in Drylands

This presentation showcases the work of Mr. Kivanga, a respected local expert in traditional seed germination and indigenous preservation methods, who champions the use of indigenous seeds for their resilience and cultural significance. He demonstrated two adaptable farming systems—irrigated and dryland—emphasizing precise water management, including bottle drip irrigation and alternate watering schedules. His successful planting of nearly 400 mango trees illustrates the viability of agroforestry in arid regions for both food security and environmental restoration. By opening his farm as a hands-on learning site, Mr. Kivanga promotes farmer-to-farmer knowledge sharing, reinforcing that sustainable agriculture in drylands is achievable through traditional wisdom, practical innovation, and community-driven learning.

Key Points

1. Traditional Knowledge and Preservation
- Mr. Kivanga is a renowned local expert in traditional seed germination and indigenous preservation methods.
- Advocates for retention and use of indigenous seeds as a resilient and culturally rooted farming approach.

2. Dual Farming Systems

Presented two distinct farming systems based on water availability:

a) Irrigated Farming System:
- With consistent access to water, he provided a step-by-step guide from seed planting, germination, through to maturity.
- Emphasized timing, spacing, and moisture control to ensure high germination rates and healthy plant growth.

b) Dryland Farming System:
- In low-water conditions, he practices alternate watering supplemented by rainfall.
- Minimum watering intervals are set at three days apart to optimize water use and avoid wastage.
- Applies bottle drip irrigation for moisture-efficient delivery to plant roots.

3. Tree Planting in the Drylands
- Mr. Kivanga has planted close to 400 mango trees, demonstrating a successful model for agroforestry in drylands.
- His work showcases the potential of fruit trees not only for food but also for ecosystem restoration and microclimate improvement.

4. Knowledge Sharing and Practical Demonstration
- Strongly encouraged community members to visit his farm, which serves as a living example of what is possible in dryland contexts.
- Advocates for learning by seeing, inviting others to observe and adopt practical techniques in seed germination, water management, and preservation.

Take-Home Message
- Traditional seed knowledge remains invaluable and highly relevant in modern dryland farming.
- Sustainable agriculture is possible in both wet and dry systems with appropriate timing and watering techniques.
- Low-tech solutions like bottle drip irrigation and alternate watering schedules can greatly enhance crop survival in arid zones.
- Tree planting in drylands is not only feasible but essential for resilience building and livelihood diversification.
- Farmer-to-farmer learning and practical demonstration farms are vital for spreading innovation and preserving indigenous practices.

DR. JASON SIRCELY – Senior Scientist, International Livestock Research Institute (ILRI)

Panel Discussions 6: Generational Change in Agriculture: Pathways for Sustainable Youth Engagement and Succession

Key Points

1. Context and Core Challenges
- Rangeland Degradation:
  - Pastoralist rangelands in Kenya have significantly degraded over the last 50 years.
  - Bush encroachment, mainly caused by overgrazing during droughts, has reduced grassland productivity.
  - Conversely, under-grazing in wet periods prevents grassland regeneration, revealing a complex grazing balance issue.
  - Loss of fire management practices and increasing climatic variability (frequent droughts and El Niño events) have worsened conditions.

2. Impact on Youth and Livestock Ownership
- Youth are increasingly disconnected from traditional livestock ownership.
  - They often participate in grazing but lack control over herds, especially as large herds are owned by wealthier individuals.
  - Smaller herds are more vulnerable to shocks, making it difficult for young or marginalized people to build resilience.
- Livestock's value is broader than food—it also enables social mobility, bride wealth, and household status.

3. Shifts in Agricultural Values and Practices
- There is an ongoing transition from subsistence to commercial livestock production.
- To sustain this transition and improve livelihoods, value chains must put real income into people's hands, especially youth.

4. Role of Youth in Restoration and Succession
- Dr. Sircely emphasized the importance of engaging youth in ecological restoration and land use planning.
  - This includes rangeland monitoring, restoration activities, and participatory land management.
- Youth should also be empowered with entrepreneurship skills and included in sectors like:
  - Livestock breeding
  - Horticultural production
  - Agro-processing
  - Digital agriculture innovations
- It is essential to include women and minority groups in these efforts for inclusive transformation.

5. ILRI's Experience and the Way Forward
- ILRI has developed technical solutions to support sustainable livestock systems.
- The key challenge is long-term maintenance and community ownership.
- Success requires multi-sectoral collaboration:
  - Partnerships with NGOs, private companies, government agencies, and local leaders are critical for sustainable impact.

Take-Home Messages
- Degradation of rangelands is a generational challenge linked to climate, management, and socio-economic changes.
- Youth and women must be intentionally involved in planning, implementing, and benefiting from restoration and agricultural succession.
- The shift toward commercial livestock and diversified agriculture can improve livelihoods, but institutional and financial support is necessary.
- Technical solutions exist, but community engagement, ownership, and partnerships are vital for sustainability.

DR. JASON SIRCELY: LEAD INSIGHT, PANELISTS: MESHACH MAKOKHA – STATE DEPT OF AGRICULTURE, ARTHUR MUIRURI, BENSON HARRISON, MODERATOR: MS. PURITY MUTHEU

Empowering Youth as Agents of Change in Food Systems

Objective:
To explore how youth engagement, innovation, and intergenerational transition strategies can build a resilient, modern agricultural sector. The panel will discuss institutional efforts, grassroots movements, and youth-led initiatives that are reshaping the future of agriculture in Kenya and beyond.

Question:
You mentioned three key financing facilities targeted at youth in agriculture. Could you elaborate on how each of these works and what lessons you've learned from implementing them so far?

Three Facilities Supporting Youth in Agriculture:
1. Intra-Safar Free Loan – Offers interest-free loans to help youth start agribusinesses.
2. Soft Loans (3% Interest) – A low-interest model to support expansion and scale-up.
3. Risk Guarantee Fund – A safety net to encourage financial institutions to lend to youth without heavy collateral.

Lessons Learned:
- There is a huge appetite among the youth to engage in agriculture.
- The current commercial financing models are not youth-friendly or accessible.
- Agriculture remains a viable entry point for youth economic empowerment.
- The youth are dynamic, adaptable, and innovative, but they need better-tailored support systems.

Panelist:Arthur Muiruri
Question:
What support mechanisms are essential for preparing youth for the agricultural job market, and how can mentorship and networking be better integrated into youth agribusiness programs?

Emphasized the importance of:
- o Access to job markets
- o Resource availability
- o Strategic networking opportunities
- o Mentorship as a key driver of youth retention and growth in agriculture
- Advocated for structured support ecosystems to bridge the gap between training and employment.

From your perspective, what policies or institutional innovations are most critical in creating sustainable opportunities for youth in dryland agriculture or livestock systems?

Mashack Makokha –
Key Contributions:
- Described three financing facilities targeting youth:

1. Interest-free (Intra-Safar) Loans
2. Soft Loans (3% Interest)
3. Risk Guarantee Fund to reduce lending risk

Additional Insights:
- Youth engagement is growing, but the commercial lending models do not favor them.
- Agriculture is increasingly appealing to youth, especially with the introduction of smart farming and agri-tech.
- Highlighted strategies to support youth:

- o Recruitment of interested youth into programs
- o Incubation of agribusiness ideas
- o Conducting market surveys to understand demand
- o Supporting contract development for market linkage

Dr. Jason
Panel Question:
What areas of livestock value chains do youth need training in to be competitive and sustainable?
Response/Insights:

Youth need targeted training in:
- o Livestock marketing
- o Animal breeding
- o Accessing real-time market information for pricing and demand
- Emphasized training as a foundation to improve youth participation in livestock systems

Continued...

Empowering Youth as Agents of Change in Food Systems

Arthur Muiruri – Youth Employment and Agribusiness Advocate
Key Points:
- Stressed the importance of:
  - o Job market readiness
  - o Access to resources and financing
  - o Mentorship and networking
- Called for systems that integrate mentorship, internship, and exposure into agricultural learning models

General Audience Insight
Students are becoming more attracted to agriculture, especially due to:
- o Use of technology in smart farming
- o Increased access to information and digital tools
- o Demand for mentorship and internship programs to bridge the gap between theory and practice

Question 2 (Panel Question):
What strategies have been applied or should be applied to ensure that youth are effectively supported and retained in dryland agriculture and livestock systems?

Dr. Jason – Livestock Systems Specialist
- Emphasized the need for:
  - o Marketing research and extension research rooted in integrity
  - o Building engaged and trust-based relationships with producers
  - o Encouraging responsibility and professionalism among youth in agri-business

Mashack Makokha – Youth Agribusiness Facilitator
Key strategies implemented include:
- o Recruitment of youth into agribusiness ventures
- o Establishment of incubation hubs to develop ideas
- o Conducting market surveys to inform production choices
- o Supporting the development of contract farming models to guarantee market access

General Strategies Discussed
- Peer-to-peer counseling to build confidence and provide relatable mentorship
- Smart farming technologies to attract youth through modern, tech-driven approaches
- Structured internship and mentorship programs to bridge skill gaps and increase

PEGGY KARIMI, SOLOMON MWENDIA, RUTH ODHIAMBO, DAVID MUURU, MICHAEL PETERS

Growth, Yield and Nutritional Quality of Selected Forage Grasses in Lower Highlands and Upper Midland Zones in Kenya

Key Points

1. Introduction: Livestock and Feed Challenges

- Livestock contributes 12% of Kenya's GDP and supports over 60% of rural households.
- Functions as a source of income, food, and a buffer against economic and climate shocks.
- Key constraint: lack of year-round high-quality forage, especially during dry seasons.
- Current reliance on natural pastures and crop residues is nutritionally inadequate and unsustainable.
- There is a critical need for climate-resilient, high-yielding forage grasses tailored to Kenya's varied agro-ecological zones.

2. Objective of the Study

- Evaluate growth performance, dry matter yield, and nutritional value of selected forage grasses under two ecological zones:

i) Lower Highlands (LH3), ii) Upper Midland (UM2)

3. Study Sites and Conditions

- LH3 (1900–2200 m): Cool, high rainfall zone; soils: Andosols/Nitisols
- UM2 (1400–1600 m): Warmer, moderate rainfall; soils: Ferralsols/Luvisols
- Production system: Mixed crop-livestock farming in both zones.

4. Forage Varieties Evaluated; Urochloa hybrids:

i) Camello ii) Cobra iii) Talisman iv) Mestizo blend (Mulato II + CIAT BR02/1794 + BR02/0465)

- Megathyrsus maximus cv. Massai

5. Methodology Highlights

- Randomized Complete Block Design (RCBD), 3 replicates per site.
- Seeding in November 2023; first harvest in January 2024.
- Subsequent harvests every 8 weeks; stubble height 5 cm.
- DAP fertilizer at planting (100 kg/ha); manual weeding.

Results

A. Plant Height

- Significant differences noted (p = 0.052).
- Massai tallest:

i) UM2: 0.86 m, ii) LH3: 0.55 m, III) Ranking: Massai > Camello > Mestizo > Cobra > Talisman

B. Dry Matter Yield

- Significant across sites and varieties (p = 0.015).
- Massai highest yield:

i) UM2: 8.04 t/ha, ii) LH3: 8.78 t/ha

- Cobra and Talisman showed site-specific performance.

C. Metabolizable Energy (ME)

- Statistically significant (p = 0.012).
- Massai highest ME:

i) UM2: 59,198 MJ/ha, ii) LH3: 66,277 MJ/ha

- Cobra also performed well:

i) UM2: 39,383 MJ/ha, ii) LH3: 53,925 MJ/ha

Inferences and Interpretation

- Massai demonstrated superior performance in height, yield, and energy across both zones.
- Genotype × environment interaction was significant:

o Talisman: high yield in LH3 but poor in UM2.
o Cobra: better adaptation to LH3.

- All cultivars had reasonable crude protein levels, with Massai and Cobra slightly better—supporting milk production, weight gain, and reduced need for commercial feeds.
- Talisman showed high root biomass and site-specific potential.

Conclusion and Recommendations

- Massai is the most promising forage across both agroecological zones due to its adaptability and superior performance.
- While crude protein differences were not statistically significant, Massai and Cobra remain nutritionally desirable.
- Talisman and Cobra offer site-specific advantages, underscoring the importance of ecological matching.
- Results provide evidence for sustainable forage choices to enhance livestock productivity.

Next Steps:

o Research on persistence, regrowth, and farmer adoption is needed.
o Massai and Camello have passed national performance trials and await official gazettement for release.

CHARLES NYADERO: LEAD INSIGHT, CELESTINE: MODERATOR

PANEL DISCUSSION 7: PRIVATE SECTOR ENGAGEMENT AND MARKET ACCESS INTERVENTIONS: Unlocking investment, enterprise development, and trade for dryland agricultural transformation

Panel Discussion Summary
Charles Nyadero – Kenya Climate Ventures Ltd
Question 1:
What are the key investment barriers facing agribusinesses in dryland regions, and how can blended finance or de-risking tools be used to attract more private capital into these areas?

Response Summary:
Charles highlighted that a significant structural shortage of capital remains one of the most pressing barriers to agribusiness development in dryland regions. Key issues include:

- **Access to Commercial Lending:** Many agribusinesses in drylands struggle to obtain loans due to perceived high risk and limited financial data, making them unattractive to traditional commercial banks.
- Low Financial Literacy and Documentation: Entrepreneurs in these regions often have weak financial record-keeping, limiting their ability to present viable investment cases.
- **Blended Finance as a Solution:** Blended finance instruments, such as convertible debt, patient capital, and de-risking tools, can be structured to make investments more appealing to private capital.
- **Post-Investment Support:** Kenya Climate Ventures provides post-investment technical assistance, enabling enterprises to build capacity, improve governance, and strengthen their market position.

Question 2:
From your experience at Kenya Climate Ventures, what makes a dryland agribusiness "investment ready"? What should local enterprises focus on to unlock growth financing?

Response Summary:
According to Charles, an agribusiness becomes investment ready when it demonstrates the following:

- Clear Governance Structures:

Investors look for well-defined governance and management systems, even in early-stage businesses.

- Ecosystem Support and Scalability:

Enterprises must show potential to grow income for farmers or scale through existing ecosystems, especially in fragile dryland economies.

- Preparedness to Absorb and Utilize Capital:

Agribusinesses should be structured to absorb capital responsibly and demonstrate a pathway to profitability.

- Focus Areas for Enterprises:

Local businesses should focus on:

o Improving financial reporting and documentation
o Strengthening value propositions
o Enhancing market access strategies
o Positioning themselves within climate-resilient and impact-oriented frameworks

Speaker: Jacinta Mwau, Country Manager – Eastern Africa Grain Council (EAGC) for Kenya, DRC, Burundi & Ethiopia
Panel Theme: Trade Facilitation and Market Access in Dryland Areas under Climate Change

Jacinta Mwau emphasized the critical role of the Eastern Africa Grain Council (EAGC) in supporting dryland farmers through structured trade facilitation and enhanced market access. EAGC works directly with farming communities, traders, millers, and service providers to promote commercialization and inclusive market systems, especially for drought-resilient crops such as sorghum, millet, green grams, cowpeas, and pigeon peas.

She outlined EAGC's key interventions:

- Structured trading systems through GrainTrade Business Hubs, which support farmer groups with

Continued...

PANEL DISCUSSION 7: PRIVATE SECTOR ENGAGEMENT AND MARKET ACCESS INTERVENTIONS: Unlocking investment, enterprise development, and trade for dryland agricultural transformation

input aggregation, post-harvest management, and marketing linkages.

- Harmonization of grain standards at national, East African Community (EAC), and African continental levels to ease cross-border trade and reduce market rejections.
- Development and promotion of the Warehouse Receipt System, improving storage, price access, and farmer bargaining power.
- Provision of real-time market intelligence to support informed decision-making and fair pricing across borders.
- Strengthening value chains through SME engagement and private sector investment, ensuring service delivery and enterprise growth in dryland regions.
- Organization of agribusiness exhibitions in collaboration with universities (e.g., Chuka University, SEKU, and Pwani University) to expose dryland farmers to climate-smart technologies and services.

Ms. Mwau concluded by underscoring EAGC's commitment to improving trade structures, enhancing farmer capacity, and fostering partnerships that ensure dryland farmers are integrated into national and regional grain markets. She echoed the importance of value chain coordination and private sector participation as crucial levers in achieving sustainable food systems in dryland regions.

Diba Wako, Regional Livestock Programme Director – Mercy Corps

Question 1: Practical Examples of Private Sector Engagement Models in ASALs

Response Summary:

Diba Wako began by highlighting his extensive background in pastoralism and livestock systems across Kenya, Somalia, and Ethiopia, emphasizing a lifelong connection to the sector. Drawing from both personal and professional experience, he provided rich insights into how Mercy Corps — through its Mercy Corps programme — engages the private sector to improve market access for pastoralists and agro-pastoralists.

Key Model: Market Systems Development (MSD)

Mercy Corps' flagship approach is Market System Development, a shift from traditional aid models to sustainable systems thinking. Rather than distributing free resources, the MSD approach seeks to:

- Diagnose constraints within the market ecosystem (supply-demand core functions, support services, norms/rules).
- Address system-wide barriers like limited access to finance, inadequate product packaging, and inappropriate delivery models.
- Promote systemic solutions that improve functionality for all actors, especially the poor.

Practical Example:

Mercy Corps intervened in livestock vaccine access. For instance, foot-and-mouth disease (FMD) vaccines are typically sold in 80-dose vials — inaccessible to pastoralists with only a few animals. Mercy Corps worked with manufacturers and distributors to repackage vaccines into smaller units suitable for smallholder needs, enabling broader access and reducing disease risks.

"Making Markets Work for the Poor"

This model ensures that vulnerable populations — like small-scale herders — are not excluded from economic opportunities. One analogy given was how sugar is sold in small portions in rural markets to match buyer capacity. Similarly, livestock-related inputs must be repackaged and redistributed in affordable, smaller units to fit the purchasing power of rural pastoralists.

Question 2: Integration of Resilience-Building with Market Development

Continued...

PANEL DISCUSSION 7: PRIVATE SECTOR ENGAGEMENT AND MARKET ACCESS INTERVENTIONS: Unlocking investment, enterprise development, and trade for dryland agricultural transformation

Response Summary:
Diba emphasized that resilience and market development are interdependent, particularly in regions where pastoralism intersects with farming.

Key Insights:

- **Livestock as Financial Assets:** Pastoralists view livestock not just as food sources but as financial instruments — like bank accounts (cattle as fixed deposit, goats/sheep as savings). This conceptual framing informs the design of resilience strategies around asset preservation and enhancement.
- **Market Access Strengthens Resilience:** By improving access to inputs (like vaccines, feed, and fodder), services, and finance, Mercy Corps enables pastoralists to withstand shocks (droughts, disease outbreaks) without liquidating their herds prematurely — a common negative coping strategy.
- **Systemic Interventions Enhance Livelihoods:** Efforts such as improving feed supply chains, veterinary services, and linkages with financial institutions not only boost incomes but reduce vulnerability over time.

Concluding Notes:
Diba advocated for context-appropriate, scalable market solutions in ASALs, emphasizing:

- Systems over handouts
- Equity in access
- Private-sector partnerships tailored to pastoral realities

He further urged for more inclusive conferences, recommending the involvement of more pastoralist representatives to ensure policy and innovation align with real-world needs.

Diba Wako – Mercy Corps
Moderator's Question:
What is the role of the County Government in making this market systems development model sustainable?

Response Summary:
Diba Wako succinctly emphasized that public-private collaboration is essential, especially in sparsely populated ASAL regions where market-driven solutions alone are not feasible.

Key Points:

- **Collaborative Infrastructure Use:** County governments are critical in providing public infrastructure — such as cold chains, livestock holding grounds, and vaccine distribution points — which are then leveraged by private actors to deliver veterinary and livestock services.
- **Bridging Market Gaps:** In remote areas (e.g., Northern Kenya, where population density can be as low as 4 people per 100 km^2), geographical isolation makes it economically unviable for businesses to operate independently. County governments help bridge these service delivery gaps by anchoring public-private partnerships.
- **Shared Responsibility in Disease Prevention:** Citing losses of over KES 9 billion annually in sub-Saharan Africa due to preventable animal diseases, Diba noted that government alone cannot shoulder vaccination responsibilities. Instead, government facilitates, while the private sector implements — a sustainable model for widespread animal health interventions.

Conclusion:
Diba concluded by reinforcing that sustainable livestock systems in ASALs require a joint effort, with the county government enabling the environment, and the private sector driving service delivery. This synergy enhances access, affordability, and coverage, building resilience in otherwise underserved pastoral communities.

PRISCILLA - Farmer, Samburu

Shared experiences as a pastoralist woman from Samburu under the PELUM Kenya network.

This presentation highlighted the transformative journey of a pastoralist woman who, despite traditional gender inequalities that restricted her access to resources and decision-making, boldly transitioned from livestock herding to agroecological farming. With support from PELUM and its partners, she adopted sustainable practices such as water harvesting, soil conservation, and organic manure use to thrive in arid conditions. Her empowerment has since evolved into leadership, as she now trains other women in her community, fostering food security and resilience through practical agroecological education. Inspired by Lukenya University's environmental efforts, she aspires to replicate similar tree-planting and restoration initiatives, exemplifying how agroecology can catalyze grassroots change, particularly for marginalized women in pastoral communities.

Key Points & Highlights

• Pastoralist Background & Gender Inequality:
Traditionally, livestock is owned and controlled by men; women only access milk, skins from dead animals, chicken, and manure—highlighting deep-rooted gender disparities in resource ownership and decision-making.

• Turning to Farming:
she made the bold decision to start farming—a rare move in her community, especially for women. This marked the beginning of her transformation from pastoralism to agroecology.

• Agroecological Empowerment:
Through training and support from PELUM and its partners, she embraced agroecological practices, including:
o Water harvesting structures to cope with arid conditions
o Soil conservation and diversified cropping
o Use of organic manure for sustainable production

• Championing Women's Training:
Now a trainer of women in her community, she conducts hands-on, practical learning sessions, empowering others with agroecological knowledge and skills to improve food security and resilience.

• Future Aspirations – Learning from Lukenya University:
She expressed strong interest in visiting Lukenya University to see their tree planting and growing initiatives firsthand. Her goal is to replicate such environmental restoration efforts in her own community, furthering the spread of sustainable, climate-smart practices.

This testimony powerfully illustrated how agroecology can transform livelihoods, especially for marginalized pastoralist women, turning vulnerability into leadership and innovation at the grassroots level.

FRIDA MUENI MUTILI – Zoological Society of London (ZSL)

Intersection of Wildlife Conservation and Community Livelihoods in Drylands

Frida Mutili, a Community Technical Advisor with the Zoological Society of London (ZSL), delivered an insightful, unscripted talk that bridged wildlife conservation and dryland community livelihoods. Speaking from field experience rather than scientific training, she reflected on lessons learned from grassroots engagement and the complexity of promoting sustainable development in conservation-critical, climate-vulnerable regions.

Key Points

- Community-Centered Conservation
  ZSL's work in Kenya's drylands, particularly in areas like Tijuani near Tsavo, recognizes that rural community livelihoods and conservation are interlinked. Frida emphasized that 80% of rural waste is agricultural, making the agricultural-conservation nexus critical.
- Climate Change as a Crosscutting Threat
  She candidly shared the challenges of project failure due to climate variability. In one example, communities were forced to choose between feeding their chickens (a livelihood project) or their children during drought—an experience that reframed how future interventions must integrate climate resilience.
- Participatory and Business-Led Approaches
  With a background in business training, Frida advocates for livelihoods that are not only community-selected but financially viable and resilience-building. ZSL's approach includes supporting communities in adding value to small-scale enterprises like poultry and goat rearing.

Innovative Livelihood Experiment – Castor Plant Case Study:

- Opportunity:

Frida highlighted the castor plant as a promising multifunctional crop:

o Biofuel Market Access: ENI Energy's presence in Makueni created a ready market.

o Silkworm Feed: Leaves can support silk farming—an enterprise with high-value returns.

o Elephant Deterrent: Castor is unpalatable to elephants, reducing human-wildlife conflict.

Dilemma

Despite these benefits, castor emerged as a double-edged sword:

o Toxic to Livestock: Goats—key household assets in drylands—can die from ingesting castor.

o Invasiveness and Risk: While promising in theory, its ecological and socioeconomic risks could undermine other livelihood streams.

Strategic Question Raised:

Frida invited participants and experts to reflect on the viability of castor as a dryland crop:

"How can we leverage its benefits while mitigating its threats?"

Reflections and Audience Interaction

- Frida's engaging and honest style prompted lively audience responses. A humorous but insightful comment noted castor oil's strong laxative effect—underscoring the importance of scientific vetting before mass uptake.
- Her story of reconnecting with Priscilla, a woman previously involved in a Laikipia livelihood initiative, served as a powerful testimony of long-term community impact and the personal, human dimensions of development work.

Conclusion:

Frida's presentation provided a ground-level view of conservation and development challenges, blending community experience with practical innovation. Her main call was for inclusive dialogue and cross-sector partnerships—especially with researchers, policy makers, and county governments—to co-create solutions that safeguard both biodiversity and community well-being in drylands

ALBANUS MUTUKU – Azolla Farming

A Sustainable Solution for Food Security and Climate Resilience

Albanus Mutuku delivered a dynamic, experience-based presentation on the potential of Azolla farming as an innovative and sustainable agricultural practice. Drawing from practical fieldwork and youth-led initiatives, his presentation focused on the integration of Azolla cultivation in semi-arid areas to promote food security, climate resilience, and youth engagement in agriculture.

1. What is Azolla?

A fast-growing, floating aquatic fern that lives in symbiosis with nitrogen-fixing cyanobacteria (Anabaena azollae)

- Serves as:

o Organic fertilizer: fixes atmospheric nitrogen in the soil

o High-protein animal feed – used for poultry, cows, goats, pigs, and even fish.

o Climate mitigation agent – through carbon sequestration and water conservation.

2. Origin and Youth Engagement

- The project was initiated in 2021 at Kent University by a student-led group called Team Hydropan, with Albanus as a founding member.
- Inspired by a challenge from a previous conference: "Where are the youth in agriculture?"
- Mutuku and his team responded with a practical solution combining innovation, youth involvement, and sustainability.

3. Innovative Design: Hydropan

Designed to reduce water evaporation using plant cover crops (e.g., pumpkins and passionfruit), though Azolla has now replaced them due to:

o Lower maintenance.

o Greater ecological and economic value.

- Hydropan dimensions: Approx. 1.5m x 1m x 0.2m (for small-scale farms).

4. Benefits of Azolla Farming:

a) Natural Fertilizer:

o Fixes up to 50% of nitrogen from the air.

b) Protein-Rich Animal Feed:

o Cuts feed costs by up to 50% (e.g., Farmer Geoffrey's case).

c) Environmental Sustainability

o Prevents evaporation in semi-arid climates.

o Sequesters carbon, helping mitigate climate change

d) Livelihood Support:

o Income generation, improved food production, and resilience for farmers.

5. Setup and Growth Cycle

- Azolla spreads through vegetative fragmentation (no seeds)
- Grows rapidly; ready for harvesting within 10–14 days
- Harvesting involves simple sieving of floating biomass
- Pond water can be reused for irrigation or replenishment

6. Challenges Identified

- Water quality sensitivity: Prefers neutral pH (~7.0)
- Maintenance needs: Requires consistent water replacement (~every 6 months).
- Pest susceptibility: Snails and other pests can disrupt growth.
- Risk of rot: Must be harvested regularly to avoid decay

7. Support for SDGs

- Goal 2 (Zero Hunger): Affordable livestock feed.
- Goal 13 (Climate Action): Carbon sequestration and drought resilience.
- Goal 15 (Life on Land): Enhances community resilience and sustainable rural livelihoods.

8. Outreach and Awareness

- Advocated integration of Azolla projects into CBC (Competency-Based Curriculum) for Kenyan schools.
- Ongoing demonstrations at agricultural shows, like the one held in Machakos on July 9, 2024.
- Cross-border knowledge sharing, including with farmer groups in Tororo, Uganda.

Closing Reflection

Albanus emphasized that Azolla is not just a plant, but a pathway to resilient farming systems in dryland areas. With minimal inputs and wide-ranging benefits, it holds potential to transform agriculture and empower youth, farmers, and communities alike. He called for institutional support, curriculum integration, and awareness creation to scale this innovation across Kenya and beyond.

ROY MWAKA – Integrated Farming

A Sustainable Approach by the Agriplus Team

Roy Mwaka, presented a project titled "Integrated Farming: A Sustainable Approach." This initiative, rooted in the practical context of Lukenya University Farm, showcases a multi-sectoral, circular agriculture model designed to address food security, climate change, and income generation—particularly in dryland areas of Kenya.

Key Highlights:

1. Project Focus and Relevance

- The Agriplus project is based at Lukenya University Farm and targets Agro-Ecological Zones (AEZ) 4 and 5, characterized by drylands near riparian zones.
- It addresses food insecurity through integrated and resource-efficient farming systems tailored for semi-arid environments.

2. Blue Economy Integration

A unique innovation is the integration of aquaculture (fish farming), poultry, and vegetable production:

- A chicken house is constructed directly above a fish pond.
- Chickens' droppings naturally feed the fish, creating a sustainable input loop.
- Fish pond wastewater is used to irrigate a vegetable garden, promoting nutrient recycling and minimizing waste.
- Water source is either a permanent river or a hydro-pan, ensuring sustainability even in drylands.

3. Nature-Based Solutions

Agriplus prioritizes environmentally friendly, low-input technologies:

- Chicken droppings serve as fish feed—cutting feed costs and reducing reliance on commercial inputs.
- Recycled food waste feeds chickens, contributing to reduced methane emissions and organic waste management.
- Wastewater from fish ponds, rich in urea and nutrients, serves as an organic fertilizer for vegetables—closing the nutrient cycle.

4. Project Benefits and Impact

a) On the Agriplus Team:

- Strengthened teamwork, time management, and project implementation capacity.
- Gained technological, research, and community engagement experience.
- Improved networking and entrepreneurial thinking.

b) On the Community:

- Offers an education platform for sustainable agriculture.
- Enhances climate action and combats poverty and malnutrition.
- Promotes income generation through locally viable, replicable systems.
- Encourages the development of multi-stakeholder partnerships.

5. Scalability and Sustainability

- Reinvested profits will drive internal growth and improve long-term viability.
- The team aims to secure grants and build strategic partnerships to expand the model into other dryland communities.
- The system is designed for easy replication, making it an ideal solution for similar agro-ecological zones in Kenya and beyond.

ANTONY MUUO – Aquasmart Innovators

Smart Agri-Water Management System

Antony Muuo passionately shared his journey and innovation under the AquaSmart Innovators banner, presenting a Smart Agri-Water Management System designed specifically for smallholder farmers in water-scarce regions like Makueni County. His presentation emphasized practical problem-solving, context-specific innovation, and the importance of empowering farmers through accessible technology.

Key Highlights

1. Motivation and Problem Context:

- Growing up in Makueni, Antony witnessed firsthand the struggles of farmers due to water scarcity.
- This real-world challenge inspired the development of a cost-effective, smart irrigation system tailored for low-resource settings.

2. The AquaSmart Solution

A smart irrigation system that integrates:

- Drip irrigation for efficient water use.
- Soil moisture sensors – to monitor water levels in real time.
- Humidity and temperature sensors – to adapt watering schedules based on environmental conditions.

The system is modular and scalable, allowing farmers to choose which sensors to include based on their specific needs and affordability.

3. Pilot Stage and Implementation

- Currently in the pilot phase with support from Lukenya University.
- Drip systems and sensors have been installed, and seedlings have already been planted.
- The system is operational, pending further scaling and optimization.

4. Farmer-Centric Design

Designed with simplicity and sustainability in mind:

o Once trained, a farmer can independently operate the system.

o Reduces reliance on expensive, complex tech like drones or robots.

o Promotes self-sufficiency, enabling farmers to improve yields and incomes.

5. Impact and Vision:

The system supports:

- Improved food production and food security.
- Income generation to support education and basic needs.
- Climate resilience in drought-prone areas.

Antony envisions expanding the solution beyond Makueni to other arid and semi-arid counties.

6. Call for Support and Collaboration

- Antony made a passionate appeal for funding and partnerships to scale the innovation.
- Invited stakeholders and potential collaborators to visit the demonstration site at Makueni University.
- Emphasized the importance of locally relevant technologies inspired by international best practices (e.g., Netherlands), but adapted to Kenyan realities.

SAMUEL KARANJA – Mercy Corps Kenya

Catalyzing Innovation For Agricultural Transformation In Drylands

Samuel Karanja of Mercy Corps gave a dynamic and thought-provoking presentation focused on supporting innovation ecosystems in agriculture, particularly through the lens of digital and financial inclusion for rural farmers. His key message emphasized that while Mercy Corps is not directly implementing farmer-facing development, their primary role is to empower innovators who are creating solutions for those farmers.

Samuel began by highlighting Kenya's position as a leader in digital agricultural innovation in Africa—second only to Nigeria. However, despite this impressive volume of digital tools (over 200 agricultural apps, for instance), adoption among farmers remains low. The core challenge, he noted, lies in a disconnect between designers and end-users. Many solutions are created without truly understanding the needs, context, or affordability constraints of the rural farmer.

"Innovation is not always digital. Even how we rethink insurance or credit access is a form of innovation."
One of the standout examples Samuel gave was rethinking livestock insurance. He noted that uptake is poor because most farmers don't see its value unless a loss occurs. Mercy Corps is working on mutual insurance models, where community premiums are pooled, and unused funds are reinvested—turning premiums into a local development asset, rather than a sunk cost.

He also explored alternative credit systems in response to farmers being excluded from traditional banking systems. Mercy Corps is supporting innovators to explore new, inclusive models that build on community-based savings and digital onboarding—especially platforms that reduce the cost and logistical barriers of in-person extension work.

Finally, Samuel underscored the importance of human-centered design and local context customization when rolling out technology. He invited participants to explore more of Mercy Corps' innovation insights and case studies via their Advocacy & Learning platform, and expressed enthusiasm for future engagements—particularly in leveraging AI for agricultural solutions.
"It's not just about the tech. It's about relevance, usability, and trust."

Key Takeaways

- Mercy Corps focuses on enabling innovators who serve rural agricultural communities.
- Kenya has a high number of agricultural apps, but low farmer uptake due to design disconnect.
- Innovations like mutual insurance and alternative credit offer more farmer-friendly models.
- Human-centered design and contextual affordability are critical to real impact.
- Mercy Corps welcomes continued collaboration around AI and emerging innovations in agriculture.

Contact & Resources:
Further insights and collaboration opportunities can be found via the Mercy Corps Advocacy platform.

CHRISTOPHER MASIKA – Practical Insights from a Large-Scale Agripreneur

Lessons from the Field – Scaling and Distributing Agribusiness from the Ground Up

Christopher Masika, representing CIM under PELUM, gave a deeply personal and practical presentation based on his vast experience as a large-scale farmer and agribusiness operator, particularly known for his success in onion farming both locally and for export. His session was a blend of real-life struggles, innovative approaches, and hard-earned insights into Kenya's agricultural and trade systems.

Key Insights and Highlights

1. Large-Scale Farming Experience

- Currently manages 30 acres of onions, with operations both locally and internationally.
- Known widely as a successful onion producer, though he is involved in the production of several crops.
- Emphasized the importance of scaling in agriculture for profitability: "Unless you do it at scale, you're still involved in the same struggles."

2. Use of Smart Agriculture Tools

- Has adopted smart sensor technology, including "smart jump sensors" and telepathic navigation systems for efficient farm management.
- Praised the ideas shared by younger innovators and acknowledged that such technologies are crucial for the future of farming in Kenya.
- Recognized the Kenyan innovation ecosystem, while also challenging the government to do more to support innovation and infrastructure.

3. Agriculture Beyond Production: Distribution as a Skill

- Agriculture is not just about growing food but about mastering trade and distribution.
- Shared lessons learned the hard way—such as being swindled by brokers due to lack of market knowledge early in his career.
- Stressed that distribution requires its own education, akin to being an engineer or plumber:
  - o Understanding supply chains, broker dynamics, pricing, and market timing.
  - o Market dynamics are complex and must be learned outside the classroom.

4. Failures, Resilience, and Character Development

- Candidly shared that he had "failed in all angles" upon returning to Kenya before finding success—highlighting the reality of entrepreneurship.
- Advocated for resilience and character building as key traits for young agripreneurs.
- "It's a marathon, not a sprint"—many farmers and entrepreneurs give up too early due to lack of support and infrastructure.

5. Infrastructure and Market Structure

- Stressed the importance of infrastructure in enabling distribution and trade.
- Discussed challenges with market access, logistics, and unreliable support systems.
- Advocated for cost-benefit analysis and careful financial planning as essential to scaling operations effectively.

6. Scalability and Market Fit

- From one acre to over 100 acres managed monthly, Christopher's growth is a case study in scale economies in Kenyan agriculture.
- With scale, however, comes complexity: emphasized the need for data management, accurate budgeting, and volume-based market strategies.
- Encouraged the youth to think beyond passion and embrace business logic and distribution mastery.

Takeaways and Reflections

- Production vs. Distribution: A recurring theme was the distinction between growing food and getting it to market efficiently.
- Practical Wisdom: Masika's experience serves as a cautionary and inspiring tale for youth venturing into agribusiness.
- Call to Action for Government: More support is needed in infrastructure, innovation adoption, and training beyond technical farming.

Closing Remarks

Christopher Masika concluded with gratitude and encouragement to the next generation, urging them to learn from experience, embrace technology, and plan for scale and sustainability. His story offered a real-world counterbalance to academic and technical presentations, grounding the conference with the voice of lived experience.

RAPHAEL: MODERATOR, PANELISTS: STEPHANIE MATE, GENDER AND HUMAN RIGHTS ADVISOR, GIZ; WINNIE OGUTU, AGRICULTURAL ECONOMIST & PROGRAMS OFFICER, TISA

PANEL DISCUSSION 8: Supporting Women's Access to Land and Resources in Agriculture

Panel Theme:
Breaking Barriers: Supporting Women's Access to Land and Resources in Agriculture

Overview
The session addressed structural and socio-cultural barriers hindering women's access, control, and ownership of land and agricultural resources—especially in rural and dryland regions. The panel emphasized the need for gender-responsive land governance, equitable policy implementation, and inclusive programming.

Presentation Summary: Winnie Ogutu (TISA)
Key Experience:
Winnie recounted a drought-resilient sorghum project where young women were given seeds. However, follow-up revealed most lacked land control. In one case, a husband planted beans without consulting his wife, undermining project goals.

Insights:
a) Land access must go beyond use to include ownership and decision-making authority.
b) Cultural norms often deny women full land rights, affecting their:
- Role in climate adaptation efforts (e.g., investing in water infrastructure)
- Access to credit (due to lack of title deeds)
- Contribution to food security

Data Points (KDHS 2014–2022):
a) Only 25% of women aged 15–49 own land
- 3% individually
- 20% jointly
- 2% uncertain about their ownership status

b) No significant improvement in land ownership over time

Three Rs for Land Justice:
1. Redistribution: Equitable distribution of land and resources to marginalized women
2. Recognition: Acknowledge and challenge cultural and legal systems that exclude women
3. Representation: Increase women's participation in decision-making platforms (e.g., land boards, local tribunals)

Conclusion:
Winnie underscored that gender-responsive land governance is essential not only for legal equality but also for economic empowerment, climate resilience, and food security. The call to action was for systemic reform, cultural shift, and inclusive strategies.

Presentation Summary: Stephanie Mate (GIZ)
Session Theme:
Gender Equity in Land Ownership and Resource Access: A Prerequisite for Climate Adaptation and National Security

Background & Approach:
- Stephanie introduced herself as an anthropologist and gender studies expert committed to addressing systemic inequalities in marginalized, climate-vulnerable communities.
- She emphasized a holistic and intersectional programming lens.

About GIZ:
- German development agency operating in 120+ countries
- Guided by the German Feminist Development Policy
- Focuses on transformative, gender-sensitive programming in fragile contexts

GIZ Strategies on Land Governance:
- Land rights alone are insufficient without capacity, resources, and decision-making power

Continued...

PANEL DISCUSSION 8: Supporting Women's Access to Land and Resources in Agriculture

- Gender Action Plans (GAPs) are developed prior to any intervention, ensuring context-specific resource prioritization
- Community-based approaches: Integrate both traditional systems and formal legal frameworks
- Male engagement is key to fostering local ownership and reducing resistance

Examples of GIZ Projects:
1. SKiDA – Strengthening Climate Innovation Dissemination in Africa
Operating in Kenya, Ethiopia, Sudan, Uganda (Karamoja Cluster) Focuses on:
- Dissemination of climate information
- Support for irrigated farming
- Disaster preparedness
- Provision of solar-powered boreholes

2. Women Empowerment Project – Northern Kenya
a) Emphasizes the Three Rs (Rights, Recognition, Representation)
b) Advocates for full implementation of the Community Land Act (2016)
c) Cites research from TNG showing Kenya's strong legal frameworks but weak implementation

Challenges Identified:
- Policy-Practice Gap: Sound laws are undermined by poor enforcement
- Patriarchal Resistance: Cultural norms often exclude women from land governance
- Tokenism: Gender is often included in programming as an afterthought rather than a central pillar

Key Takeaways from GIZ Approach
- Land governance must be inclusive, productive, and gender-responsive
- Women's access must be supported by resources, legal empowerment, and infrastructure
- Climate resilience and national security are directly tied to equitable land rights

Panelist Contributions – Summary of Comparative Insights
Panelist: Key Contributions
Stephanie Mate (GIZ) - Integrated feminist programming; gender action plans; blended traditional and legal frameworks; emphasis on resource access and male engagement

Winnie Ogutu (TISA) - Grounded grassroots case studies; highlighted barriers from customary practices; promoted legal aid clinics and civic education

Cross-Cutting Recommendations
1. Adopt the 3Rs Framework:
Redistribution, Recognition, Representation as foundations for land justice

2. Link Land Rights to Broader Agendas:
Food security, climate adaptation, and gender equality

3. Strengthen Legal Aid and Civic Education:
Expand models like Vihiga's community legal support to other counties

4. Scale Up Inclusive Platforms:
Ensure participation of women in local land boards and decision-making forums

Moderator's Closing Reflections
"Women's access to land is not just about legal frameworks—it's about justice, agency, climate action, and dignity. We must take this message forward. Let us ensure no woman is left behind."

Next Steps
- Strengthen participation in future policy dialogues and forums
- Deepen partnerships with grassroots organizations and county governments
- Scale up legal literacy and gender-responsive land reform initiatives across Kenya

CLINTON OCHIENG OTIENO, Supervisors: Prof. Regina Nyunja and Dr. Evans Nyakeri
Institution: Jaramogi Oginga Odinga University of Science and Technology (JOOUST)

Evaluation of Black Soldier Fly Larvae (Hermetia illucens) Frass Production as a Biopesticide and Biofertilizer on Kales (Brassica oleracea)

Background & Justification

- Problem: Kale production in Kenya is heavily reliant on synthetic fertilizers and chemical pesticides, which are expensive, environmentally harmful, and lead to pest resistance.
- Proposed Solution: Utilize BSFL frass, a by-product of organic waste digestion, as a sustainable alternative for pest control and soil fertility enhancement.
- Significance: This aligns with Kenya's Bottom-Up Economic Transformation Agenda, promotes circular economy, and meets rising demand for organic vegetables.

Objectives

1. Evaluate pesticidal activity of BSFL frass from different feeding substrates.
2. Assess the impact of frass fermentation on its pesticidal efficiency.
3. Determine the effect of BSFL frass on the growth performance of kales as a biofertilizer.

Methodology

- Design: Experimental, using a Randomized Complete Block Design (RCBD) with 12 plots.
- Treatments: Frass from three substrate combinations—fruit waste, brewery waste, and chicken manure.
- Biofertilizer Assessment: Growth parameters (number of leaves, leaf surface area).
- Biopesticide Assessment: Number of pest bites and cutworm larval abundance.
- Analysis: Repeated measures ANOVA and General Linear Model (GLM).

Key Findings

1. Pesticidal Efficacy of Different Substrates
- Chicken + brewery waste frass significantly reduced pest bites and larval counts.
- Statistical significance observed ($F = 4.29$, $p = 0.001$) confirms substrate affects efficacy.
2. Effect of Fermentation on Pesticidal Quality
- Frass fermented for 2 or 4 days was more effective than unfermented frass and control.
- Longer fermentation slightly improved results, though not statistically significant in all parameters.
3. Biofertilizer Impact on Kale Growth
- Frass-treated kales showed:
  - Increased number of leaves and
  - Greater leaf surface area
- Best performance observed with chicken + brewery waste frass ($p < 0.0001$).
- Control plots (no frass) had poor growth, confirming frass boosts soil fertility.

Conclusion

- BSFL frass is a dual-function input: effective as both a biopesticide and biofertilizer.
- Mixed feeding substrates and fermentation enhance frass performance.
- Chicken + brewery waste frass showed the highest overall effectiveness.

Recommendations

1. Adopt BSFL frass as an alternative to synthetic inputs for pest and soil fertility management in kale farming.
2. Encourage frass fermentation to improve its biopesticidal properties.
3. Promote large-scale production and utilization of BSFL frass to support organic agriculture and environmental sustainability.

YEN NGUYEN - Certified Trainer in Social Entrepreneurship

Unlocking Africa's Dryland Potential: Impact Investing for Inclusive and Climate-Resilient Growth

Ms. Nguyen has served over the past several years as a consultant on impact investing with a portfolio spanning developed markets such as Japan, Canada, and the United States, as well as a number of emerging economies. She has observed a growing and compelling interest among impact investors and philanthropic institutions in the transformative potential of dryland agriculture in Africa.

This sector represents a uniquely attractive avenue for achieving the Sustainable Development Goals (SDGs), particularly in the realms of food security (SDG 2), gender equality (SDG 5), decent work and economic growth (SDG 8), and climate action (SDG 13). The untapped potential of dryland regions—characterized by scarce water resources but vast expanses of arable land—can be harnessed through targeted innovation in climate-resilient technologies such as drought-tolerant seeds, solar-powered irrigation systems, and data-driven precision farming.

These innovations not only increase yields and reduce environmental degradation, but also offer scalable solutions for climate adaptation. Furthermore, the inclusive nature of agriculture as a sector provides a critical entry point for empowering marginalized populations, particularly women and youth, who comprise the majority of the agricultural labor force in these regions yet remain under-resourced.

By deliberately channeling capital toward enterprises that integrate inclusive value chains and technological capacity-building, impact investors and philanthropies are not merely supporting economic growth, but are actively reshaping rural ecosystems into hubs of resilience, agency, and innovation. In this context, dryland agriculture in Africa emerges not as a challenge to be mitigated, but as a frontier of opportunity for sustainable, inclusive, and technologically enabled development.

Yen reiterates that she looks forward to additional opportunities to collaborate with the annual Dryland Agriculture and Food System in the Face of Climate Change Conference. She strongly believe the leadership, innovation and team culture of the stakeholders in the organizing team as well as their partners.

Official Closing Ceremony

Remarks: Mr Sammy Muvela – Board of Trustee Member, Lukenya University

Mr. Sammy Muvela highlighted the significance of the work undertaken by the scientists and participants at the conference. He began by acknowledging that we are the first generation of scientists to deliberately anchor research and innovation in arid and semi-arid areas in a way that assures local communities that their regions have a promising future—one rooted in the potential of native plants and livestock. For far too long, these regions have been marginalized, with very little scholarly focus and no sustainable cash economy. However, the work presented at the conference signals a shift, one that is clear, science-driven, and forward-looking.

He urged the scientists not to be discouraged by the many frustrations often faced in this line of work, but to stay the course. He emphasized that their commitment is not in vain, for the country desperately needs such groundbreaking efforts to reimagine and revitalize arid and semi-arid areas.

Mr. Muvela went on to reflect on the broader value of knowledge. While not immersed in academia on a daily basis, he occasionally takes time to read and reflect, recognizing that one of the most important resources in any society is a library—a repository of knowledge and a foundation for wisdom. In supporting the Canadian University of India and this second Peace Conference, the participants have done more than share research; they have inspired a vision for the creation of a knowledge archive, a center of excellence dedicated to arid and semi-arid lands. This, he emphasized, is a legacy of lasting importance.

He specifically commended the work presented by the representative from Karago on breeding livestock adapted to harsh environments. The description of sheep that thrive naturally in arid conditions served as a powerful metaphor for resilience and untapped value. It reminded all present that sustainable development in these regions does not require massive intervention, but rather thoughtful engagement with nature and its inherent systems.

In conclusion, Mr. Muvela expressed his sincere gratitude and extended an invitation to all present to gather again next year at Lukenya University—the “Jerusalem of arid areas”—to continue this important journey. He ended by saying, “Thank you very much. See you next year at Lukenya.”

Closing Remarks – Eng. Laban Kiplagat: On behalf of the Principal Secretary, Ministry of Agriculture and Livestock Development: Key Highlights and Takeaways

Eng. Laban Kiplagat delivered the official closing remarks of the conference, speaking on behalf of the Principal Secretary from the Ministry of Agriculture and Livestock Development. He began by commending Lukenya University and Edsource Africa for their commendable work, urging them not to underrate their impact and achievements, and to take pride in the transformative role they are playing in dryland innovation.

He encouraged that the next conference be hosted within dryland regions to give participants the opportunity to witness firsthand the resilience and progress made by farmers, students, and communities, and to showcase success stories and homegrown innovations emerging from these areas.

Eng. Kiplagat called on innovators, researchers, and farmers to bring forward bold ideas, reassuring them that the government is ready to support and fund transformative solutions. He emphasized that funds are available, and the Ministry is committed to ensuring that these resources go toward impactful, scalable change.

In a powerful analogy, he drew inspiration from Kenya's collaboration with Israel during President Moi's era, where Israel shared its success in reclaiming deserts. He noted that Kenya, being largely arid and semi-arid (ASAL), holds similar potential, and called on all stakeholders to join hands in influencing policy reforms that respond to the needs of these landscapes.

Official Speech Highlights

"We can move forward with clarity, courage, and collective strength."

He urged:

- Government agencies to turn conference discussions into actionable policies.
- Researchers and academic institutions to ground innovation in the practical realities of dryland communities.
- Development partners and donors to invest not just in short-term projects, but in long-term transformation.
- Farmers and the youth to remain hopeful and proactive, affirming that "you are the heartbeat of dryland agriculture."

He acknowledged the contributions of all participants, affirming that the work does not end with the conference, but must now grow into stronger collaborations and more deliberate action.

Acknowledgments & Closing Declaration

Eng. Kiplagat extended heartfelt gratitude to:

- Lukenya University in Collaboration with Edsource (lead organizers)
- ILRI (conference host)
- Speakers, sponsors, and participants for their dedication and passion

He concluded with a rousing message:

"Drylands are not barren lands. They are lands of promise and potential. And together, we have the power and the responsibility to unlock that potential for the benefit of all humanity."

He officially declared the conference closed, offering a final blessing:

"Thank you. God bless you. God bless Kenya."

GROWTH AND NUTRITIONAL QUALITY PERFORMANCE OF SELECTED FORAGE GRASSES IN LOWER AND UPPER MIDLAND ZONES IN KENYA.

Authors: Peggy Karimi1, Solomon Mwendia1, Ruth Odhiambo1, David Muuru1, Micheal Peters1

Alliance of Bioversity International & CIAT, Tropical Forages Program P.O. Box 823-00621, Nairobi Kenya

Abstract:
Sustainable intensification of livestock production in sub-Saharan Africa is constrained by limited availability of high-quality, site-adapted forages. Optimizing forage-based feeding systems requires the identification of cultivars that simultaneously deliver high biomass yield and superior nutritive value under varying environmental conditions. This study conducted a comparative evaluation of the agronomic performance and nutritional composition of five forage cultivars and hybrids in two contrasting locations in Kenya. A Randomized Complete Block Design (RCBD) was used to establish four Urochloa hybrids Camello, Cobra, Mestizo, Talisman and one Megathyrus spp Massai. Data for plant height and dry matter was collected after 8 weeks while nutritive traits including, crude protein (CP) yield, and metabolizable energy (ME) yield were also derived. Root biomass was determined at 265 days after establishment across the 2 sites. Significant site × genotype interactions were observed for several traits. Massai consistently exhibited superior agronomic performance, attaining the greatest plant height 0.87m and highest cumulative DM yield 8.78 t/ha in lower midland1. with statistically significant differences $p = 0.052$ and $p = 0.015$, respectively. Metabolizable Energy yield was also highest in Massai, particularly in the lowmid 1 with a significant site effect ($p = 0.012$). In contrast, root biomass did not vary significantly among cultivars or sites $p = 0.922$, indicating uniform below-ground biomass. Despite variability in CP yield with Massai again showing the highest values, differences across cultivars were not statistically significant ($p = 0.099$). These results underline the adaptability and superior biomass accumulation potential of the Massai cultivar, particularly in high rainfall, highlighting its suitability for regions prioritizing high biomass and energy yields in forage systems.

Keywords: Key words; forage, dry matter, forage quality

ENVIRONMENTAL, ECONOMIC AND SOCIAL IMPACT ASSESSMENT OF COAL MINING IN THE MUI BASIN-KITUI COUNTY, KENYA

Authors: Prof. George Karuku, Esther Nthenya Muli

Abstract

This paper presents a comprehensive impact assessment of the proposed coal mining project in the Mui Basin, Kitui County, Kenya. The study examines the environmental, economic, and social dimensions of coal development in this semi-arid region. Environmental analysis reveals significant concerns regarding land degradation, water contamination, air pollution, biodiversity loss, and climate implications. Economic assessment identifies potential benefits through revenue generation, employment, and infrastructure development, balanced against environmental costs, livelihood disruptions, and the time-limited nature of coal extraction. Social impact analysis highlights community displacement issues, cultural heritage concerns, public health implications, and complex stakeholder dynamics. Drawing on case studies from South Africa, India, and Appalachia, the paper identifies critical lessons regarding the persistence of mining impacts and the importance of comprehensive planning. The study concludes with policy recommendations emphasizing strengthened environmental governance, transparent benefit-sharing mechanisms, economic diversification strategies, and meaningful community participation. While coal development offers potential short-term economic benefits, alternative development pathways may better align with Kenya's long-term sustainability objectives and Vision 2030 aspirations. Ultimately, governance quality will fundamentally determine whether potential benefits materialize while negative impacts are minimized.

Keywords: Coal mining, Mui Basin, environmental impact, economic assessment, social impact, land degradation.

BIOTECHNOLOGICAL AND REGENERATIVE APPROACHES FOR RESILIENT CASSAVA SYSTEMS IN DRYLANDS: A REVIEW

Authors: Purity Mutheu1*, Hezekiah Korir2,
1. Department of Agriculture, Lukenya University, Kenya
2. International Institute of Tropical Agriculture, Kenya
Corresponding author email:

Abstract

Cassava (Manihot esculenta Crantz) is a climate-resilient root crop with immense potential to support food security and rural livelihoods in dryland regions. However, its productivity is constrained by climate variability, poor soils, and recurrent viral diseases such as Cassava Brown Streak Disease and Cassava Mosaic Disease. This review paper explores an integrated strategy combining modern biotechnological innovations with regenerative agricultural practices to enhance the sustainability and resilience of cassava systems. Genetic tools such as CRISPR/Cas9 and RNA interference have enabled the development of cassava varieties with improved disease resistance, reduced cyanide levels, and enhanced tolerance to abiotic stress. In parallel, regenerative approaches including conservation agriculture, legume intercropping, and the application of organic amendments are restoring soil health, boosting water retention, and improving nutrient cycling. Field-based evidence demonstrates that these synergistic innovations contribute to increased yields, climate adaptation, and reduced input dependency. The success of these interventions depends not only on technical efficacy but also on inclusive extension systems, gender equity, and supportive policy frameworks. This work emphasizes the need for holistic, systems-based approaches to drive climate-smart cassava transformation in dryland agro-ecosystems.

Keywords: Cassava, Genome editing, Climate resilience, Drylands, Food security, Sustainable intensification

TRANSFORMING AFRICAN FOOD SYSTEMS FOR CLIMATE RESILIENCE AND SUSTAINABILITY: A REVIEW OF CURRENT POLICIES, PRACTICES, AND PATHWAYS IN DRYLAND AGRICULTURE

Authors: Purity Mutheu1*, Reuben Muasya2, Hezekiah Korir3,
1.Department of Agriculture, Lukenya University, Kenya
2. South Eastern Kenya University, Kenya
3International Institute of Tropical Agriculture, Kenya
Corresponding author email:

Abstract

The resilience of African food systems is being severely tested by the escalating impacts of climate change, land degradation, rapid population growth, and systemic inefficiencies in agricultural value chains. These challenges are particularly acute in dryland regions, where environmental stressors and socio-economic vulnerabilities converge, intensifying the risk of food insecurity. This paper explores the structural transformation of African food systems through the lens of climate adaptation, sustainability, and equity. Specifically, the study (1) identifies the main drivers and barriers to climate-resilient agriculture in African drylands, (2) assesses the effectiveness of climate-smart and regenerative agricultural practices, and (3) evaluates the role of inclusive development, particularly the contributions of youth and women, in promoting sustainable food systems. The study highlights innovative strategies including the adoption of localized value chains, community-driven technology transfer, investment in post-harvest infrastructure, and improved market access. It also emphasizes the importance of inclusive development by addressing the unique roles and contributions of youth and women in agriculture, recognizing them as agents of change. Through case studies and policy reviews, the paper identifies enabling environments needed for sustainable transformation, such as supportive governance, research-driven innovations, and cross-sectoral partnerships. This research contributes to the discourse on building food systems that are not only climate-resilient and nutritionally adequate but also economically viable and socially just. The findings offer actionable recommendations for policymakers, development agencies, and private sector actors working to unlock the potential of Africa's dryland agriculture in the context of climate change.

Keywords: Climate-Smart agriculture, Food system resilience, Regenerative farming, Agroecology, Sustainable development, Policy reform.

INNOVATIVE CLIMATE-SMART SOLUTIONS FOR SUSTAINABLE DRYLAND AGRICULTURE

Authors: Author: Anthony Maina

Affiliation: FoodCloud
Email: Maina@foodcloudmega.com

Abstract
This study explores the vulnerabilities of dryland agriculture to climate change, focusing on innovative solutions to enhance productivity and resilience. The objectives are to identify and evaluate 15 cutting-edge climate-smart innovations that integrate renewable energy, biotechnology, and digital tools.

A methodology involving case studies and pilot projects was employed to gather data on these innovations. Key findings indicate that AI-optimized solar micro-irrigation systems, biochar soil amendments, and the paper also highlights digital agriculture solutions, including AI-powered mobile apps for farm decision support and drone-based monitoring for early pest/disease detection. Complementary approaches like BSF feed production and holistic grazing management demonstrate how integrated systems can enhance sustainability. These innovations collectively address four critical needs: (1) water use efficiency, (2) climate adaptation, (3) energy-food nexus optimization, and (4) data-driven precision agriculture. And CRISPR-engineered drought-tolerant crops can significantly improve resource efficiency and crop yields.

These results suggest that implementing these technologies can increase agricultural productivity by 30-50% while reducing water use by 20-40%. Overall, this research contributes to sustainable agricultural practices in arid regions, addressing food security and climate change mitigation. Future research should focus on local adaptation and cost reduction to enhance accessibility for smallholder farmers.

Keywords: Arid agriculture, climate adaptation, precision farming, water conservation, sustainable intensification, data driven agriculture, energy,-food nexus, water use efficiency.

STAGING EMPOWERMENT: WOMEN'S LAND RIGHTS AND GENDER ADVOCACY IN FRANCIS IMBUGA'S AMINATA

Author: KOdundo Allan

Abstract

Access to land and agricultural resources remains one of the most significant barriers to women's empowerment in many African societies. Patriarchal inheritance systems, cultural norms, and legal loopholes continue to marginalize women, particularly in rural areas where land ownership directly correlates with economic stability and agency. While policy efforts are ongoing, literature—and especially theatre—offers a powerful space for advocacy and reflection. Francis Imbuga's play Aminata is a seminal text that dramatizes the struggle for gender justice in a society where land rights are traditionally reserved for men. Although previous studies have examined the play from feminist and socio-political angles, there exists a notable gap in exploring Aminata as a performative tool for advocating women's agricultural and land rights. This paper interrogates how Aminata stages the intersection of gender advocacy, land ownership, and agricultural empowerment, offering both critique and resistance to patriarchal control. It poses the following research questions: How does Imbuga use character, dialogue, and dramatic tension to articulate the denial of land rights to women? In what ways does the play encourage critical awareness and social change through theatre arts? Utilizing a qualitative literary analysis supported by feminist and postcolonial theoretical frameworks, the study examines key scenes and symbolic elements in the text. It also draws on comparative legal and cultural sources on land tenure in Kenya to contextualize the drama's themes. Findings reveal that Aminata not only exposes systemic injustices but envisions a transformative role for women in reshaping societal narratives about land, power, and identity. Ultimately, this research demonstrates that literature and performative storytelling can serve as potent mediums for public education and policy influence. By amplifying women's voices and challenges, Imbuga's work remains deeply relevant in contemporary conversations about cultural equity and social justice.

Keywords: gender advocacy, land ownership, agricultural empowerment, theatre arts, feminist literature, performative storytelling, cultural equity, social justice

CIRCULAR BIO FIBER INNOVATION: VALORIZING MAIZE HUSKS FOR NEXT-GENERATION SUSTAINABLE TEXTILES.

Author: Apollo Ngitto, Affiliate organization and institution: Alkebulan Agri-business Venture, University of Eastern Africa Baraton, Official contacts: +254792723696 (apollongitto72@gmail.com), +254713683554 (info@ueab.ac.ke), ().

Abstract.

The textile industry contributes nearly 20 % of industrial water pollution and 10 % of global carbon emissions, highlighting an urgent need for sustainable alternatives. Maize husks an abundant agro-byproduct often discarded contains up to 30 % cellulose by dry weight, offering a promising feedstock for biodegradable textile fibers. Project ECO-FIBER leverages a green-chemistry framework to transform maize husk biomass into textile-grade fibers. Rather than traditional, resource-intensive protocols, our approach integrates eco-friendly pretreatment using biodegradable solvents and enzyme aided delignification with continuous flow reactors to maximize yield and minimize effluent. Pilot trials demonstrated that coupling mild alkali hydrolysis with a proprietary bio-catalytic bleaching step reduces chemical usage by 40 % and water demand by 55 %, while preserving fiber integrity and biodegradability. This modular process design can be retrofitted into existing agro-processing facilities, facilitating rapid scale-up and decentralization of production. The optimized process consistently delivers over 28 % cellulose yield by dry weight, producing fibers with tensile strength (~230 MPa) and thermal stability (degradation onset at 30.5°C) on par with conventional cotton (Samir et al., 2022). Compost ability assays confirm full mineralization within 100 days under industrial composting conditions. Socioeconomic modeling indicates that integrating local farmers into feedstock collection and micro processing can boost rural incomes by up to 15 %, fostering inclusive agribusiness growth. ECO-FIBER exemplifies a scalable, circular-economy solution that valorizes agricultural waste into high-value textile fibers. Aligned with Africa's Agenda 2063, this innovation supports environmental stewardship, rural empowerment, and the transition to eco-conscious fashion (African Union, n.d.). Maize-derived fibers thus emerge as a credible and sustainable alternative to resource-intensive and synthetic textiles.

References. African Union. (n.d.). Agenda 2063: The Africa We Want. Retrieved April 30, 2025, from https://au.int/en/agenda2063/overview

EVALUATION OF BLACK SOLDIER FLY LARVAE (HERMETIA ILLUCENS) FRASS AS BIOPESTICIDE AND BIOFERTELIZER ON KALES AT JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY INSECTARY FARM

Authors: Otieno Clinton, Regina Nyunja and Evans Nyakeri.

Abstract:
The use of insects for waste management and production of protein rich biomass is being promoted, as it contributes to the circular economy concept (reduce reuse and recycle). This research intended to investigate the use of black soldier fly frass as both biofertilizer and biocontrol agent on kales (Brassica oleracea). The study was carried at Jaramogi Oginga Odinga University of Science And Technology Insectary Farm. The black soldier fly larvae frass was produced from different feeding substrates i.e. fruit waste, brewery waste and chicken waste collected from Bondo open air market as BSFL frass contain more chitin composition as a result of shedding of exoskeleton of black soldier fly at pupae stage and the frass was used to grow kales ad both biopesticide and as biofertilizer and The that parameters such as bites number on leaves, larvae abundance, leave number emergence and leave surface area data was recorded and analyzed using ANOVA i.e. General linear model was used and means value was recorded. The general objective was to investigate the effects of Black soldier fly larvae frass as biopesticide and biofertilizer in kales growth. i) first objective was to assess the pesticidal activity of BSFL frass from different feeding substrate on kales i.e. fruit+brewery waste, chicken+brewery waste and fruit+brewery+chicken waste where number of bites were and larvae abundance were recorded in a table and data was analyze, results indicates that chicken+brewery waste was more effective as it has less bites and low larvae abundance of means value 0.16±0.10a and 0.06±0.06a respectively compared to control which had more bites and high larvae abundance of0.87±0.09b and 0.42±0.17b respectively. I) second objective was to determine the effect of fermentation on frass efficiency as a pesticide and results indicates that day 4 fermented frass was more effective to control pest as there was less bites and low numbers of larvae abundance with mean value of 0.69±0.10b and 0.50±0.14b respectively compared to which had mean value of 0.87±09b and 0.62±0.17b. iii) third objective investigate the effect of BSFL frass on growth performance on kales and the results indicates large leave surface area with mean value of 1.01±0.8a and2.15±0.02d respectively compared to control which had low number of leave emergence and small leave surface area of means value of 0.47±0.1b and 1.16±0.10b respectively.

In conclusion results indicates that chicken+brewery waste was more effective as it has less bites and low larvae abundance for the first objective and for second objective the results indicates that day 4 fermented frass was more effective to control pest as there was less bites and low larval abundance and lastly for the third objective indicates that chicken+fruit+brewery waste had more growth on leave number emergence and large surface area.

KEYWORDS: BSFL, FRASS, Biopesticide, Biofertelizer, Kales

GENERATIONAL CHANGE IN AGRICULTURE: A YOUTH-LED MODEL FOR RESILIENT DRYLAND FOOD SYSTEMS IN KENYA

Auther: Gailyne Muthoni Nakuru Tubers, Kenya

Abstract

Abstract Dryland regions in Kenya face unique challenges, including climate variability, land degradation, and limited youth involvement in agriculture, threatening future food security. Despite being the majority, young people are often excluded from value chains due to barriers such as access to land, finance, and relevant skills. This study explores how Nakuru Tubers, a youth-led agribusiness initiative, is driving generational change and positioning young people as agents of transformation in dryland agriculture. The objective was to examine the effectiveness of an integrated youth empowerment model in enhancing resilience and succession in potato-based food systems. A mixed-methods case study was employed, using key informant interviews, participatory assessments with youth farmers, and institutional document reviews. Data focused on training outcomes, access to clean planting materials, and peer-to-peer learning. Findings reveal that over 1,200 farmers, 60% of whom are youth under 35, were trained in climate-smart seed production and regenerative practices. Through the empowerment by Nakuru Tubers, youth accessed certified mini tubers and participated in seed multiplication. A peer-led extension model fostered rapid diffusion of knowledge, while internship programs created early career pathways. Youth involvement in value addition and digital record-keeping further diversified livelihoods and enhanced their leadership role in the sector. This model demonstrates that structured mentorship, institutional collaboration, and inclusive agribusiness training can unlock youth potential as innovators and change-makers. Empowering youth in drylands is not only a pathway to succession but a cornerstone of building climate-resilient, inclusive food systems.

ANALYSIS OF MORPHOANATOMICAL AND AGRONOMIC TRAITS EFFECTS OF SILICON (SI) TECHNOLOGY ON IRON STRESS TOLERANCE ON SELECTED PHASEOLUS VULGARIS L. BEANS VARIETIES IN KATHIANI SUB-COUNTY, MACHAKOS COUNTY, SOUTH EASTERN REGION, KENYA REGION

Conference: Innovating Dry Land Agriculture for Resilience, Sustainability and Climate-Responsive Food Security

Authors: Mutua E.1*, Mwanzia V.1, Kimatu J.2
1, Department of Agriculture, Lukenya University
2 Department of Agriculture, South Eastern Kenya University
1*Corresponding Author. Email:

Abstract
Silicon has been reported to strengthen plant structural integrity, regulate water balance, and enhance photosynthetic activity, thereby improving crop performance under limited water conditions. Although silicon (Si) is not classified as an essential nutrient, increasing evidence highlights its role in enhancing plant tolerance to abiotic stress, particularly drought. This study investigates the effect of silicon supplementation on drought tolerance in two common bean (Phaseolus vulgaris) varieties, Kakunzu and Nyota, which are vital food crops in East Africa but are often constrained by water scarcity. The experiment will be conducted in a controlled environment using a completely randomized design. Plants will be subjected to varying silicon concentrations (including a control) through soil application and foliar spraying, and drought stress will be induced during critical growth stages. Morphological (leaf area, number of leaves, plant height, stem girth), reproductive (pod number, pod length, seeds per pod, seed weight, total yield), and root traits (length, density, weight) will be assessed. Anatomical changes in root and leaf tissues will also be examined to determine any silicon-induced structural adaptations. This research aims to provide insights into the potential of silicon as a sustainable agronomic input for improving bean productivity and resilience in drought-prone areas. The findings are expected to contribute to improved water use efficiency and food security in semi-arid regions.

Keywords: Drought Stress, Phaseolus Vulgaris, Silicon Supplementation, Yield Improvement, Climate Resilience, Sustainable Agriculture

HARNESSING AGRICULTURE FOR CLIMATE ACTION: SUSTAINABLE BIOMASS BRIQUETTING IN KENYA THROUGH LOCAL RESOURCES, COMMUNITY ENGAGEMENT, AND EMISSION REDUCTION.

Author: Raphael M. V. Otakwa 1, 2 , Herrick Othieno 1 , Andrew A. Oduor 1

Abstract

This study explores the raw materials and processing techniques for producing attractive, sustainable biomass briquettes in arid and drylands in Kenya. Utilizing ethnographic methods such as participant observation, semi-structured interviews, and focus group discussions, the research provides deep insights into local biomass resource availability, social norms, and community perceptions. The findings highlight key agricultural residues—such as maize cobs, banana peels, mango seeds, and sorghum stalks—and livestock waste as viable feedstocks, prioritized for their availability and calorific potential. Laboratory analysis shows these materials possess calorific values ranging from approximately 2,870 to 4,694 kcal/kg, with optimized mixing ratios significantly improving energy density. The briquetting process involved carbonization, binder addition, and manual compression, resulting in thirty briquette grades. Notably, composite briquettes from mixed feedstocks achieved calorific values approaching 4,052 kcal/kg, demonstrating their capacity to displace fossil fuels and contribute to reducing greenhouse gas emissions by over 30%. Given that agriculture significantly contributes to Kenya's greenhouse gas emissions, these bio-briquettes present an effective local strategy for climate mitigation. Importantly, everyone—from local communities and students to university faculty—has a role in climate action: promoting sustainable biomass use, raising awareness, and developing innovative solutions. In mosquito-prone areas like Lukenya, briquettes could be further improved by incorporating plant components with natural mosquito-repellent properties that activate when burned. This holistic approach underscores the critical importance of community engagement, resource prioritization, and technical innovation in advancing Kenya's climate goals and fostering a sustainable energy future.

ENHANCING DRYLAND RESILIENCE AND AGRICULTURAL PRODUCTIVITY THROUGH ALGAE-BASED SYSTEMS: THE CASE OF PROJECT ALSIGHT DEMO FARM IN CENTRAL KENYA

Authors: Project Alsight Team, Green Thumb Movement, Kenya

Abstract

Dryland ecosystems account for over 41% of the Earth's land surface and is home to more than 2 billion people who are among the most vulnerable to climate variability, water scarcity, and land degradation. In Kenya, arid and semi-arid lands (ASALs) represent over 80% of the national territory which support approximately 38% of the population and 70% of the national livestock herd yet they remain underutilized for crop innovation (FAO, 2023). Project Alsight which is an initiative under the 2025 Data Science Africa Conference (datascienceafrica.org) and hosted by the Green Thumb Movement (thegtm.or.ke), introduces an algae-based climate resilience model tailored for dryland agricultural ecosystems. The initiative integrates low-cost Spirulina cultivation with a multi-modal data monitoring system to support sustainable food production, water-use efficiency, and knowledge dissemination across marginalized communities. The Alsight Demo Farm which is in its initial phase in Central Kenya, prioritizes practicality and frugal innovation by using repurposed water jars for small-scale Spirulina culture. These simple setups allow for early testing of key growth parameters such as pH, light exposure, and temperature tolerance, using low-cost tools and observation-based methods. This phase aims to build foundational knowledge and local capacity while minimizing startup costs. As the project progresses on, the system is designed to evolve into advanced algae cultivation models, including photobioreactors, open ponds, and raceway ponds, equipped with IoT-enabled sensors for real-time environmental monitoring and data collection. A companion digital platform (alsight.thegtm.or.ke) will support data visualization, analytics, and feedback integration to inform precision cultivation and decision-making at scale. Preliminary trials demonstrate that Spirulina can yield up to 15 g/m²/day, translating to 4–6 tons/year of dry weight per hectare, offering a high-protein and micronutrient-rich crop (containing up to 60% protein, iron, calcium, and beta carotene). This makes it a viable dietary supplement for vulnerable populations in dryland regions where food insecurity and undernutrition persist. Integrating algae into local diet either directly or through school feeding programs and local processing can significantly bridge nutritional gaps caused by limited access to diverse foods. Key Expected Outcomes: a. Enhanced food and nutritional security through algae-derived supplements for communities in arid regions. b. Increased water-use efficiency by up to 80% compared to traditional vegetable crops. c. Youth-led microenterprises for algae-based products (e.g., powders, animal feed, biofertilizers). Project Alsight will share early implementation results, discuss barriers to algae adoption, and explore policy frameworks for integrating algae into dryland farming systems. The model demonstrates how data-driven, resource-efficient bioproduction systems can catalyze resilience and address both climatic and nutritional challenges in ASAL regions.

Keywords: algae farming, Spirulina, dryland agriculture, climate resilience, food systems innovation, frugal innovation, nutrition security, youth agribusiness.

CLIMATE SMART AND MULTISECTORAL INNIOVATIONS FOR DRYLAND RESILLIENCE

Author: BY KOMBO MILKA NYOMENDA

Abstract

Dry land regions constitute over 40% of the world land surface which is critical for sustaining the livelihoods of 2 billion people and yet they face escalating threats from climate change, land degradation and socio-economic pressures. Addressing these intersecting challenges requires climate-smart and multisectoral innovations that integrate agriculture, health, water management, policy and ecosystem services. This study examines how such innovations enhance resilience, bolster food security and foster sustainable development in dry land systems. The primary objective is to examine the effectiveness and scalability of climate-smart, multisectoral interventions such as drought-tolerant crop varieties, precision water harvesting, regenerative grazing, integrated pest and disease management, One Health linkages and supportive policy instruments in agricultural productivity and community resilience. The research will involve mixed-methods i.e. 1) surveys and key informant interviews capture socio-economic and food security metrics. 2) Participatory innovation platforms engage farmers, extension agents and policymakers to co-design context-specific solutions. 3) Geospatial and remote-sensing analyses quantify land-use changes, vegetation health and water-balance dynamics finally health and nutrition assessments outcomes of integrated livestock and human health interventions.

Preliminary findings indicate that combining precision irrigation and soil-moisture sensors with regenerative agro ecological practices increases crop yields by up to 25% under reduced rainfall scenarios. Regenerative grazing coupled with livestock vaccination campaigns has decreased pasture degradation and animal morbidity rates by 30%. Participatory water-user associations, supported by digital decision-support tools, have improved equitable water allocation and reduced conflicts. Multi-stakeholder policy dialogues have catalyzed enabling frameworks for climate-finance access and strengthened local governance. This research underscores the relevance of climate-smart, multisectoral innovation for transforming dry land food systems. By demonstrating synergistic benefits across sectors: agriculture, health, water and policy which offer a blueprint for scaling resilient practices. To overcome persistent barriers such as limited financing fragmented institutions and capacity gaps, the study recommends: 1) expanding innovation hubs 2) strengthening extension and health services 3) harmonizing cross-sector policies and 4) leveraging digital platforms for knowledge exchange. These pathways can accelerate the transition to sustainable, food-secure and climate-resilient dry land landscapes.

INTEGRATED APPROACHES TO AGRICULTURAL LAND RESTORATION AND CLIMATE RISK MANAGEMENT FOR FOOD SECURITY IN NORTHERN NIGERIA

Author: Angela Oyilieze Akanwa

Abstract

Northern Nigeria faces escalating challenges of desertification and land degradation, exacerbated by climate change and unsustainable agricultural practices. These issues threaten food security and the livelihoods of millions. Grounded in the theory of Climate-Smart Agriculture (CSA), this study employs a comprehensive desk review and key informant interviews with agricultural experts, environmental scientists, and community leaders to examine integrated strategies for restoring agricultural lands, food security, and managing climate risks in the region. Findings highlight persistent challenges, including limited access to funding, inadequate infrastructure, application of local agricultural techniques, restriction of women's access to lands, and policy implementation gaps. However, Professionals contributed that the effectiveness of sustainable agriculture practices, including agroforestry, conservation agriculture, and climate-smart farming techniques, lies in rehabilitating degraded lands. Initiatives like the Agro-Climatic Resilience in Semi-Arid Landscapes (ACReSAL) and the National Agency for the Great Green Wall (NAGGW) have been instrumental in implementing large-scale land restoration projects, promoting afforestation, and enhancing water resource management. Also, Community engagement emerges as a critical factor in the success of these interventions. Empowering local populations through education, capacity building, and the incorporation of indigenous knowledge systems has led to more sustainable land management practices and increased resilience to climate variability. This study recommends a multifaceted approach that integrates scientific research, policy reforms, and community participation. This study underscores the necessity of adopting holistic and inclusive strategies to combat desertification, restore agricultural productivity, and ensure food security in Northern Nigeria. By aligning sustainable agricultural practices with climate resilience efforts, inclusivity, and gender equality of stakeholders can foster environmental sustainability and socio-economic development in the region.

Keywords: Climate Resilience, Desertification, Food Security, Northern Nigeria, and Integrated Land Management.

EMPOWERING YOUTH AS CATALYSTS FOR SMART AGRICULTURE AND FOOD SYSTEM TRANSFORMATION IN AFRICA

Author: Angela Oyilieze Akanwa Faculty of Environmental Management, Agriculture and Renewable Energy (FEMARE), University of Technology and Arts, Byumba (UTAB), Rwanda.

Abstract

Africa's agricultural sector stands at a pivotal juncture, confronting challenges such as climate variability, land degradation, and escalating food insecurity. Amidst these challenges, the continent's burgeoning youth population emerges as a vital force for innovation and change. This study delves into the role of African youth as agents of transformation in food systems, emphasizing the integration of Artificial Intelligence (AI) technologies in smart agriculture. Employing qualitative methodologies—including semi-structured interviews and focus group discussions with young agripreneurs, AI developers, and agricultural extension officers across diverse African regions—the research captures first-hand insights into youth-led initiatives and experiences. Findings reveal that youth are at the forefront of adopting AI-driven solutions, such as predictive analytics for crop yield forecasting, AI-powered pest and disease detection, and precision farming techniques. Initiatives like the AI4AFS Innovation Research Network have spotlighted youth-led projects in countries like Kenya, Nigeria, and Malawi, where affordable AI tools are enhancing smallholder farmers' productivity and resilience. However, challenges persist, including limited access to capital, inadequate digital infrastructure, and gaps in technical training. Moreover, socio-cultural barriers and policy constraints often hinder the full potential of youth engagement in agri-tech sectors. The study underscores the imperative for targeted interventions, such as capacity-building programs, inclusive policy frameworks, and investment in digital infrastructure, to empower youth in leading the AI driven transformation of Africa's food systems. By harnessing the innovative spirit and technological adeptness of its youth, Africa can pave the way toward sustainable, resilient, and food-secure futures.

Keywords: Artificial Intelligence, Digital Agriculture, Food Systems Transformation, Youth empowerment, and Smart Agriculture.

EFFECT OF RATE OF HYDROGEL APPLICATION AND SOURCE OF FERTILIZER NITROGEN ON GROWTH AND YIELD OF MAIZE IN A SUB-HUMID ENVIRONMENT OF KENYA

Antony Mangusho Twaem1, Kitonyo Onesmus1, James Mutegi2 and V.M Kathumo3
Corresponding author email: amtwaem@gmail.com
1 Department of Plant Science and Crop Protection, Faculty of Agriculture, University of Nairobi, Kenya
2 African Plant Nutrition Institute
3 Lukenya University

Abstract

Maize, Kenya's major staple crop, is cultivated widely on Kenyan farms. It is an important generator of revenue, job creation, and savings on foreign exchange expenses through substitute imports. However, soil moisture and Nitrogen scarcity can negatively affect maize growth and output either separately or in combination. Water and Nitrogen stress under field conditions are common and gaining insight into how the two interact is critical for efficient maize production. The study aimed to assess the effect of applying hydrogel, a polymer that is non-reactive and transforms into a gel by capturing and holding soil moisture and nutrients and releasing them to plants when needed, and nitrogen fertilizer sources, which influences the availability, uptake, and utilization of nitrogen by plants on maize crop growth, yield water usage efficiency, nitrogen utilization efficiency, including cost-benefit analysis in a Kenyan sub-humid climate. The methodology involved the application of varying hydrogel amount (15, 10, 5, 0 kg/ha) and nitrogen-based fertilizer sources (CAN, slow-release urea, and conventional urea) in a randomized complete block design using a split-plot layout for three seasons. The key parameters measured included crop phenology, growth characteristics, and yield components. The effect of the treatments on nitrogen use efficiency and water use efficiency were computed. Economic benefit was assessed by computing the net income and cost-benefit ratio of the various treatments. Data analysis involved analysis of variance (ANOVA) and Fisher's LSD (least significance difference) test to separate means at 5 % confidence level. Hydrogel application significantly ($p < 0.001$) increased height, where height increased from 105.48 cm to 132.40 cm, leaf greenness increased from 43.83 to 46.13, and leaf area index, increased from 543.5 to 629.4. Besides, there was an increase in yield from 1.444 t/ha to 1.956 t/ha, water-use efficiency increased from 3.74 kg ha^{-1} mm^{-1} to 9.95 kg ha^{-1} mm^{-1}, and nitrogen-use efficiency, in particular AEN and PFPN, increased from 0.019 to 0.025 and 0.010 to 0.029, respectively. Comparing the effectiveness of the N-fertilizer sources applied, slow-release urea was noted to be much better compared to other sources of nitrogen fertilizer. As noted, slow-release urea led to an increase in plant height by 29.27%, leaf greenness by 17.89%, LAI by 26.69%, yield (t/ha) by 164.42%, and WUE by 164.51%. For NUE, slow-release urea improved AEN as indicated

by a mean of 0.019, while PFPN increased by 164.68%. A notable increase in net income and CBR was noted following application of hydrogel alongside the slow-release urea. The net income amounts due to hydrogel rate ranged from Ksh.19,288 to Ksh.30,708 across the experiment. Slow-release urea also had a high impact compared to other nitrogen-based fertilizer sources used, as it consistently resulted in the highest mean net income. Benefit-Cost Ratio (BCR), hydrogel use significantly influenced BCR, although raising the levels contributed to lower BCR values, implying that too much hydrogel use might not enhance economic viability. Slow-release urea consistently resulted in the highest BCR (1.4 to 1.57) when used along with hydrogel treatments. The results above point out that for increased plant growth and economic viability, farmers need to understand the critical role of integrating moisture retention techniques and efficient nutrient management in enhancing maize production and resilience. The findings from this study recommends the adoption of hydrogel at an optimum amount of 10kg/ha which enhances soil moisture and prolongs nutrient uptake. Additionally, the use of slow-release nitrogen fertilizer is highly encouraged as it guarantees sustained supply and uptake of essential nutrients throughout the growing periods and minimizes nutrient losses thus enhancing nitrogen use efficiency. Promotion of these practices within the farming community is crucial in building climate-resilient agricultural systems to ensure sustainable maize production.

Key words: Soil moisture conservation, Water use efficiency (WUE), Nitrogen use efficiency (NUE), Soil conditioner, slow-release urea, LAI (Leaf Area Index), Net Income and CBR (Cost-Benefit Ratio)

REVITALIZING INDIGENOUS SEED SYSTEMS FOR RESILIENT DRYLAND AGRICULTURE: LESSONS FROM EASTERN KENYA

Author: Angela Kiamba, Lukenya University.
Email: 34angela.kiamba@gmail.com Phone: +254704820270

Agriculture in the semi-arid areas of Eastern Kenya, especially in Kitui and Makueni counties, is severely hampered by irregular rainfall, protracted droughts, and degraded soil. The livelihoods and food security of smallholder farmers, the backbone of the region's economy, are at risk due to these environmental stressors made worse by climate change. Access to climate-resilient seeds that can withstand challenging agro-ecological conditions is a major obstacle to sustainable food production in these regions. The revitalization of indigenous, community-based seed systems is examined in this paper as a potential tactic to support dryland agriculture. The study emphasizes how locally adapted crop varieties and participatory research can strengthen resilience, encourage seed sovereignty, and aid biodiversity conservation.

Context and Importance of Indigenous Seed Systems

Low and erratic rainfall, frequently less than 500 mm annually, is a defining feature of dryland agriculture in Eastern Kenya. Crop varieties that flourish in environments with limited water resources and low soil fertility are needed. Native seed varieties that are specifically adapted to these difficulties have been created and preserved by farmers in Kitui and Makueni counties over many generations. Because of their early maturity, resistance to drought, and suitability for local soils, varieties like Nyayo, Kakunzu, and Katumu beans, Mbikamba and Makueni maize, and Kamenzele sorghum have been chosen. In addition to their agronomic value, these crops have great cultural significance and are frequently associated with customs, rituals, and community identity. However, these native varieties have been marginalized due to the dominance of formal seed systems, fueled by government-sponsored initiatives and commercial seed companies. The variable and resource-constrained conditions of semi-arid regions are not well suited for hybrid and genetically modified seeds, which are frequently advertised for their high yields under ideal circumstances. Furthermore, many smallholder farmers cannot afford them due to their high cost and reliance on outside inputs like irrigation and fertilizers. Vulnerability to climate shocks has increased due to the depletion of native seed systems and restricted access to high-quality seeds, highlighting the necessity of reviving community-based strategies.

TRANSFORMING PASTORAL LIVELIHOODS WITH COMMUNITY-BASED RANGELAND MANAGEMENT AND DIGITAL TOOLS: THE AFRISCOUT EXPERIENCE IN ETHIOPIA AND KENYA

Authors: Hellen Mutogoh / Tom Mortimore/ Joshua Laizer

Abstract:
The presentation will highlight the effects of community-led rangeland management and mobile technology on pastoral livelihoods in Ethiopia and Kenya. In Ethiopia, the AS Regen initiative has facilitated a transition from uncontrolled grazing to rotational management, fostering collective decision-making and enhancing rangeland health. Respondents reported significant improvements in pasture quality, livestock productivity, and household incomes, alongside a notable decline in conflicts over resources. In Kenya, adopting the Afriscout mobile app has transformed herd management by providing real-time data on pasture and water availability, promoting conflict reduction, and enabling strategic livestock sales. The integration of traditional knowledge with innovative digital tools has strengthened community resilience, reduced migration pressures, and improved food security. Overall, the findings highlight how participatory governance combined with accessible technology can foster sustainable pastoral systems, mitigate conflicts, and enhance livelihoods in arid and semi-arid regions.

EFFECTS OF PROJECT MANAGEMENT ADOPTION AS ENABLER FOR SUCCESSFUL FINANCIAL TECHNOLOGY PERFORMANCE: A CASE OF MOBILE BANKING APPLICATION IN KENYA

Abstract

The fast development of financial technology, particularly through mobile banking transforms banks by providing better access to customers at high speed along with strong customer focus. Success in implementing properly designed technologies needs efficient project management practices to achieve it. The analysis investigates how project management practices influence mobile banking application performance at Kenya's FinTech sector. This research explores how project management practices improve performance quality and security threats together with customer satisfaction outcomes but also resolves framework ambiguation in FinTech operations. The research shows growth becomes hindered because of inadequate project management which lacks the use of structured methods including Agile and PRINCE2. The research question about efficiency and security and customer satisfaction has multiple independent variables creating challenges to understand final results clearly. Strategic project management implementations enable minimum resource waste and risk reduction for mobile banking application quality improvement through user-centered enhancement of security features and application usability. The research data presents essential recommendations for developers and financial service providers and policymakers to use project management best practices that boost mobile banking performance alongside user needs fulfilment and compliance and innovation rates.

Keywords: Project management, mobile banking, financial technology, FinTech, Kenya, Agile, PRINCE2, performance, efficiency, security