Agroecology TPP

Agroecology in Action!

Mzee Mukoko's Legacy of Regenerative Farming

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1. Executive summary

At 79, Mzee Mika Mukoko has transformed his modest two-acre farm in Vihiga County, Kenya, into an inspiring example of farmer-led agroecological innovation. A former wildlife conservationist trained in organic farming at the Rodale Institute (US), Mukoko blends traditional wisdom with modern science to create a lighthouse for regenerative agriculture. His farm demonstrates how smallholder farmers can achieve ecological resilience, economic viability, and community empowerment on limited land.

The foundation of his system is soil restoration. Mukoko produces biochar from crop residues and animal bones, crafts nutrient-rich Terra Preta compost, and applies fermented liquid fertilizers to revive degraded soils. For pest management, he deploys plant-based biopesticides, raised planting mounds for mole control and drainage, and diversified polycultures to maintain ecosystem balance. Space-efficient designs, including floating gardens, vertical cropping, and integrated multi-story systems, maximize yields while conserving biodiversity. These innovations have attracted over 25 bird species, boosted pollinator populations, and improved soil resilience to climate extremes.

Mukoko applies circular bioeconomy principles, turning farm outputs into value-added products for local markets, reducing waste, and extending shelf life. His mentorship of women, youth, and fellow farmers ensures the transfer of agroecological skills, building local capacity for sustainable food systems. By connecting grassroots ingenuity with science, policy, and investment, Mzee Mukoko's work offers a compelling model for climate-resilient, inclusive, and regenerative food systems, safeguarding agroecological heritage for future generations.

However, challenges remain, from limited financing and missing scientific validation to weak market incentives for organic produce. Undeterred, Mukoko envisions establishing the **Mukoko Agroecological Innovation, Incubation, and Training Centre** as a hub for practical training, research collaboration, and policy advocacy. He calls for partnerships with scientists to validate his methods, policymakers to embed agroecology in Kenya's Competency-Based Education, and private investors to scale promising technologies like his biochar kilns.

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2. Introduction

On a quiet hillside in Luanda sub-county, Vihiga County, an 82-year-old farmer has turned two acres of land into a living blueprint for Kenya's agroecological future. Mzee Mika Mukoko, once a wildlife conservationist and later trained in organic farming by the Rodale Institute in the United States, has spent decades refining an approach that blends deep indigenous knowledge with modern science. His farm is not just a place of production, it is a living classroom, a testing ground for innovations, and a community hub where farmers, youth, researchers, and policymakers come to learn, question, and collaborate.

Vihiga County, covering 568.3 km^2 in western Kenya, is one of the most densely populated rural areas in the country, with over 1,000 persons per square kilometre and average household farm sizes of just 0.38 hectares (C-ADP 2025/26). Smallholders here face severe land pressure, declining soil fertility, water scarcity, biodiversity loss, and food insecurity, challenges worsened by climate variability and the low adoption of improved farming techniques.

These constraints undermine agricultural productivity and rural livelihoods, creating an urgent need for solutions that regenerate ecosystems while sustaining livelihoods.

Against these odds, Mzee Mukoko has developed a replicable model of sustainable intensification that merges indigenous farming wisdom with cutting-edge agroecological innovations. His farm is both a production unit and an open-air classroom, a dynamic space where biochar from farm waste, nutrient-rich Terra Preta compost, space-efficient vertical gardens, and plant-based pest management come together to restore soil health, enhance biodiversity, and triple productivity on limited land. Over 25 bird species, thriving pollinator populations, and resilient soils bear witness to the ecological benefits of his approach.

Table 1. Vihiga County – socio-ecological snapshot

Attribute	Description
Geographic area	568.3 km^2 in western Kenya
Population density	>1,000 persons/km^2 – among Kenya's highest
Average farm size	0.38 ha per household (C-ADP 2025/26)
Agroecological zones	High-potential midlands; bimodal rainfall (1,800–2,000 mm/year)
Key livelihoods	Smallholder farming (maize, beans, bananas, vegetables, dairy goats, poultry)
Major challenges	Agroecology, diversified agroforestry, integrated crop–livestock systems, value addition, community-based biodiversity conservation
Opportunities	Agroecology, diversified agroforestry, integrated crop–livestock systems, value addition, community-based biodiversity conservation

Mukoko's work has made his farm a magnet for universities, schools, non-governmental organizations (NGOs), farmer groups, county governments, and policymakers seeking practical, low-cost solutions to land and soil constraints. His training model, rooted in peer-to-peer mentorship and hands-on demonstrations, empowers women, youth, and farmer groups to adapt agroecological practices to their contexts. This case study documents his journey from wildlife conservationist to agroecology pioneer, examining:

- **techniques** that overcome land scarcity and degraded soils
- **impacts** on productivity, biodiversity, and ecosystem services
- **training and outreach models** for scaling farmer-led innovation
- **policy and investment opportunities** to accelerate adoption

The case study documents Mzee Mukoko's comprehensive agroecological innovations – practical, locally rooted solutions that enhance soil health, biodiversity, and food security in resource-constrained contexts. It examines the environmental and social impacts of his work, his role in mentoring and mobilizing communities, and the policy and investment opportunities for scaling similar farmer-led models. The lessons from this modest two-acre farm carry profound implications for Kenya's agricultural future, demonstrating that the path to food security in Africa's crowded highlands lies not in expanding farmland, but in farming smarter, regeneratively, and in harmony with nature.

Figure 1. Cacao plantation integrated with an apiary.
Photo: © CIFOR-ICRAF/Anne Kuria

3. From wildlife conservationist to regenerative farmer: The lifelong journey of Mzee Mika Mukoko and the roots of his agroecology legacy

Mzee Mika Mukoko's hands tell the story of a lifetime spent healing two different but deeply connected worlds. The same calloused fingers that once mixed pepper paste to deter elephants in Tsavo now craft biochar from banana stems to breathe life back into Vihiga's depleted soils. At 82, his extraordinary transition from wildlife ranger to regenerative farming pioneer reveals a truth he has lived for decades: the principles that safeguard wilderness can also restore farmlands.

Mzee Mika Mukoko's path to becoming one of Kenya's most inspiring agroecologists spans more than four decades, rooted in a lifetime of learning, adaptation, and deep respect for the land. His journey began at the Wildlife College in Tanzania, where he received multidisciplinary training in forestry, wildlife management, natural history, parasitology, and marine biology. These formative years immersed him in the interconnectedness of ecosystems, a perspective that would later shape his holistic approach to farming.

He went on to serve with the Kenya Wildlife Service across some of the country's most iconic landscapes: Marsabit, Tsavo East and West, Lake Nakuru, Sibiloi, Kisite, Meru, and Kyunga. Confronted with the complex realities of human–wildlife conflict, Mukoko developed a knack for practical, low-cost solutions, such as using pepper barriers to deter elephants from farmland. These experiences cemented his belief that sustainable solutions must work with nature, not against it.

A transformative visit to the Rodale Institute in the United States exposed him to the principles of organic farming. That moment marked a turning point, shifting his focus from wildlife protection to regenerating the agricultural landscapes where people and nature coexist. Returning to his ancestral home in Luanda, Vihiga County, a region where average farm sizes have shrunk to just 0.38 hectares and soils are under extreme pressure, Mukoko set out to prove that farming could be productive, affordable, and restorative.

Drawing from both his ranger's fieldcraft and his new agroecological training, he became an agricultural alchemist by:

- turning crop residues and animal bones into "black gold" biochar, enriched Terra Preta compost, and fermented liquid fertilizers to restore soils;
- brewing plant-based biopesticides from neem, wild garlic, and chilli – just as he once used pepper to keep elephants at bay – to manage pests;
- designing whole-farm ecosystems where every beetle, bird, and bacterium plays a role, and space-efficient techniques like floating gardens, vertical layers, and miniaturized plots maximize yields on limited land.

Mukoko's approach is defined by a philosophy of self-reliance through ecological harmony. Rejecting dependence on synthetic inputs, he relies on locally available resources and context-specific innovations, turning crop residues, animal bones, and other organic matter into biochar, compost, and natural fertilizers. His guiding principle is simple yet profound: *"There is no waste; it only becomes waste when we waste it."*

By blending indigenous knowledge with scientific insight, he has refined a diverse suite of agroecological practices tailored to his land's unique conditions and his community's needs. His farm is more than a production unit; it is a living laboratory and training ground, showing that farming can be productive, affordable, and regenerative. For Mzee Mukoko, agroecology is not merely a technique, but a way of life that integrates ecological sustainability, economic empowerment, and cultural rootedness.

4. Agroecological innovations

4.1 Soil health revolution: Mzee Mukoko's homegrown solutions for healthy soils

On his modest two-acre farm in Luanda, Vihiga County, Mzee Mika Mukoko has engineered a set of soil health innovations that combine Indigenous wisdom, scientific principles, and relentless experimentation. His mission is clear: restore soil fertility without costly external inputs, using only resources that are locally available, affordable, and ecologically sound.

4.1.1 Biochar

Central to Mukoko's soil restoration strategy is the production of biochar through the pyrolysis of crop residues, maize stalks and cobs, dead wood, cacao husks, shells, and even animal bones. He has observed that biochar's high carbon content significantly improves soil structure, enhances nutrient retention, and increases water-holding capacity, allowing nutrients to be released gradually to crops. To make biochar, Mukoko employs a range of technologies:

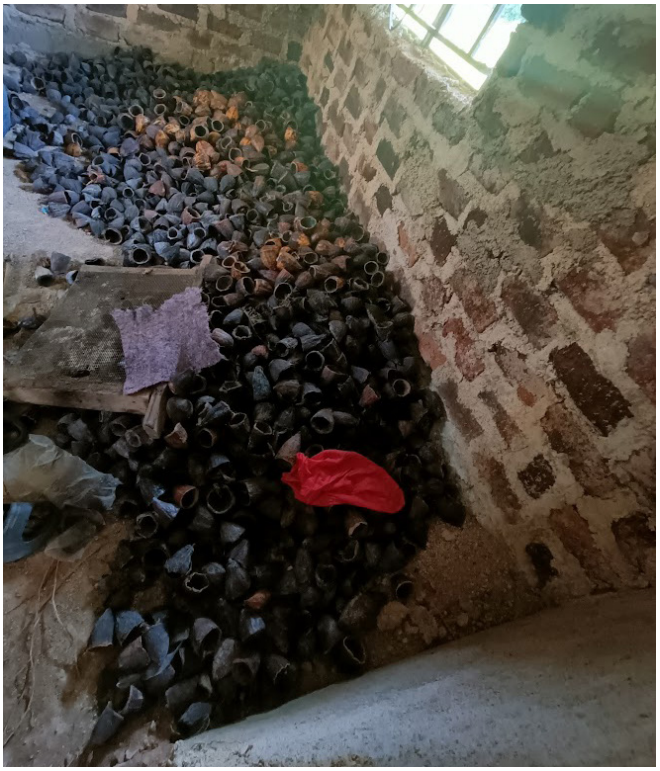

Figure 2. Cacao shells used to produce biochar.
Photo: © CIFOR-ICRAF/Anne Kuria

- **Drum kilns** for small-scale, rapid production
- **Kon-Tiki kilns** for larger volumes and uniform charring
- **Energy-saving** cooking stoves custom-designed for both household use and biochar processing

These devices are continually refined for efficiency, reduced smoke emissions, ease of assembly, and adaptability to different feedstocks and volumes.

4.1.2 Composting

Turning waste into fertility, Mukoko integrates biochar into a variety of enhanced composting methods. His base mix combines animal manure with Effective Microorganisms, human or animal urine, and market waste. Biochar is blended in to lock nutrients into the compost, resulting in a balanced organic fertilizer rich in potassium, nitrogen, calcium, and phosphorus.

Figure 3. A kiln innovation that Mzee Mukoko uses for pyrolysis. Photo: © CIFOR-ICRAF/David Lelei

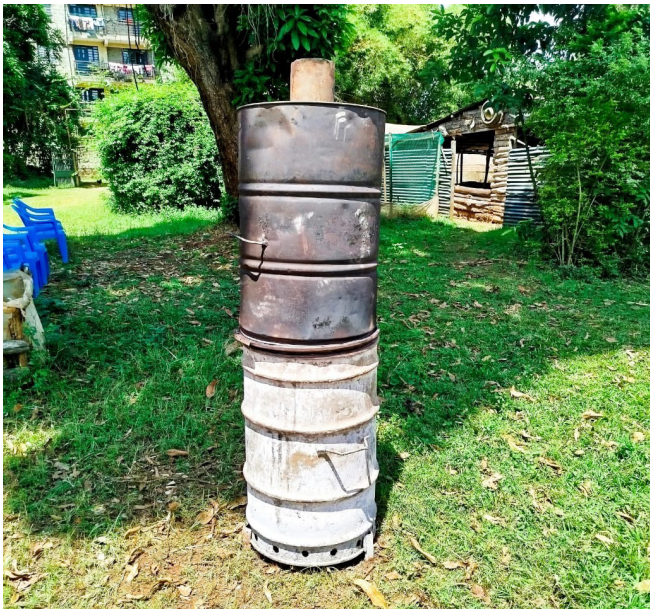

Figure 4. A kiln innovation that Mzee Mukoko uses for pyrolysis. Photo: © CIFOR-ICRAF/David Lelei

One of his hallmark innovations is the creation of Terra Preta, a highly fertile black soil inspired by ancient Amazonian practices. He achieves this by composting nitrogen- and phosphorus-rich materials together with biochar and livestock manure, producing a soil amendment that builds long-term fertility. He also uses nutrient-rich termite mound soil as a bulking agent to improve texture and microbial diversity. For faster results, he has adapted the Bokashi fermentation[1] technique, reducing composting time from the traditional 3–4 months to just 21 days.

4.1.3 Liquid fertilizers

Precision nutrition for crops! Mukoko also produces fermented liquid fertilizers by soaking plant and animal residues for seven days to extract soluble nutrients. These are applied at carefully adjusted dilution rates – commonly 1:3 or 1:4 – depending on crop type, growth stage, and observed plant responses. This allows for precision nutrient delivery while minimizing waste.

4.1.4 Mulching, nitrogen fixation, and soil cover

Beyond compost and biochar, Mukoko improves soil health through mulching with plant biomass such as bamboo, which decomposes in 2–3 months and releases silica that promotes plant vigour. He enriches the soil nitrogen pool by interplanting nitrogen-fixing trees and shrubs including Sesbania sesban, Gliricidia sepium, Calliandra calothyrsus, Tephrosia vogelii, and Tithonia diversifolia. For seasonal cover, he plants Mucuna pruriens, pumpkin, and sweet potato to protect soils from erosion, suppress weeds, and enhance organic matter content. These practices are embedded within zero-tillage and intercropping systems that preserve soil structure, foster biodiversity, and sustain productivity without exhausting the land.

1 The Bokashi fermentation technique is an anaerobic composting method that uses beneficial microorganisms to break down organic matter into a nutrient-rich soil amendment without producing foul odours. It is a Japanese word that literally means fermented organic matter.

4.1.5 Observation, adaptation, and impact

Although Mukoko's soil management system has not undergone formal laboratory analysis, he continuously monitors effectiveness through field-based observation- tracking changes in soil texture, crop performance, pest/disease incidence, and overall plant vigour.

Over the years, the results have been clear:

- **increased crop yields and quality** without synthetic inputs
- **year-round food availability** through diversified production
- **improved soil resilience** to drought and heavy rains
- **lower production costs** through reliance on farm-derived inputs

By closing the loop between waste and fertility, Mzee Mukoko has built a regenerative, self-sustaining soil health system that not only nourishes crops but also sustains the ecosystem on which his farm depends.

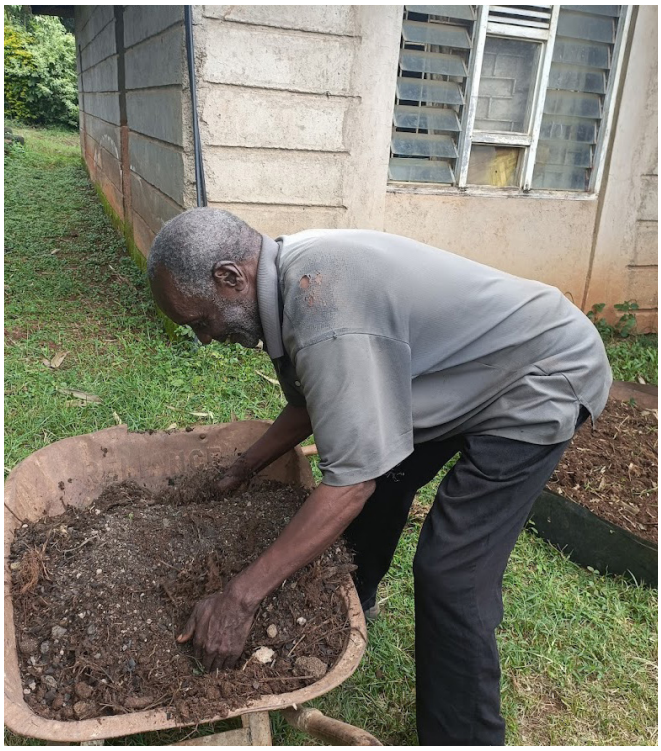

Figure 5. Mzee Mukoko preparing Terra-Preta, beside recycled gardens. Photo: © CIFOR-ICRAF/Anne Kuria

4.2 Pest management: Harnessing indigenous knowledge for ethical, eco-friendly integrated pest management

On Mzee Mukoko's farm, pest management is not a battle to be fought, but a relationship to be managed. Guided by both ecological principles and ethical considerations, he has built an Integrated Pest Management (IPM) system that works with nature's rhythms rather than against them, relying on biological, structural, and cultural controls rooted in Indigenous knowledge and locally available resources.

One of his signature techniques involves raised planting mounds for cassava and sweet potatoes. These elevated beds interrupt mole tunnels, discouraging the rodents without killing them – a pest control method that reflects his belief that every creature has its place in the ecosystem.

Mukoko's plant-based biopesticides are another cornerstone of his approach. Sourced from herbs and shrubs grown on his own farm, these preparations are designed for specific challenges:
Extracts from *Tithonia diversifolia* and *Tephrosia* species combat fungal diseases such as cucumber blight, while also suppressing insect pests like fall armyworm.

- Their roots repel moles, and their nitrogen-fixing ability enriches the soil, making them multifunctional allies in the field.

These botanical solutions are brewed, diluted, and applied with precision dosing based on decades of on-farm experimentation and observation. His pest control arsenal also includes diatomaceous earth (diatomite), which desiccates soft-bodied pests such as aphids while being effective, low in toxicity, and safe for beneficial insects.

Mukoko reinforces these measures through diversified cropping patterns:

- **Repellent plants** such as onions deter insect pests naturally.
- **Intercropping and crop rotation** disrupt pest life cycles while maintaining soil health.

By avoiding synthetic pesticides, Mukoko not only protects pollinators and soil biodiversity but also safeguards long-term farm productivity. His IPM system embodies the essence of agroecology, where pest management is part of a wider ecological symphony, balancing productivity with the preservation of life in all its forms.

4.3 Growing more with less: Mzee Mukoko's integrated, diversified and space-smart farming

Mzee Mukoko's two-acre farm is a living blueprint for how smallholder farmers can produce more with less, using ecological design to intensify production without degrading the land. Rejecting monocultures, he has designed a highly integrated polyculture system where annuals, perennials, vegetables, fruits, herbs, and medicinal plants coexist in mutually supportive arrangements. This diversity not only maximizes productivity per unit area but also improves soil health, disrupts pest cycles, and ensures a balanced year-round food supply. Every available space, from the ground to vertical layers, is part of his carefully orchestrated farming system.

To overcome space constraints, Mukoko has developed space-smart innovations. His floating gardens allow bananas to grow in the shade beneath raised wooden frames that support pumpkins, tomatoes, and other climbing crops. In multi-storey gardens, vegetables and herbs are layered vertically, capturing sunlight at multiple levels and making full use of limited space. His "miniaturization" technique, where the roots of large trees like Acacia are coiled in containers to slow their growth, allows such species to thrive in buckets, sacks, and other small spaces, ideal for urban agriculture or non-arable land.

Mukoko's farm is also a platform for dietary diversity and nutrition education. He challenges the perception of "weeds" as worthless, instead promoting underused species such as blackjack (*Bidens pilosa*), potato vines, and African leafy vegetables like slenderleaf (*mitoo*), jute mallow (*mrenda*), pumpkin leaves, and nightshade (*osuga*). These crops, rich in vitamins and minerals, are integrated into local diets and school feeding programmes. He also raises awareness about the health implications of cooking oils, advocating for those with high smoke points, such as avocado and canola, and proposes farmer training programmes to build local specialization in nutrient-rich crops like sweet potatoes, pumpkins, and organic poultry.

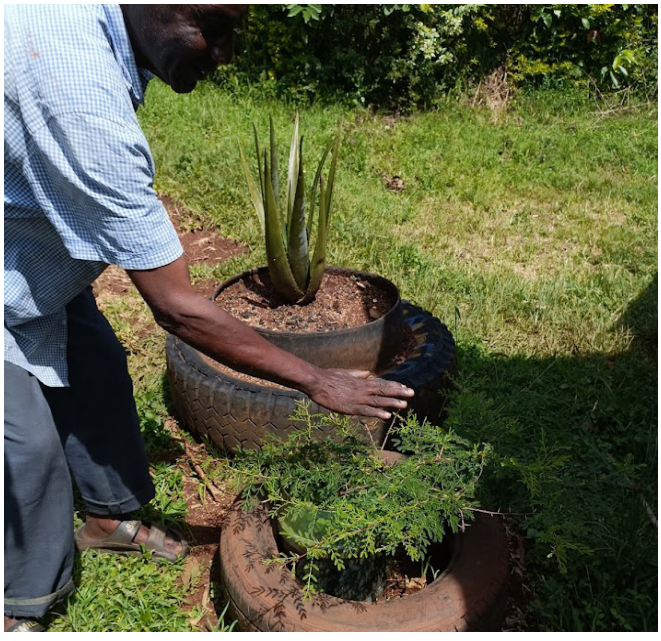

Figure 6. Mzee with his miniaturized Acacia spp. Photo: © CIFOR-ICRAF/Anne Kuria

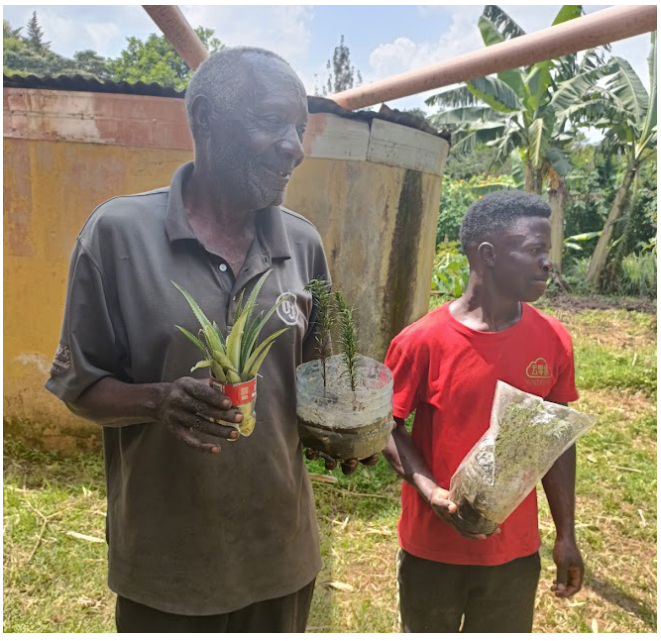

Figure 7. Raising pineapple cutting in recycled containers. Photo: © CIFOR-ICRAF/Anne Kuria

Figure 8. Floating garden. Photo: © CIFOR-ICRAF/ David Lelei

The crop portfolio on his farm reflects both tradition and innovation. He grows emerging cash crops such as cacao, bamboo, and castor oil; herbs like stevia, mint, and rosemary; tubers including yacon, cassava, Irish potatoes, sweet potatoes, and taro; staple crops like maize, bananas, and beans; and fruits ranging from pepino melon, strawberries, and loquat to guava, apples, avocados, pawpaws, dragon fruit, gooseberries, and mangoes. Medicinal plants such as aloe vera are also cultivated, alongside natural sweeteners like jaggery, sugarcane, and comfrey for soil enrichment.

In keeping with circular bioeconomy principles, Mukoko burns locally available residues, banana stalks, cowpea stems, and bean stalks, to produce ash ("*Munyu*" or "*Musherekha*"), which he uses for water purification and as a natural food tenderizer. By recycling every organic resource, he reduces waste, cuts costs, and closes nutrient loops on the farm.

For Mukoko, this is about more than production; it's about food sovereignty. He believes agroecology hubs like his can anchor local food systems, especially in counties like Vihiga, where small landholdings and declining productivity force reliance on imported food. His vision is clear: diversify production, localize supply, and ensure that every household can access healthy, affordable, and culturally appropriate food throughout the year.

5. Impacts and outcomes

5.1 Environmental co-benefits

5.1.1 Soil health and productivity

Through consistent agroecological practices, including zero tillage, year-round cover crops, mulching, and Terra Preta compost enriched with biochar, Mzee Mukoko has significantly enhanced soil moisture retention and fertility on his two acres, a critical buffer as Western Kenya faces more erratic, lower rainfall. He reports clear yield gains: maize with darker foliage, larger cobs, and more vigorous kernels; leafy vegetables that branch more, grow nearly twice the size of conventionally grown crops, and weigh more, with fewer pest and disease issues. Soil biology has rebounded, too: diverse earthworms and dung-beetle larvae now abound, bokashi consistently shows a vigorous whitish fungal community, and indicator plants of high soil quality (e.g., Bidens pilosa, Galinsoga parviflora, Camelina spp.) are more common, signals of improved structure and nutrient cycling.

5.1.2 Biodiversity and ecosystem services

The farm doubles as a biodiversity refuge. A dedicated woodland, mainly established by natural succession and featuring indigenous species such as Albizia spp., Markhamia lutea, Erythrina abyssinica, and giant bamboo, now hosts 25+ bird species and thriving bee populations. Mukoko is developing a nature trail and tagging trees to turn this habitat into a living classroom for visitors. Across the fields, intercropping of perennial and annual species sustains agrobiodiversity, breaks pest/disease cycles, and keeps soils active year-round. Nitrogen-fixing trees and shrubs (Sesbania sesban, Gliricidia sepium, Tephrosia vogelii, Inga edulis, Tithonia diversifolia) enrich soils naturally; bamboo biomass mulch (silica-rich) decomposes within 2–3 months to feed the soil; and plant-based biopesticides replace synthetics, supporting ecological balance.

5.1.3 System-level results

The integrated, space-efficient design maximizes local organic resources, cuts dependence on external inputs, and builds climate resilience. Outcomes observed over multiple seasons include: more fertile, moisture-stable soils; higher and more reliable yields; improved food quality and year-round availability from diversified cropping; and lower production costs through reliance on local inputs. In short, the farm demonstrates that ecological health and agricultural productivity are mutually reinforcing and achievable on small plots under dry-season stress.

5.2 Economic outcomes and impacts

Mzee Mukoko's agroecological model demonstrates that smallholder farming can be both environmentally sustainable and economically viable. By relying on locally available, low-cost inputs, he has drastically reduced expenses associated with synthetic fertilizers and pesticides, improving profitability while enhancing biodiversity and climate resilience.

His philosophy is simple: feed the household first, then sell the surplus locally. This approach minimizes transport costs, reduces post-harvest losses, and ensures food security for his family and community. Local markets, especially the nearby Luanda trading centre, provide a regular outlet for his produce.

Value addition is central to his economic strategy. On a modest scale, he processes crops such as cacao, canola, soya, avocado, tamarind, neem, olive, and castor into oils, powders, wines, and sweeteners. Surplus fruits become banana or tree tomato wine, jaggery from sugarcane, and fruit powders that extend shelf life and open year-round market opportunities. Even peels and scraps are transformed into fermented juices or compost, ensuring nothing goes to waste. His work embodies circular bioeconomy principles, turning waste into resources and creating multiple revenue streams.

Despite producing high-quality organic goods, Mukoko faces challenges in market recognition. Without structured premium markets, his produce competes with conventional food, often without price differentiation. He calls for dedicated organic and agroecological marketplaces that reward farmers for stewardship of healthy soils and safe food. Scaling larger value-addition ventures, such as commercial herb processing or compost packaging, remains constrained by finance, equipment, and market incentives.

Mukoko is equally committed to bridging the gap between grassroots innovation and research institutions. Collaborating with Masinde Muliro University and aspiring to partner with KALRO and KEMRI, he explores new value-addition opportunities for food and medicinal oils. He actively participates in farmer field days, using cooking demonstrations and tasting sessions to challenge food taboos and promote underused crops.

In his own words,

> ***There is so much that has been said about academics and agriculture... but what about this man in the village?***

Believing in the "tyranny of numbers," he urges farmers to create markets collectively rather than wait for them to emerge. Through training in value addition, food hygiene, and food safety, particularly targeting youth, he builds entrepreneurial capacity, stimulates local economic development, and cultivates the next generation of agroecological leaders.

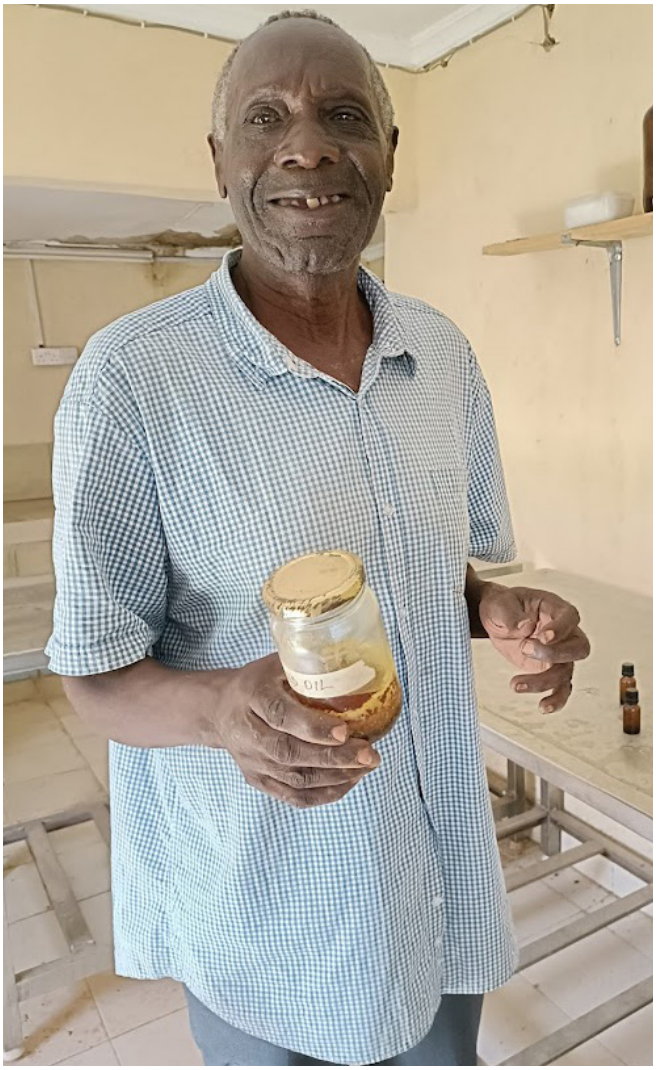

Figure 9. Mzee showcasing his value added product. Photo: © CIFOR-ICRAF/Anne Kuria

5.3 Planting seeds of change across generations

Through decades of pioneering agroecological innovation, Mzee Mukoko has become a transformative force in Vihiga County, empowering farmers, youth, and women with practical skills, market opportunities, and a vision for soil and food sovereignty. His mentorship has spawned entrepreneurs, inspired young leaders, and strengthened local economies, while his environmentally regenerative methods stand as a model for sustainable farming. Respected by peers, academia, and government alike, he is widely recognized as both a role model and a catalyst for agricultural transformation in the region.

Dr. Betty Mulianga, Chief Officer of Agriculture, Livestock, and Fisheries for Vihiga County, hails Mzee Mukoko as a model agroecological farmer and a key figure the county showcases as a best-practice example.

"He is self-driven, self-motivated, and deeply knowledgeable in agroecology. Passionate about mentoring people from diverse backgrounds, Mzee Mukoko has positively impacted communities within and beyond Vihiga County, including youth and women. His constant curiosity, daily reading, and readiness to experiment fuel the steady evolution of his innovations. Each visit reveals something new – ideas with the potential to transform farming in Vihiga."

Dr. Mulianga describes Mzee Mukoko as a leading force in aggregating and marketing organically produced goods from Luanda and beyond. She notes that his planned Mukoko Agroecology Innovation Hub will expand his mentorship outreach by hosting open days for Vihiga farmers to collectively showcase their products, advancing the county's agroecology and agripreneurship agenda. She calls him "an invaluable resource" and urges partners such as CIFOR-ICRAF to support his vision.

At the core of Mzee Mukoko's social impact is his commitment to fostering agroecological knowledge through community mentorship and hands-on learning.

His expertise draws from three primary sources:

- **Formal agricultural training** grounds his practice in sound agronomic principles.
- **Global best practices** have been gained through expos, farmer-to-farmer exchanges, and learning journeys within Kenya and across Africa, as well as building networks with farmers in Uganda, Kakamega, Busia, and Kiambu.
- **Deep local knowledge** has been developed over years of observation and experimentation, testing and refining new ideas in the field and adapting them based on practical results.

Professor Mwanje is an agroecology farmer, policy analyst, researcher, and former lecturer at Kenyatta University's Department of Environmental Sciences. He first met Mzee Mukoko in 2018 during a Vihiga County Department of Environment benchmarking visit to Mukono District, Uganda, to study cocoa farming. Both returned as pioneers of cocoa production in Kenya, Mzee establishing seedlings in Luanda sub-county, and Mwanje in North-East Bunyore, Emuhaya sub-county.

Since then, their friendship has flourished, grounded in shared learning and reciprocal innovation. Mwanje adopted several of Mzee Mukoko's techniques, including foliar biofertilizers that significantly boosted leafy vegetable yields. He also praises Mzee's mastery in producing premium natural soda ash (munyu), a food softener crafted through a meticulous six-step process, and in growing gigantic sweet pumpkins, locally celebrated for their flavour.

"Mzee Mukoko is a selfless and self-driven agroecology farmer-researcher who experiments with anything and everything, never stops learning, and, if supported, will continue to bring positive change to society at large. What he urgently needs is collaboration with research scientists and stakeholders to document, refine, and scale his agroecological innovations."

Beyond academic connections, Mzee Mukoko's mentorship has had long-term entrepreneurial impacts. James Okoba, now 50, recalls his 25-year mentorship journey:

"Every morning, I would collect market waste from Luanda Market to feed and raise Black Soldier Fly (BSF) at Mzee Mukoko's farm. Together, we tested the suitability of different organic resources, discovering, for example, that a mix of maize bran and urine produced larger, higher-quality BSF than fruit or vegetable waste alone."

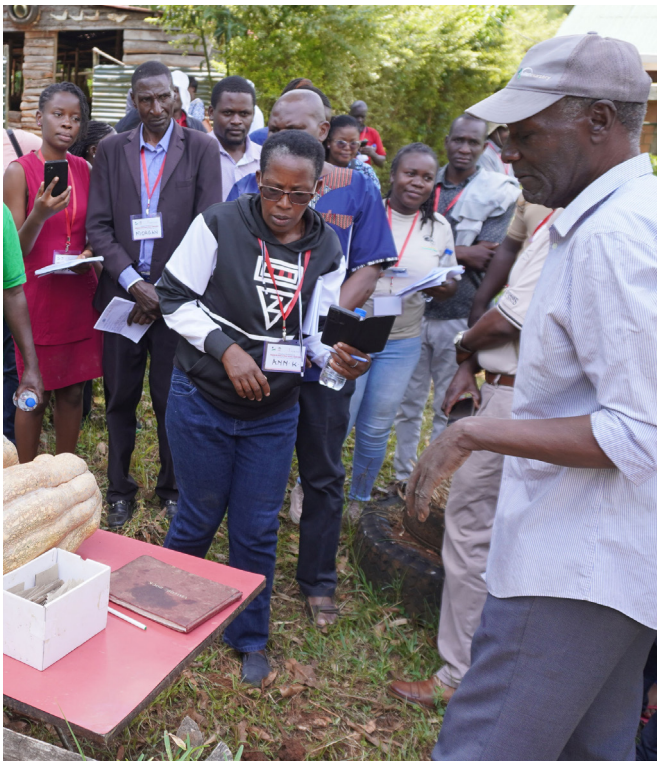

Figure 10. Mzee Mukoko hosting stakeholders from Vihiga, Nandi, and Kisumu counties. Photo: © CIFOR-ICRAF/Anne Kuria

Under Mzee's guidance, James mastered innovations such as biopesticides from Russian comfrey and Tithonia to control banana nematodes, herbal herbicides for Striga, biochar via pyrolysis, and Terra Preta to improve sandy soils. He learned to rear BSF for fertilizer and extract nutrient-rich BSF oil for human consumption. Mzee also trained him in value addition, cold-processing avocado oil, cocoa butter, and honey. James went on to found two companies, Maviology Services (biotechnology for environmental sanitation) and Messers Adfinitum Ltd (biochemistry and value addition).

Mzee Mukoko actively mentors both youth and women, pairing labour contributions with targeted, hands-on training. Youth focus on soil enhancement technologies, while women gain value addition skills to improve the quality, marketability, and profitability of their products. This inclusive model builds technical expertise and strengthens household incomes and community resilience.

Vincent Ochami, a 20-year-old full-time mentee, shares:

"Over the past year, I have gained invaluable hands-on skills, from carbonization and making Terra Preta to setting up multi-storey and vertical gardens. Guided by Mzee Mukoko's example, my approach to farming has been transformed, and I now inspire other youth and unemployed community members to engage productively through agroecology. I am confident these skills will one day enable me to run my own agroecology farm."

Mzee believes agroecology should be taught as a life skill, not just a classroom subject. He advocates for community learning farms and school demonstration plots where experiential learning can take root. Through these spaces and his farm-based training programmes, he urges participants to use local resources creatively, seeing farming not just as work but as a transformative practice that fosters self-reliance, resilience, and economic independence.

His lifelong commitment to learning, sharing, and mentoring reflects a vision of agroecology as both a way of life and a legacy, one capable of curbing rural–urban migration by giving young people the skills and purpose to thrive in their communities. mentorship journey:

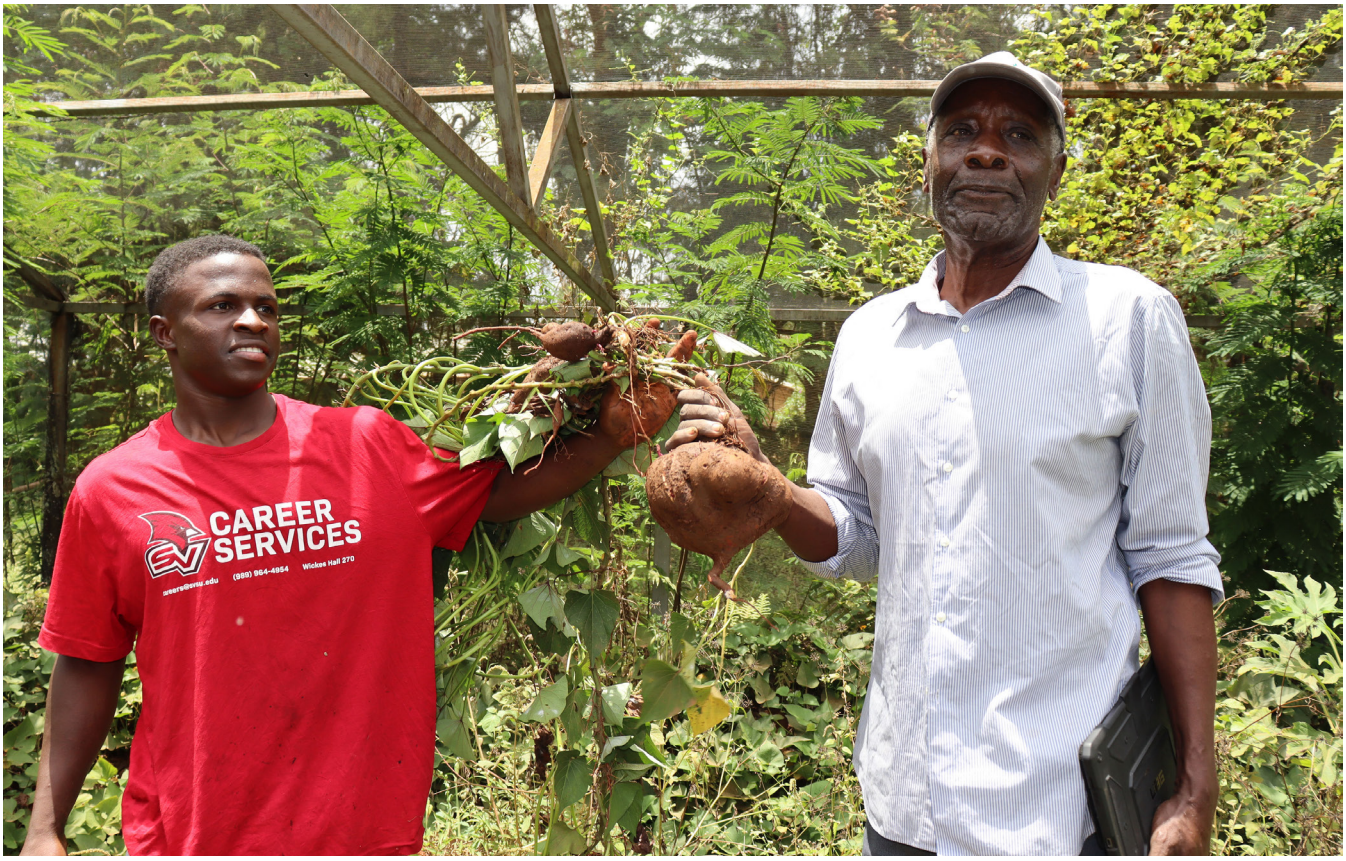

Figure 11. Mzee and a mentee showcasing some of their harvested produce. Photo: © CIFOR-ICRAF/Anne Kuria

6. Building the legacy: Mukoko Agroecological Innovation, Incubation and Training Centre

Despite his remarkable achievements, Mzee Mukoko faces persistent obstacles that limit the full realization of his vision. Many of his innovations, such as composts, biofertilizers, and organic pesticides, lack scientific validation, restricting their credibility and broader adoption. The absence of standardized production protocols undermines consistency, quality assurance, and trust in agroecological products. Limited documentation of his work further hampers knowledge sharing, while advancing age and insufficient labour make it challenging to expand his activities. Financial constraints, inadequate infrastructure, cultural resistance, and skepticism towards alternative foods like blackjack and potato vines, and the stigma around using human urine for soil fertility pose additional barriers.

Rather than deter him, these challenges have sharpened his vision through establishment of the **Mukoko Agroecological Innovation, Incubation, and Training Centre,** a vibrant, inclusive hub for nurturing agroecological knowledge, scaling innovation, and empowering communities. This one-stop facility will bring together farmers, youth, researchers, academia, policymakers, and development partners for hands-on learning, innovation, and benchmarking.

The Centre will feature regular expo days to showcase organic and value-added products, and a digital library offering practical “How-To” manuals on pest and disease control, composting, high-yield crop production, and seed preservation. It will also support biodiversity through an expanded seed bank for traditional crops, open to community contributions.

Mzee Mukoko’s vision extends to building complete value chains, such as cocoa, from cultivation through processing into butter, cosmetics, and edible products, creating opportunities for local enterprise and employment.

Central to his plan is developing “agroecological-preneurs” through tailored training:

- **youth** trained in kiln fabrication, soil enhancement tools, organic fertilizer production, BSF, and azolla farming
- **women** engaged in value addition, biochar production, and seedling propagation
- **children** introduced to agroecology via school garden programmes

To ensure credibility and adoption, he seeks partnerships with research institutions such as CIFOR-ICRAF for scientific validation, on-site demonstration trials, and standardization of production processes. He also invites collaboration with private sector actors for the fabrication of scalable, affordable agroecological tools for smallholders, schools, and cooperatives.

> ***My journey is not complete, and I’m not just an innovator. I’m looking for people to partner with, to pass on these innovations to future generations***

Mukoko advocates integrating agroecology into Kenya’s Competency-Based Curriculum as a life skill, supported by school demonstration plots and community learning farms. He envisions local innovation hubs for seed saving, experimentation, and enterprise incubation, alongside a youth-led agroecology cooperative for training, mentorship, processing, and value addition.

With the proper financial, technical, and infrastructural support, Mzee Mukoko believes his farm and knowledge systems can become a national and continental model of grassroots agroecological innovation. He calls on NGOs, universities, government agencies, innovation networks, and the private sector to partner with him in building this legacy, supporting infrastructure development, scientific testing, and certification of his innovations.

7. Conclusion

Mzee Mukoko's lifelong commitment to integrated agroecological farming fuses profound local wisdom with scientific principles and an unwavering dedication to community empowerment. His two-acre farm stands as a living laboratory, demonstrating environmental resilience, economic viability, and social inclusion in rural Kenya.

Through soil restoration using locally available organic resources, biochar production, space-smart farming, ethical pest management, and circular resource use, he has revitalized degraded soils, boosted biodiversity, and secured year-round productivity.

By mentoring youth, women, and fellow farmers, Mzee Mukoko is cultivating a new generation of agroecological practitioners equipped to transform rural livelihoods and drive sustainable food systems. His journey proves that agroecology is not just a farming method but a transformative pathway for food security, climate adaptation, and socioeconomic renewal.

Despite barriers such as limited scientific validation, resource constraints, and cultural resistance, his hands-on innovations and inclusive mentorship highlight the vast untapped potential of grassroots agroecology. His vision, embodied in the planned **Mukoko Agroecological Innovation, Incubation, and Training Centre**, offers a blueprint for scaling impact through mentorship, validation, value addition, and market linkages. This hub will train "**agroecological-preneurs**," preserve indigenous seeds, reduce rural-urban migration, and expand livelihood opportunities.

Mzee Mukoko's legacy is both an inspiration and a challenge: to rally coordinated partnerships that recognize, resource, and scale the work of grassroots innovators. His life's work is a reminder that the future of sustainable and regenerative food systems will be built from the ground up, rooted in local realities but carrying lessons of global significance.

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AGROECOLOGY IN ACTION!

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