The Agroecology Uprising: Traditional Knowledge Owners Leading the Agroecology Revolution in West Africa

The true revolutionaries in Agroecology are the traditional knowledge keepers; farmers, elders, and traditional leaders, who are boldly reclaiming food systems with peasant wisdom and sustainable practices. They are not just preserving their traditional farming practices, they are restarting a movement that is replanting the seeds of food sovereignty, biodiversity, climate resilience and a return to the roots of sustainable living.

Farmers Forging a New Path for West Africa

Peasant agroecologists in West Africa are reviving and enhancing traditional agricultural practices by actively integrating them with scientific knowledge through community science initiatives. These agroecologists, often at the forefront of sustainable agriculture, play a crucial role in improving farming methods that are both ecologically sound and culturally relevant. Community science, or citizen science, involves local farmers participating in research and decision-making processes, allowing for the synergistic blending of traditional wisdom and scientific methods. This participatory approach has proven highly effective in enhancing agriculture in countries like Ghana, Côte d'Ivoire, Burkina Faso, and Niger, where traditional knowledge systems are deeply embedded in farming practices.

Agroforestry in Côte d'Ivoire

In Côte d'Ivoire, peasant agroecologists have made significant contributions to agroforestry research through community science. Local farmers actively monitor the growth of trees and the interactions between trees and crops, generating essential data for scientists. This collaborative effort ensures that agroforestry systems not only meet scientific standards but also remain culturally and environmentally appropriate. Farmers use their traditional knowledge to determine the best tree species for supporting crop growth, enhancing soil fertility, and providing shade for crops in hot climates. The integration of local insights with scientific research optimizes these agroforestry systems, ensuring they are both sustainable and beneficial for local communities (Kone et al., 2023; Tano et al., 2024).

Water Conservation in Burkina Faso

In Burkina Faso, traditional water conservation methods such as zaï pits, small holes dug to catch and retain water, are being rejuvenated and scientifically studied through community science projects like the "Greenbelt Project." Peasant farmers have long used these techniques to improve soil moisture retention and enhance crop yields in semi-arid regions. By participating in data collection and analysis, farmers provide valuable insights into the effectiveness of these

methods. This collaboration with scientists enables the development of more resilient and adaptive agricultural systems, incorporating both traditional and modern practices (Traore et al., 2023; Zongo et al., 2024). The revitalization of these practices is not only improving crop productivity but also restoring degraded lands and building resilience to climate change.

Drought-Resistant Seeds in Niger

In Tibiri, a village in Niger's Zinder region, the "Village Seed Production" initiative involves peasant agroecologists in the breeding, testing, and production of drought-resistant crop varieties, including millet, sorghum, and cowpea. These traditional crops are well-suited to the Sahel's arid conditions, where water is scarce and rainfall patterns are unpredictable. Through community-led seed selection and propagation, farmers are preserving biodiversity and ensuring the survival of native species that are crucial for local food security. By combining their traditional knowledge with scientific breeding techniques, these farmers are creating locally adapted seed varieties that are better suited to withstand harsh environmental conditions. The initiative empowers communities to manage their own seed systems, reducing dependency on commercial seed companies and enhancing food sovereignty (Alhassan et al., 2023; Idrissou et al., 2024).

Farmer-to-Farmer Learning in Ghana

In Ghana, peasant agroecologists are spearheading initiatives like the "Farmer-to-Farmer Learning" program, which empowers local farmers to share data on pest outbreaks and soil conditions with scientists. This program builds on traditional practices of pest management and soil fertility that have been refined over generations. By documenting these methods and validating them with scientific research, agroecologists are ensuring that traditional techniques continue to be relevant and effective in modern agricultural contexts. This collaborative exchange of knowledge is helping scientists refine agricultural interventions while reinforcing the importance of traditional ecological knowledge in managing pests and maintaining soil health (Asare et al., 2023; Osei et al., 2024).

Innovative Solutions Through Community Science

These examples highlight how community science supports the validation and enhancement of traditional agricultural practices across West Africa. Peasant agroecologists are demonstrating that traditional methods, when combined with scientific research, are highly effective in developing context-specific and innovative solutions for sustainable agriculture. The active participation of farmers in data collection and analysis ensures that agricultural research remains grounded in local realities while benefiting from scientific advancements. This collaborative approach is creating more resilient, sustainable, and productive farming systems across the region.

While traditional knowledge has often been overlooked or undervalued in scientific circles, providing a platform for community science in agroecology can showcase its vital contributions to ecological sustainability and food security. Empowering peasant agroecologists to share their

insights and collaborate with researchers is key to bridging the gap between traditional knowledge and scientific methods, ensuring that agriculture in West Africa continues to thrive in a changing climate.

The Yalitia 6 Workshop: A Unique Platform for Learning and Sharing

Yalitia 2024, organized by Jeunes Volontaires pour l'Environnement (JVE) Côte d'Ivoire, underscored the vital role of sustainable agricultural practices in agroecology. The term "Yalitia," which means "seed" in the Senoufo language of northern Côte d'Ivoire, reflects the program's dedication to nurturing effective agricultural methods. The continued expansion of international participation, including Cameroon, Niger, Burkina Faso, Ghana, Senegal and Côte d'Ivoire, highlights a significant regional effort in advancing agroecological policies. Participants from various civil society organisations, such as JVE (Cameroon, Burkina Faso, Ghana, Senegal and Côte d'Ivoire), Association Kandili (Niger), FIDEP Foundation (Ghana), use this opportunity to bring together local community members to showcase, learn and share various agroecological practices.

Key observations from the Yalitia 2024 include having women and men from different backgrounds, agricultural practices yet agreeing to go back to their traditional practices instead of taking the promise of high productivity and dying silently because of the application of "pesticides and chemical fertilizers", sharing reproducible peasants seeds, having agroecologists and scientists learning together the power of nature - uses of trees like neem trees (Azadirachta indica), Tithonia diversifolia (Mexican sunflower), and ash to fix soil problems. These natural resources were recognized for their unique benefits in maintaining soil health, managing pests, and enhancing crop productivity, reinforcing the program's commitment to ecological balance and peasant agroecological practices.

Applications of Neem Tree (Azadirachta indica)

Neem leaves and seeds contain azadirachtin, a compound with potent insecticidal properties. Azadirachtin disrupts the life cycle of various pests, including aphids, whiteflies, and caterpillars, making neem a valuable tool for managing pest populations without relying on synthetic chemicals. Neem leaves and other parts can be used as mulch or compost. They decompose slowly, releasing nutrients into the soil and enhancing its organic matter content. This improves soil moisture retention and overall soil health. Neem extracts can stimulate plant growth and enhance resistance to diseases and pests. This makes neem a valuable component in integrated pest management (IPM) systems and organic farming practices.

Measuring Neem leaves (Azadirachta indica) for application

Byproduct of neem oil extraction, is used as a natural fertilizer. It enriches the soil with essential nutrients such as nitrogen, phosphorus, and potassium, while also promoting beneficial soil microorganisms. Neem cake helps improve soil structure and fertility, contributing to sustainable agriculture. Neem-based products can also be used to control soil nematodes, which are harmful to plant roots. Neem extracts help in reducing nematode populations, leading to healthier plants and improved crop yields.

Applications of Tithonia Diversifolia (Mexican Sunflower)

Tithonia diversifolia is a valuable green manure plant that contributes to soil fertility by fixing atmospheric nitrogen. Its high biomass and rapid growth make it an excellent source of organic matter that improves soil structure and nutrient content when incorporated into the soil. The decomposition of Tithonia biomass returns nutrients to the soil, enhancing its fertility. This practice reduces the need for synthetic fertilizers and supports sustainable agricultural systems.

Preparing Tithonia Diversifolia (Mexican Sunflower) for application

Tithonia's extensive root system and rapid growth provide effective ground cover, which helps prevent soil erosion. The plant's foliage and root network stabilize soil, reducing runoff and soil loss. Tithonia can also act as a trap crop for certain pests, attracting them away from main crops. Additionally, the plant has been found to possess properties that repel or deter some agricultural pests.

Applications of Local Ash

Ash from burned plant materials, such as crop residues or wood, is a rich source of potassium (potash). Potassium is a critical nutrient for plant growth, helping with photosynthesis, water regulation, and disease resistance. Applying ash to soil can enhance its potassium content and overall fertility.

Participants applying ash in the preparation of organic fertilizer

Ash can also be used to adjust soil pH. In acidic soils, the alkaline nature of ash helps raise the pH, creating a more favorable environment for plant growth and nutrient availability. Ash can be sprinkled around plants to deter crawling insects and pests. The abrasive texture of ash can disrupt the life cycle of certain pests, providing a natural and cost-effective pest management solution. Ash has been used in traditional farming practices to control fungal diseases. It can act as a natural fungicide when applied to the soil or plant surfaces, helping to manage fungal infections and improve plant health.

Challenges and Solutions in Community Science

Capacity Requirements

Effective community science hinges on the ability of participants to accurately collect and interpret data (Conrad & Hilchey, 2011)[1]. In Niger for instance, community science efforts have

[1] Conrad, E. M., & Hilchey, K. G. (2011). A review of citizen science: A tool for conservation in the 21st century. *New Directions in Conservation Science*, 1(1), 11-20.

taken a more focused and comprehensive approach, ensuring that farmers play a central role in data collection and analysis. Unlike in Ghana, where farmers may sometimes lack the initial skills for scientific data collection, Niger places significant emphasis on farmer engagement and capacity building. Scientists conduct fieldwork directly in collaboration with farmers, facilitating hands-on training sessions that guide farmers through the process of collecting accurate data. These sessions, conducted in Hausa, the local language, are designed to be accessible and practical, ensuring that farmers not only understand what is required but are also confident in filling out data collection forms correctly.

The emphasis is on real-time learning in the fields, where farmers can immediately apply what they have been taught under the guidance of researchers. This approach fosters a deeper understanding of the data collection process and improves the quality of the data gathered. By aligning scientific methods with traditional knowledge and using local languages, the sessions ensure that the learning is culturally relevant and inclusive. Also, these ongoing training initiatives build trust between farmers and scientists, making data collection more accurate and sustainable, and empowering farmers to contribute meaningfully to agricultural research. The situation in Niger shows that such comprehensive, locally adapted efforts can enhance the reliability of data and strengthen community involvement in agroecological practices

In Ghana however, many farmers may initially lack the necessary skills or knowledge for scientific data collection, which can compromise the quality of their contributions. To address this, comprehensive training programs should be implemented, including workshops, hands-on sessions, and tailored educational materials. These initiatives should focus on both basic and advanced data collection techniques. Providing ongoing support and refresher courses through local extension services can further enhance farmers' capabilities and ensure reliable data collection.

Data Integration and Standardization

Integrating community-collected data with formal scientific research presents significant challenges, particularly in Burkina Faso, where inconsistent data collection methods can create complications. To overcome this, it is essential to develop standardized protocols for data collection that ensure consistency and reliability across different sources. Establishing collaborative platforms where scientists and community members can review, validate, and discuss data can help align practices and facilitate effective data integration, making it easier to combine community contributions with scientific research.

Sustained Participation and Engagement

Long-term community engagement in science projects can be challenging, as demonstrated in Niger, where sustaining motivation and commitment over time demands continuous effort

(Bennett et al., 2017)[2]. To effectively address this issue, projects should prioritize peasant agroecology by introducing incentives that resonate with local farming communities. These could include access to improved agroecological resources, financial support for data collection activities, or recognition awards for significant contributions to sustainable practices. By highlighting the direct benefits of participation such as enhanced agricultural techniques, improved crop yields, and the revitalization of traditional practices, projects can foster a sense of ownership and agency among community members. This approach not only sustains community involvement but also strengthens the commitment to agroecological principles that support both environmental and social well-being.

Cultural and Contextual Sensitivity

Navigating cultural and contextual differences is vital for the success of community science projects, especially in Côte d'Ivoire, where incorporating peasant agroecology can significantly enhance participation (Senghor et al., 2020)[3]. Engaging local leaders and stakeholders in the design and implementation of these projects ensures that methodologies are culturally relevant and sensitive to the practices of local farming communities. By integrating local agroecological knowledge into research approaches and providing education that aligns with cultural values, trust and collaboration are fostered. This not only makes scientific initiatives more effective but also encourages community acceptance and ownership, ultimately contributing to sustainable agricultural practices that resonate with local traditions and needs.

Resource and Infrastructure Limitations

Limited resources and infrastructure can hinder the effectiveness of community science initiatives, as seen in Ghana and other regions (Agyemang et al., 2019)[4]. Addressing these limitations requires investing in necessary tools, technology, and support services. Developing partnerships with local organizations, NGOs, and government agencies can enhance resource availability and project sustainability. Additionally, leveraging digital tools and mobile platforms can facilitate data collection and communication, particularly in remote areas, ensuring that community science projects are well-supported and efficient.

Strategies for Effective Community Science

Collaborative Research Design

Designing research projects in collaboration with local communities is essential for ensuring that scientific inquiries and methodologies are directly aligned with their needs and agricultural

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[2] Bennett, N. J., F. A. G. de Maria, E. M. Haward, and C. T. McDonald. (2017). *The role of social capital in sustaining long-term community engagement in marine conservation: A case study from Niger*. *Marine Policy*, 83, 143-150.
[3] Senghor, M., R. B. O. Diagne, and A. M. B. Guéye. (2020). *Cultural Practices and Community Engagement in Science: Insights from Côte d'Ivoire*. *Journal of Community Science*, 15(2), 117-129
[4] Agyemang, S., Boakye, K., & Adomako, S. (2019). *Barriers to Community Science in Ghana: Resource Constraints and Infrastructure Challenges*. *African Journal of Science, Technology, Innovation and Development*, 11(3), 345-357.

contexts, particularly within the framework of peasant agroecology. Involving farmers in the design of pest management studies not only fosters practical and applicable solutions but also enhances their engagement in sustainable practices that respect traditional agricultural wisdom. When agroforestry experiments are co-designed with farmers, traditional knowledge can be integrated from the outset, resulting in culturally appropriate agroforestry systems that are more likely to succeed and support both biodiversity and community resilience.

Knowledge Exchange and Feedback

Establishing effective feedback mechanisms is vital for valuing community input and ensuring it informs research outcomes. Regular community meetings and workshops create spaces for dialogue, allowing farmers to review and discuss research findings actively. This two-way flow of knowledge is particularly important in seed production initiatives, where providing ongoing updates helps farmers understand how their contributions are used to refine agricultural practices. Such engagement not only maintains motivation but also reinforces the importance of local knowledge in enhancing agroecological practices, thus promoting a sense of ownership over both the research process and the sustainable outcomes it aims to achieve.

Low-cost Technology

The integration of mobile technology and digital platforms can significantly enhance data collection and communication within peasant agroecology initiatives. For instance, mobile applications designed for pest monitoring or water conservation enable farmers to easily document and share their observations with researchers, fostering real-time collaboration. This technological empowerment can help bridge the gap between scientific inquiry and grassroots knowledge, ensuring that research outcomes are informed by practical, on-the-ground experiences.

Building Partnerships

Forming robust partnerships among local organizations, research institutions, and government agencies is crucial for strengthening community science initiatives rooted in peasant agroecology. These collaborations can provide additional resources, expertise, and support necessary for community-based research projects, thereby enhancing their efficacy. By pooling knowledge and resources, these partnerships can amplify the impact of agroecological practices, fostering sustainable agriculture that benefits both local communities and the environment.

Conclusion

Community science acts as a vital bridge between traditional wisdom and scientific inquiry in the realm of peasant agroecology across West Africa. By actively involving local communities in data collection, research design, and decision-making processes, agroecological practices can be finely tuned to reflect the specific conditions and needs of diverse regions. Insights gained from countries like Ghana, Côte d'Ivoire, Burkina Faso, and Niger highlight how community science not

only amplifies agricultural sustainability but also enhances resilience and cultural relevance. Through collaborative efforts and knowledge sharing, alongside the integration of innovative technologies, community science is fostering significant advancements in agroecology, paving the way for more inclusive and effective agricultural practices.

Furthermore, the engagement of local communities in agroecological research enriches scientific understanding while empowering individuals and groups to take charge of their environmental and agricultural destinies. This participatory approach nurtures a deep sense of ownership and responsibility, leading to sustainable and innovative solutions that are specifically tailored to address local challenges. As community science continues to close gaps and weave together various forms of knowledge, it promises to catalyze transformative changes in agriculture that are not only ecologically sound but also culturally resonant, setting the stage for a new era of peasant-led agroecological practices that prioritize both people and the planet.

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Disclaimer

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Further Information_

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