CLIMATE RESILIENCE THROUGH AGROECOLOGY

Fifteen Years of Community-Led Sustainable Agricultural Practice in Kenya

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Background

When Grow Biointensive Agriculture Centre of Kenya (G-BiACK) first started documenting agricultural practices in central Kenya back in 2009, the landscape looked very different from what we see today. Walking through the farms in Kiambu, Muranga, and Machakos counties, you'd encounter farmers heavily dependent on synthetic inputs, bags of chemical fertilizers stacked outside homesteads, empty pesticide containers scattered around, and soils that looked increasingly depleted despite the constant chemical additions.

The dependency was almost heartbreaking to witness. Farmers knew something wasn't right. They talked about how their grandparents grew abundant crops without all these expensive inputs, how the rains seemed less predictable, how their children were getting sick more often. But they felt trapped. The extension officers told them to use more chemicals. The input dealers were always ready with new products. It was a cycle that kept getting more expensive and less effective.

That's when G-BiACK stepped in with what many farmers initially dismissed as "going backwards." The idea of double-digging beds by hand, making compost from kitchen scraps, saving seeds; it sounded like too much work for uncertain returns. What happened over the next 15 years changed the entire agricultural landscape of these three counties. This case study documents that transformation from the ground level, based on countless conversations with farmers, field visits, and witnessing the gradual but profound changes that occurred when communities embraced agroecological principles.

Impact at a Glance

- **30,000+ Farmers reached**
- **52% Adoption rate**
- **60% Synthetic input reduction**
- **30% Income increase**

Layout, Planning, and Technologies in Agroecological Units

Deep Land Preparation and Bed Design

The foundation of everything is the double-dug bed system. This method means digging down to about two spade depths, roughly 24 inches and loosening the soil to create a deep, healthy bed.

We've watched farmers transition from conventional tillage to this method, and the initial skepticism is always the same, "Why dig so deep when a tractor can do it faster?" But after one season, they see the difference. The soil structure changes completely. Water infiltration improves dramatically. Root penetration goes deeper.

On sloped areas, farmers now use raised beds for better drainage, while in drier zones, they've adopted sunken beds and zai pits for water retention. It's not a one-size-fits-all approach; each farm adapts the techniques to their specific microclimate and soil conditions.

Deep Land Preparation and Bed Design

Integrated Soil Fertility Management

The composting systems have become quite sophisticated over the years. What started as simple compost piles has evolved into systematic approaches using crop residues, kitchen waste, and animal manure. Many farmers now produce several types of organic inputs:

- Vermicompost for high-value crops
- Cold Compost
- Liquid manures like super magro
- Bokashi fermentation
- Biochar from agricultural waste

Integrated Soil Fertility Mangement

Seed Systems and Crop Diversity

Perhaps the most revolutionary change has been the return to locally adapted varieties. G-BiACK helped establish 15 community seed learning centers, and the impact has been remarkable. Farmers are now growing crops their parents had almost forgotten; indigenous vegetables like African nightshade (managu), spider herb (sagaa), and various amaranth varieties. Women have emerged as the primary custodians of these seed banks, and their knowledge of seed selection and storage has become invaluable community assets.

Seeds exchange and exhibition with farmers

Impact Assessment

Climate Resilience & Adaptation

Our projects have significantly strengthened both climate mitigation and adaptation in the farming communities we work with. Farmers capture carbon from the air when they grow crops like maize. The plants absorb carbon dioxide during growth and store it in their leaves, stems, and roots. Instead of burning or discarding the maize stalks after harvest, farmers return them to the soil by making compost and they also have improved management of soil organic matter (SOM), where increases of about 15% have been recorded. These figures come from annual soil sampling at consistent depths of 0–30 cm, with laboratory analysis using the Loss on Ignition (LOI) method. Because soil organic matter is roughly 58% carbon, the 15% rise in SOM translates to an estimated 8.7% increase in soil carbon. More than 10,000 trees have also been planted, contributing to eco-system

restoration, soil stabilization, and long-term carbon storage. At the same time, reduction of about 60% has been observed in the quantities of synthetic fertilizers being used, thereby reducing nitrous oxide emissions as well as the demand of inputs based on fossil fuel. Cover crops and perennials give additional benefits to soil fertility and carbon retention.

Biodiversity Conservation & Enhancement

Community seed banks well managed have preserved and promoted indigenous and open-pollinated seed varieties for conservation of biodiversity. Seed exchange events have helped transfer farmer-to-farmer knowledge and genetic resources, while documentation of seed characteristics and origin stories has helped sustain cultural heritage as well as genetic diversity.

Health & Nutrition Outcomes

There are substantial health benefits with an increased reduction of exposure to synthetic pesticides and fertilizers, that are harmful to nature. This also provides safer working conditions for farmers and a reduction in chemical-related illnesses, both acute symptoms and chronic conditions. Less incidence of respiratory problems and skin diseases has been reported, with environmental health benefiting from cleaner water sources due to less chemical runoff.

Farmers standing beside a compost pile

The participating households are enjoying nutritionally enriched diets owing to the increased dietary diversity as they produce an array of crops including indigenous vegetables, legumes, fruits, and cereals. Organic produce has higher nutrient density for better immunity and health. Thus, malnutrition cases have decreased, especially among children and vulnerable groups, while increased household food sovereignty guarantees the availability of freshly harvested foods throughout the year.

Farmers With their Harvest

Gender Equality & Social Empowerment

A lot of progress has been made in women's empowerment. The number of women occupying leadership roles across farming cooperatives, community committees, and market networks has increased by 40%. Women are occupying strategic decision-making positions and can now influence agricultural planning and resource allocation. Seed custodianship has grown into a strong women-led movement, with many operating community seed banks and spearheading indigenous seed conservation efforts. More training, finance, and marketing opportunities have equipped women to take greater control of household incomes. This has led to increased investment into health, education, and nutrition.

Findings

G-BiACK's evaluation is thorough and draws on 15 years of participatory monitoring and evaluation, incorporating quantitative indicators on the one hand and qualitative inspection on the other, thus providing a very well-rounded view of outcomes and impacts. It incorporates annual farmer surveys and focus group discussions that consider the challenges of various farming contexts, as well as innovations developed at the community level as solutions. Soil fertility assessment and biodiversity monitoring are considered across different categories of indicators.

Physical indicators include soil color, structure, moisture content, and the presence of micro- and macro-organisms that point to active soil life. Soil organic matter (SOM) is also tracked as a key marker, since a large share of it is carbon, making it a useful way to estimate soil carbon levels while also reflecting overall soil quality. Under biodiversity assessment, we focus on soil biota and functional diversity, with observations drawn from processes like decomposition and nitrogen fixation that demonstrate how soil ecosystems are recovering and supporting productivity. Economic analyses, including changes in household income, cost–benefit balances, and market participation, complement these measures by providing insight into livelihood improvements.

Collection of climate resilience indicators and adaptation outcomes give us insight into farmers' adaptation to emerging weather patterns, resource shortage, and climate-related risks.

Adoption and Reach:

- 52% Adoption Rate among participating farmers
- 30,000 + Farmers Reached across three counties

Environmental Transformation:

- Synthetic input reduction: 60%
- Trees planted: 10,000
- Soil organic matter increase: +15%
- Demonstration farms: 30

Social Transformation:

- 40% increase in women's leadership
- 45 Seed events and fairs organized

Social impact measurement will gauge gender and youth participation vis-a-vis equity and inter-generational transfer of knowledge placed as the core of program outcomes.

Social Transformation

Methodology

- **Demonstration Farms:** There are 30 demonstration farms serving as live laboratories, where farmers can see and learn first-hand practice methods of agroecosystem farming.
- **Farmer-to-Farmer**: Initiating mutual learning through cross visits, farmer networks, and farm field days through which farmers build trust and hasten adoption.
- **Community Centers:** 15 seed learning centers serve as hubs for knowledge sharing, seed banking, and community organization.

Core Agroecological Practices Implemented

Method	Further information	Agroecology principles
Deep land preparation	Covering soils with dried leaves, straw and green manure leaves	Synergy, biodiversity, soil health
Composting	Composting by use of crop residues, kitchen waste, and animal manure to improve moisture retention, increase the level of organic matter, and increase minerals and microbial activities in the soil.	Recycling, soil health, efficiency, input reduction
Seed Saving	Community-managed seed banks with women as custodians. Regular seed exchange, seed forums Preserved drought-tolerant varieties.	Diversity, efficiency, circular and solidarity
Agroforestry	Planting of trees like lucerne and calliandra for fodder, and moringa and neem as herbs.	Synergy, Biodiversity
Livestock Integration	Crop and small livestock integration (African integrated farming system)	Crop and small livestock integration (African integrated farming system)

Challenges & Lessons Learned

Key Challenges

- **Policy Environment**: Seed policies that restrict farmer-managed seed systems and limit the integration of agroecology in national agricultural policies.
- **Market Challenges**: Limited markets for agroecological products and high costs of organic certification processes.
- **Resource Constraints:** Inadequate government extension support and limited funding for scaling agroecological practices.
- **Cultural Resistance:** Initial skepticism from communities accustomed to conventional Farming methods and instant results from synthetic inputs.

Lessons Learned

- **Patience & Persistence:** Agroecological transformation requires time. Building soil health and farmer confidence is a gradual process that yields long-term benefits.
- **Community-Centered Approach**: Success comes from working with existing community structures and empowering local leadership rather than imposing external solutions.
- **Farmer-Farmer Trainings Demos:** Visible success stories and peer learning are more powerful than theoretical training in driving adoption.

Critical Success Factors

- **Partnership:** Strong collaborations with local and international organizations
- **Evidence-Based:** Continuous monitoring and documentation of impacts
- **Capacity Building:** Investment in local expertise and leadership development
- **Adaptive Management:** Flexibility to adapt approaches based on local contexts

Recommendations for Policy and Practice

Based on fifteen years of observation and documentation, several key recommendations emerge for policymakers and development practitioners.

- **Policy Integration:** Agroecology needs to be explicitly integrated into national agriculture, environment, and climate policies. This isn't just about adding a section on organic farming – it requires rethinking how agricultural development is planned and funded. Seed policies must be reformed to recognize and support farmer-managed seed systems. Community seed banks should receive the same support as major seed companies, including quality assurance and marketing support.
- **Extension System:** Reform Agricultural training institutions need curriculum reform to include agroecological principles and practices. The current focus on conventional agriculture leaves extension officers unprepared to support farmers interested in sustainable alternatives. The farmer-to-farmer learning model should be formally recognized and supported. Lead farmers who have successfully adopted agroecological practices should be integrated into official extension systems.
- **Market Development:** Simplified organic certification processes for small-scale farmers would help access premium markets. Participatory guarantee systems, where communities certify each other's practices, have shown promise in other countries. Public procurement policies should prioritize agroecological products for schools, hospitals, and other government institutions. This would provide stable markets while supporting public health objectives.
- **Research and Documentation:** More systematic documentation of agroecological practices and outcomes is needed. Farmer participatory research approaches should be supported to generate locally relevant knowledge. Long-term studies comparing agroecological and conventional systems across different ecological zones would provide stronger evidence for policy decisions.

Community Voices

Patrick Muthemi, Kitabasiye Community

"The 2017 drought almost broke me. All my neighbors who were still using chemical fertilizers lost everything. But my farm, which had been building soil organic matter for five years through composting and cover cropping, actually produced a harvest. Not a big one, but enough to feed my family and have something to sell. That's when the whole community really took notice. Now I host field days where farmers come to see our water harvesting structures and learn about drought-resistant varieties. My son, who was working in Nairobi, came back to help expand our agroecological practices."

"For many years, we bought seeds every planting season, and that was costly and stressful, especially when they were not available. We learned during the training on how to preserve the indigenous seeds. These days, we plant from our own seed banks and share seeds with other farmers of the community. These jars of seeds actually mean security for our families because today we do not worry about what to plant. They carry our culture and tradition within them, preserving the heritage so future generations will be able to grow the very same healthy and resilient crops. This work has given us pride and dignity for knowing that it is preserving life itself."

Grace Musyoki (left) and Agnes Kileti (right) from Mwanga Community

Mama Ruth from Kanini Kaseo Community

"Before I had entered the program, farming was always uncertain for me. The soil was tired, my yields were low, and sometimes I could not produce food for my family. I have learned through training on sustainable farming methods to care for the soil, plant to conserve moisture, and diversify my crops. What a change! The farm is now healthy, and I am able to feed my family throughout the year and even sell what remains. It's no longer hard to work on the field; rather, it is a source of enjoyment and pride. This transformation has inculcated with me the belief that farming can be a decent living for anyone with the right knowledge and practices."

Future Prospects and Scaling Opportunities

The momentum for agroecological transformation is building across Kenya and the broader East African region. G-BiACK has already supported the establishment of satellite centers in Uganda, Tanzania, Malawi, Rwanda, Ghana, Nigeria, and Sierra Leone. This regional expansion demonstrates the adaptability of agroecological principles across different contexts.

Future scaling efforts should focus on:

- Establishing more community seed learning centers and demonstration farms
- Digitizing training content to reach farmers in remote areas
- Strengthening partnerships with schools to engage younger generations
- Advocating for supportive policy environments at the national and county levels
- Developing sustainable financing mechanisms for agroecological transitions

The 52% adoption rate among farmers exposed to G-BiACK programs suggests that agroecological practices are viable and attractive when properly introduced and supported. With appropriate policy support and continued technical assistance, this transformation could be replicated across much of sub-Saharan Africa.

Conclusion

Fifteen years of documentation have shown that agroecological transformation is not only possible but profitable and sustainable. The farmers in Kiambu, Muranga, and Machakos counties have demonstrated that agriculture can be productive, environmentally regenerative, and socially just simultaneously.

The journey hasn't been easy, and challenges remain. But the evidence is clear: when farmers have access to appropriate knowledge, supportive communities, and basic resources, they can create farming systems that work for people and planet. The question now is whether policymakers and development institutions will provide the support needed to scale these successes.

As climate change intensifies and conventional agriculture faces increasing sustainability challenges, the experiences documented here offer hope and practical pathways forward. The farmers of central Kenya have shown the way – now it's time for policies and institutions to catch up.

Pesticide Action Network International (PAN International) is a network of over 600 participating nongovernmental organizations, institutions and individuals in over 90 countries working to replace the use of hazardous pesticides with ecologically sound and socially just alternatives.

Web: pan-international.org

Bluesky: paninternational.bsky.social

Facebook: PesticideActionNetworkInternational

Linkedin: Pesticide Action Network International

The Grow Biointensive Agriculture Centre of Kenya (G-BiACK)

Empowering Communities, Transforming Lives

G-BiACK is a training and demonstration center that promotes Agroecological agriculture, food sovereignty and environmental conservation through the GROW BIOINTENSIVE method.

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This case study was produced by **G-BiACK** in collaboration with PAN International. It is one in a series of PAN case studies showcasing the benefits and contributions of agroecology to climate resilience, food security, health and biodiversity protection. The series is produced by members of the PAN International Agroecology Workgroup. The full series is available in a number of languages via the QR code.

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