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Policy Brief

Valorizing Underutilized Tree Species for Soil Fertility Improvement: Agroforestry for Future Soil Health

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Introduction

Declining soil fertility and soil erosion are increasingly threatening the sustainability of small scale farming systems throughout Africa, and affordable external nutrient inputs are seldom available to farmers. Agroforestry practices, particularly the use of green manure from tree species, offer a viable solution to improve soil health and boost agricultural productivity. Leaf litter from available agroforestry tree species, is a source of nutrients and organic matter when it decomposes and, could contribute to replenish soil. It is necessary to understand the nutrient content of leaf litter and their release pattern during the mineralization process. We provide a summary of findings and policy recommendations based on a study conducted in Rwanda's semi-arid (Kayonza) and humid highland (Musanze) regions, focusing on six agroforestry species: *Calliandra calothyrsus* and *Alnus acuminata* (N-fixing), *Croton megalocarpus* and *Markhamia lutea* (native), *Grevillea robusta* and *Eucalyptus globulus* (non-Nitrogen fixing).

Despite the proven potential of agroforestry tree species to enhance soil fertility through organic matter inputs, green manure from many native and nitrogen-fixing tree species remain underutilized by farmers. There have been relatively few studies investigating the nutrients cycling in Rwandan agroforestry systems in terms of litter fall production, litter decomposition and nutrient release. This underutilization represents a significant missed opportunity to leverage these species' ability to enrich soils with vital nutrients through litter decomposition, offering a sustainable and eco-friendly alternative to synthetic fertilizers.

It is crucial to recognize and integrate the underutilized species into farming practices to foster resilient and sustainable agricultural systems. Species-specific information as source of organic inputs is largely lacking, but very much needed for decision-making. As government of Rwanda is currently promoting agroforestry to provide potential restoration solution to land degradation, apply the underutilized green manure to improve species-specific adoption, enhance soil nutrient status, soil structure, reduce demand for inorganic fertilizers and thereby reduce greenhouse gas emissions. Successful valorization of agroforestry species in terms of their green manure is dependent upon ensuring an enabling policy. It is also a good response to sustainable development goals (SDG) number 2 (Zero hunger); number 13 (climate action) as the use of inorganic fertilizers stand for a significant part of Rwanda's greenhouse gas emissions.

Key Research Findings

- There are a number of different agroforestry practices that are recognized as good practices. These include the integration of high-value green manure into efficient nutrient cycling and, mixed leaf litter application resulting into a more balanced and sustained nutrient release compared to single-species leaf biomass due to nutrient profiles. Mixing N-fixing species with native species significantly boosts nutrient release through species diversity and promotes synergistic interactions between species, towards long-term improvements in soil organic matter.
- The integration of species-specific traits into agroforestry systems has not yet been fully optimized. The characterization of leaf traits, such as thin leaves and higher

specific leaf area, can promote the use of species with favorable traits to accelerate decomposition and enhance nutrient cycling. By selecting agroforestry species based on these traits, farmers can improve soil fertility more efficiently, reducing the reliance on synthetic fertilizers and fostering more sustainable agricultural practices.

- The emphasis was placed on the importance of species that decompose slowly but play a crucial role in contributing to long-term soil organic matter formation due to their nutrient content. While these species may not provide immediate nutrient release, they contribute to the gradual accumulation of organic matter, enhancing soil structure and long-term fertility. Policy makers should encourage the integration of these species into agroforestry systems as part of a balanced approach to sustainable soil management. Promoting these species, alongside faster-decomposing varieties, ensures that soils maintain a steady supply of nutrients over time while building resilience against erosion and nutrient depletion.

Policy Implications

The findings from this study underscore the significant role of agroforestry by valorizing green manure of under-utilized agroforestry species, whereby farmers can access affordable organic inputs that improve soil health and crop productivity. While the need to adopt these practices is clear, the time needed to secure real effects on the ground for visible benefits may slow adoption. Addressing these challenges highlight the need for rigorous implementation of the Rwanda Agroforestry Strategy and Action Plan that promotes sustainable land-use practices. Furthermore, the study illustrates that for effective agroforestry systems we have to ensure smart species selection based on morphological traits, resilience under varied growing conditions and real capacity to enhance soil fertility. Importantly, the limited awareness of green manure application among farmers suggests that educational policies aimed at developing outreach campaigns that communicate the advantages of these practices to local communities are crucial.

Policy Recommendations

1. Promote agroforestry species selection based on leaf trait-based approaches for enhanced soil fertility management

Develop guidelines for agroforestry practitioners to consider leaf traits when selecting tree species, promoting species with traits that match the specific environmental and soil fertility needs of different regions. This approach will help policy makers recognize the tangible benefits of utilizing species with favorable traits to enhance soil fertility and promote sustainable land management practices.

2. Promote native tree species for biodiversity and agroforestry intensification

Encouraging the conservation and widespread adoption of native species in agroforestry practices can significantly increase the number of scattered trees on croplands and agroforestry areas. Valuing these species is key to intensifying agroforestry systems on all suitable lands while supporting biodiversity. Integrating native species into agroforestry promotes sustainable land use, enhances ecosystem services, and contributes to long-term agricultural productivity

3. Improve resilience of agroforestry systems with mixed litter from under-utilized tree species

Promoting the adoption of underutilized agroforestry species offers a cost-effective, eco-friendly alternative to synthetic fertilizers, particularly in resource-constrained farming communities. By incentivizing the use of mixed litter through agricultural extension services and farmer training programs, the benefits of green manure can be effectively communicated. This approach emphasizes the role of these species in enhancing long-term soil health, reducing reliance on chemical inputs, and fostering environmentally friendly sustainable agricultural practices.

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Higher crop yields, less fuel use, less pollution from cooking and reduced climate impacts: Can smallholder farmers in Rwanda achieve all these benefits at the same time?

by

Solange Uwingabire




Introduction, Rationale and Methodology

Rwanda has a high population density (525 people per km^2), which is projected to increase to 987 people per km2 by 2050. The high population coupled with unstainable farming practices are major causes of land degradation, increased deforestation and diminishing soil fertility. The majority of the population use wood biomass (57% firewood and 23% charcoal) and inefficient stoves resulting to unsustainable woodfuel extraction and significant emissions with negative health implication to the people. In addition, there are major soil constraints in Central plateau and Eastern Savanna agro-ecological zones (AEZs) including nutrient depletion in combination with low permanent charge (0.5 to 2.45 cmol (+)/kg), soil acidity (pH below 5.5), Aluminum (Al) toxicity, and soil organic matter (SOM) depletion.

Concurrently, the rising population, ineffective species-user-site matching, insufficient management, and premature cutting of trees, have resulted in a significant imbalance between wood supply and demand. The shortage was anticipated to be 4.3 million tons (oven dry weight) in 2017, with a forecast of 7.5 million tons by 2026.

To alleviate the soil fertility problem and boost crop yields, significant measures have been proposed, including liming acidic soils, increasing the use of inorganic or organic fertilizers, and promoting agroforestry. However, the use of inorganic fertilizers is problematic due to their high cost and negative environmental effects. In addition, organic fertilizers such as manure, despite its high nutrient content, cannot be entirely absorbed once it is applied to soils, resulting in rapid nutrient release and leaching. Manure also needs to be applied annually because microbial decomposition continues all year round, leading to leaching of the nutrients before the next planting season'.

The government has proposed that the wood deficit problem be remedied by more efficient alternative fuels (biogas, pellets, briquettes, and liquid petroleum gas), as well as the building of modern kilns for charcoal production and improved cook stoves. However, not enough effort has been made and the gap between demand and supply of biomass energy is increasing. Meanwhile, there is pressure at the global and local levels to protect the environment without compromising sustainability of agriculture.

Rwanda is promoting use of agroforestry to provide potential restoration solution to land degradation. The adoption of biomass cookstoves, specifically Top-Lit Updraft (TLUD) gasifiers, could play a crucial role. TLUD gasifiers pyrolyze biomass to generate heat for cooking while simultaneously producing biochar, which can contribute to soil improvement. However, while Biochar has demonstrated a positive effect on soil quality, its efficacy as a nutrient supplier is limited because of its relatively nutrient content and recalcitrant property. When combined with locally available amendments such as livestock manure, Biochar could potentially enhance nutrient availability to crops through its intermediate nutrient-holding capacity and through improving soil physical and biological properties. Through participatory on-farm and on-station experiments in Rwanda, we have demonstrated that biochar production and application can provide multiple benefits in real-world agricultural systems. Biochar-producing cook stoves offer a sustainable solution by reducing fuel consumption and improving energy access.

Key Findings and Policy Implications:

- **Energy Efficiency and Health Benefits:** The gasifier stoves namely Karundura (Rwandan brand) and Gastov (Kenyan brand) were tested and found to effectively reduce fuelwood consumption by 25-50% compared to traditional three-stone fire (TSF) stoves and produced biochar. This aligns well with

Rwanda’s efforts to transition away from traditional biomass use, improve energy efficiency, and reduce household reliance on unsustainable firewood supplies. Gasifier stoves reduce indoor air pollution by producing less smoke, thus improving the health of rural households, particularly for women and children. This supports Rwanda’s public health objectives and policies that focus on reducing health risks associated with traditional biomass stoves and aligns with Rwanda’s National Energy Policy (2015), which aims to transition away from traditional biomass use, promote energy use-efficiency, and clean cooking technologies. By reducing the time required for fuel collection and cooking supervision, gasifier stoves support Rwanda’s **Gender Policy,** which promotes women’s empowerment and livelihoods. Women can utilize the saved time in income-generating activities and education, thereby contributing to achievement of broader social development goals.

- **Soil fertility and Agricultural Productivity:** Research findings showed that plots treated with combinations of biochar and manure showed an increased yield compared to sole Biochar or manure plots. A seasonal increase was observed across different plot types. In sole biochar (B) plots, the percentage increases were **16%, 33.56%,** and **173.06%** for seasons 1, 2, and 3, respectively. In sole livestock manure (LM) plots, the recorded increases were **40.28%, 14.43%,** and **11.76%** for seasons 1, 2, and 3, respectively. Meanwhile, in biochar combined with livestock manure (B+LM) plots the increases were **125%, 156%,** and **209.8%** for seasons 1, 2, and 3, respectively.

- The results indicated that the application of biochar (B) alone or combined with livestock manure (LM) significantly raised soil pH, organic carbon, total nitrogen, available phosphorus, and cation exchange capacity. The production of biochar has an additional policy implication related to Rwanda’s agricultural policy and climate change goals. The significant increase of yields indicates that biochar can improve soil health and resilience. This aligns with Rwanda’s National Strategy for Climate Change and Low Carbon Development, which emphasizes sustainable agricultural practices. Promoting biochar use can help Rwanda to enhance soil carbon sequestration and reduce greenhouse gas emissions, thereby mitigating the impacts of climate change. In addition, the findings support policies that integrate organic farming practices, including the use of biochar and livestock manure. Rwanda’s Organic Agriculture Promotion Policy could benefit from incorporating biochar use as part of its strategy to improve soil fertility, reduce chemical inputs, and boost agricultural productivity in a sustainable manner.

Policy Recommendations

- **Reduce fuelwood consumption through improved cook stoves:** The key policy recommendations include raising awareness through public campaigns and training, offering financial incentives like subsidies and microfinance schemes, and supporting local cook stove manufacturing capacity and distribution networks. Establishing quality standards and certification programs can ensure efficiency and safety.
- **Support Training and Extension Services**: To maximize the benefits of biochar and manure application, **agricultural extension services** should train farmers on the best practices for applying biochar in combination with organic fertilizers. This includes educating farmers on optimal application rates, timing, and methods to enhance productivity sustainably.
- **Subsidize Biochar Production and Application**: Given the positive results of using biochar, the government should consider **subsidies or financial incentives** to lower the cost of biochar production and encourage its use, especially for small-scale farmers. This could include support for local biochar production facilities and access to biochar through cooperatives.
- **Encourage Sustainable Organic Farming**: The results suggest a strong case for promoting biochar and manure as alternatives to synthetic fertilizers. The government is advised to include biochar-manure combinations in Rwanda's **Organic Agriculture Promotion Strategy** to reduce reliance on chemical inputs and foster more sustainable farming practices.
- **Invest in Research and Development**: To further optimize the use of biochar and manure, the government should fund **agricultural research** to explore the long-term effects of biochar on soil health, crop yields, and environmental sustainability. This research could help refine the application methods for various crops and soil types in Rwanda.

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Harnessing the Potential of Smallholders' Tree-Based Systems for Sustainable Bioenergy Production in Rwanda's Agricultural Landscapes

Nelly Bapfakurera

Introduction, rationale, and methodology

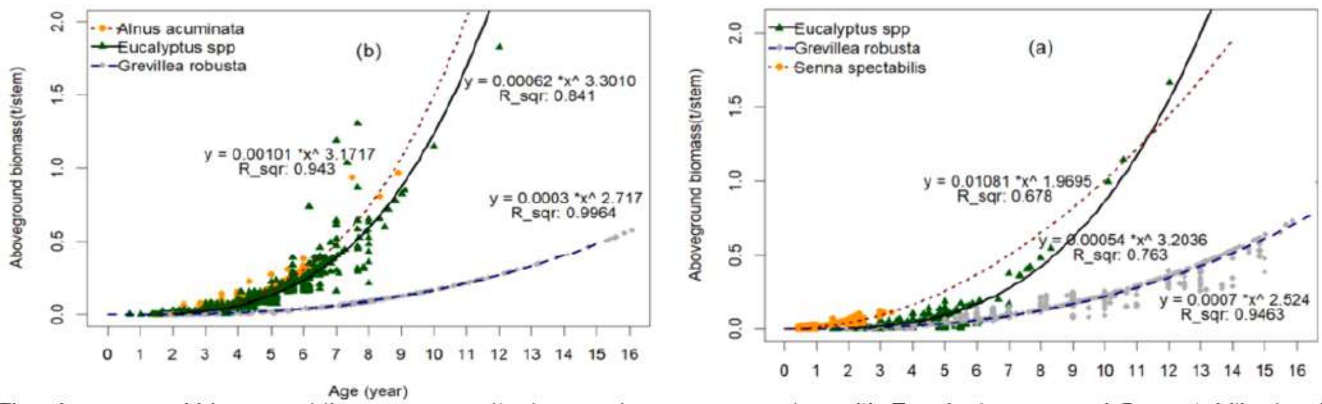
Like many developing nations, Rwanda faces a critical cooking energy crisis rooted in its heavy dependence on biomass, particularly fuelwood. Rwanda's land scarcity further complicates the problem. As the population grows, the demand for agricultural land increases, making it impractical to expand forest plantations to meet fuelwood needs. Agricultural land, essential for food security, competes with forest land, leaving little room for expanding forested areas for biomass production. To address these challenges, the integration of Tree-Based Systems (TBS) into Rwanda's agricultural landscapes offers a promising solution. By planting trees within farmlands, smallholder farmers can sustainably produce fuelwood without compromising the availability of land for agriculture. TBS provide a renewable source of fuelwood and enhance soil fertility, erosion control, and agricultural productivity. This system ensures that agricultural land remains productive while addressing the growing demand for biomass.

Over 85% of householders rely on fuelwood, with around 90% of rural households using traditional three-stone fireplaces (TSF) and 65% of urban households relying on charcoal stoves. These inefficient cooking stoves result in high fuelwood consumption, significantly contributing to deforestation and forest degradation. The excessive demand for fuelwood, combined with inefficient charcoal production methods that yield only about 12% conversion efficiency, further strains Rwanda's forests. The ongoing pressure on forest resources threatens the environment and the population's health, as indoor air pollution from biomass combustion is a leading cause of respiratory illnesses. Improving the efficiency of fuelwood use is crucial. Adopting modern cooking technologies, such as Kuniokoa and MimiMoto stoves, reduces fuelwood consumption compared to traditional methods. By optimizing both biomass supply through TBS and fuelwood demand through efficient stoves, Rwanda can significantly reduce pressure on its forests, promote environmental sustainability, and improve household energy efficiency.

This policy brief provides evidence-based recommendations to enhance bioenergy production by integrating TBS in Rwanda's agricultural landscapes with fuelwood use efficiency. These systems offer a sustainable alternative to mitigate the fuelwood crisis. The methodology employed in this research involved a systematic assessment of tree species used for fuelwood across two districts named Bugesera and Musanze, where 130 transects were established to quantify aboveground biomass (AGB) and tree productivity. Additionally, the fuelwood use efficiency of traditional cooking methods was compared with improved cooking stoves in real-life settings of 45 households. This approach provided critical insights into how TBS and improved stove technologies can jointly address the fuelwood supply challenges while promoting environmental sustainability and reducing household energy costs.

Key Findings and Policy Implications

The integration of Tree-Based Systems (TBS) into agricultural landscapes emerged as a promising solution for meeting fuelwood demand. Research undertaken in Bugesera and Musanze districts showed that Eucalyptus species and *Senna spectabilis* have higher biomass productivity, which can contribute significantly to the fuelwood supply. Smallholder farmers can produce fuelwood without compromising agricultural productivity by promoting the large-scale planting of these fast-growing species.



The aboveground biomass at the young growth stage varies among species, with *Eucalyptus* spp. and *S.spectabilis* showing a relatively rapid increase in biomass within five years in Bugesera District (a) while *Eucalyptus* spp. and *A.acuminata* showing a relatively faster growth rate in Musanze district (b).

Tree-based systems (TBS) offer the benefits of enhancing soil fertility, controlling erosion, and increasing farm productivity. A key policy option here is to incentivize the integration of TBS into farming systems, particularly using high-biomass-producing species. This can be achieved by offering technical support and financial incentives to farmers who adopt agroforestry practices.

The second significant finding concerns the efficiency of fuelwood use in rural and urban households. The research results suggest transitioning from traditional cooking methods to improved cook-stoves (ICS) to reduce fuelwood consumption.

The Kuniokoa stove reduces fuelwood consumption by 41%, while the MimiMoto stove achieves an 88% reduction compared to traditional charcoal stoves. These improved technologies reduce fuelwood demand and improve household air quality by lowering emissions, thereby reducing health risks associated with indoor air pollution.

Policymakers should therefore consider promoting the widespread adoption of improved cooking stoves. This could involve providing subsidies or financing options to make these stoves affordable for low-income households and partnering with the private sector to scale up production and distribution. The benefits of this approach are clear: reduced pressure on forest resources, improved health outcomes, and reduced time spent collecting fuelwood, particularly for women and children. However, implementation challenges include the need for significant upfront investment and potential cultural resistance to new cooking technologies.

Lastly, the study identified that fuelwood quality varies significantly among tree species. High-value species were preferred for their high Fuel Value Index (FVI), which means they provide more energy per biomass unit. Integrating these high-FVI species into agroforestry systems could ensure a more sustainable and high-quality fuelwood supply.

Policymakers should encourage cultivation of high-FVI species through targeted programs that provide seedlings, technical support, and financial incentives to farmers. This would improve fuelwood quality and reduce the overall amount of biomass needed for cooking, thus further alleviating pressure on forest resources. It is essential that tree planting initiatives consider the ecological impacts and promote a diverse range of tree species to maintain ecosystem balance.

In summary, the integration of tree-based systems, the promotion of improved cook-stoves, and the cultivation of high-quality, fast-growing fuelwood species are all viable policy options for addressing Rwanda’s fuelwood crisis. Each option has advantages and challenges, but when implemented together, these strategies can significantly reduce fuelwood consumption, protect forest resources, and improve household energy efficiency.

Policy Recommendations

1. ***Promote fast-growing tree species under Tree-Based Systems for Fuelwood***

Policymakers should prioritize integrating high-biomass-producing species, such as *Eucalyptus spp.* and *Senna spectabilis*. These species provide a sustainable fuelwood source in short rotation, mitigate deforestation, and reduce fuelwood collection time, improving the livelihoods of smallholder farmers. The Rwandan government should develop a comprehensive bioenergy policy integrating sustainable Tree-Based Systems and improved cooking technologies into the national energy strategy. This policy should prioritize using short-rotation species and promote modern cooking technologies to close the fuelwood supply-demand gap.

Practical Steps:

- Draft and implement a bioenergy policy with clear targets for TBS integration and adoption of improved stoves.
- Establish regulatory incentives for the private sector to invest in bioenergy solutions.
- Monitor and evaluate the impact of bioenergy initiatives on fuelwood consumption and forest conservation.
- Provide farmers with seedlings of high-biomass tree species through government programs or partnerships with private nurseries.
- Offer training and technical support on TBS practices to ensure proper tree maintenance and sustainable fuelwood harvesting.

- Establish demonstration plots to showcase the benefits of Tree-Based Systems (TBS) and encourage widespread adoption.
- Ensure policy coherence across multiple sectors (forestry, agriculture, energy, and environment).
- Secure long-term funding and political support for bioenergy programs.

2. **Scaling Up Improved Cooking Technologies**

A national campaign promoting the adoption of improved cooking stoves, such as Kuniokoa in rural areas and MimiMoto in urban areas, should be launched. Improved cookstoves can significantly reduce fuelwood consumption and enhance the quality of air.

Practical Steps

- Provide financial subsidies or low-cost financing options for low-income households to purchase improved stoves.
- Partner with private companies to scale up the production and distribution of improved cookstoves.
- Conduct awareness campaigns on improved stoves' health and environmental and economic benefits.
- Ensuring consistent availability of required resources and supply of the improved cookstoves in rural markets.
- Ensure involvement of government ministries (Energy, Health, and Environment), private sector stove manufacturers, and NGOs focused on clean energy.
- Ensure collaboration with local governments for distribution and outreach efforts in rural areas.

3. **Capacity Building and Community Engagement**

To ensure the long-term success of TBS and improved cooking technologies, capacity building and community engagement initiatives are crucial. Training programs for farmers on agroforestry and fuelwood efficiency must be prioritized, along with direct community involvement in testing and adopting these technologies.

Practical Steps

- Organize workshops and training programs for farmers and local communities on sustainable TBS practices and improved cooking stoves to enhance adoption of new practices or technologies, especially in rural areas with deep-rooted traditional methods.
- Involve local leaders and influencers to promote the benefits of these technologies and encourage adoption.
- Implement a feedback mechanism where communities can provide insights on the technologies and their effectiveness.
- Ensuring consistent support and follow-up with trained farmers and households
- Enhance collaboration with agricultural extension officers, local government officials, NGOs, and community-based organizations.
- Funding from government programs and international donors focused on rural development and environmental sustainability.

Call for Action

Addressing Rwanda's fuelwood crisis requires urgent and coordinated action from all stakeholders. Integrating Tree-Based Systems, scaling up the use of improved cooking technologies, and strengthening bioenergy policies will contribute significantly to sustainable energy production and environmental conservation.

These efforts can be synchronized to amplify the benefits of Tree-Based Systems (TBS) and improved cooking technologies for sustainable bioenergy. The recommendations offer a roadmap to reducing pressure on forests, improving household energy efficiency, and securing a sustainable future for Rwanda's energy needs. Policymakers must act swiftly to implement these solutions, ensuring adequate resources, training, and community engagement are in place to make these initiatives successful.

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Harnessing the potentials of Rwanda's indigenous fruit trees for biodiversity conservation and economic growth

Introduction

Wild Indigenous Fruit Trees (WIFTs) play a crucial role in food, nutritional and income security, particularly in Rwanda's rural communities. Despite their potentials, these valuable resources face threats as arable land expands, leading to a decline in their natural populations. Domestication of WIFTs in Rwanda is urgently required to address biodiversity loss and food insecurity challenges. Integrating WIFTs into smallholder farming systems can contribute to biodiversity conservation and also improve the socio-economic welfare of rural communities in terms of food, nutritional security and economic benefits.

Photo: *Myrianthus holstii* fruits at the local market in Nyamagabe (Imyufe) district

Rationale

The Government of Rwanda is committed to land restoration and climate change mitigation through agroforestry, but this initiative primarily focuses on exotic species. WIFTs are currently underutilized, despite their potential to provide economic, environmental, and health benefits. By integrating WIFTs into agroforestry systems and land restoration programs, their availability will be enhanced thereby diversifying food and income sources while also conserving biodiversity.

Methodology

This policy brief draws on findings from a study conducted in two districts, Bugesera and Nyamagabe, where 380 community members were interviewed to assess their perceptions, challenges, and potential interventions for WIFT domestication, using semi-structured questionnaires and focus group discussions. Analysis of the yield potential, morphological traits and nutritional compositions of the prioritized species was done using standard approaches. The effects of different pre-sowing treatments on the germination and seedling growth of Myrianthus *holstii* (Umwufe) was examined to support its domestication in Rwanda. The treatments included mechanical nicking of seeds, boiling of seeds in water at 100 ℃ for 5 minutes or treating seeds with concentrated Sulphuric acid (98%) for 15 or 30 minutes. Descriptive and inferential statistics were performed to answer the research questions.

Photo: Household survey (Left side) and Focus Group Discussions (Right side)

Key Findings and Policy implications

Key Findings

Species Diversity: A total of 19 WIFT species were documented in Bugesera and Nyamagabe. However, availability of documented WIFTs in both study area, is scarce indicating a significant decline in their natural populations. The communities prioritized *Garcinia buchanannii* and *Myrianthus holstii* for domestication due to their socio-economic importance.

Photo: *G.buchananii* (Left side) and *M.holstii* (Right side)

Uses of WIFTs: The documented WIFT species are essential for household food, medicinal, and as sources of fuelwood. Rural communities do sell the WIFTs for income generation as well.

Community Interest on domestication: Over 98% of the surveyed communities expressed interest in WIFT domestication, with willingness to integrate these species into their farms if planting materials were available locally.

Nutritional value: The studied fruits were rich in nutritional elements such as Na, K, Fe, and vitamins A and C and hence could contribute towards nutritional security among the rural communities in Rwanda.

***M.holstii* propagation**: Two seed pre-sowing treatments namely (i) mechanical scarification and (ii) application of concentrated Sulphuric acid for 15 minutes were used and proved to be effective in increasing seed germination. Mechanical scarification is suitable and safe for the resource-scarce farmers.

Photo: Seedlings of *M.holstii*

Policy Implications

Food Security: *M. holstii* and *G. buchananii* had high nutritional value. If well promoted, they can help combat food insecurity and malnutrition to communities in Rwanda and beyond. By promoting their domestication, the government can address hidden hunger in rural areas

Environmental Sustainability: Integrating WIFTs into agroforestry systems can contribute to land restoration and biodiversity conservation while reducing pressure on wild species populations.

Economic opportunities: the domestication of WIFTs presents opportunities for value chain development, improving rural incomes through the sale of fruits and other WIFT-based products.

Conclusion

The domestication of Wild Indigenous Fruit Trees is a viable strategy to address food insecurity, improve rural livelihoods, and enhance biodiversity conservation in Rwanda. By focusing on WIFT domestication, the government can meet both economic and environmental goals. The implementation of national program that supports farmers, provides planting materials, and develops value chains for WIFT products will ensure long-term sustainability and resilience for rural communities. Now is the time for policymakers to take decisive action and incorporate WIFT domestication into national agricultural and environmental strategies.

Recommendations

1. Develop national WIFTs domestication program. Ministry of Environment in collaboration with the Ministry of Agriculture and Animal Resources should develop policies, strategies and action plans that recognize the significance of WIFTs and provide roadmap to their domestication.
2. Rwanda Agriculture and Animal Resources Development Board should initiate research to identify WIFT genotypes that are resistant to disease and drought-tolerant.

3. Integrate WIFTs into National Agroforestry and land restoration efforts. Starting with prioritized species (M. holstii and G. buchananii), the integration of WIFTs into agroforestry systems will increase biodiversity on farm and contribute to the community livelihood.
4. The Rwandan research institutions and agricultural institutions should develop programs to improve yield and quality of prioritized WIFTs through better farming practices, pest management and post-harvest handling technologies
5. The Ministry of environment in collaboration of the Ministry of Agriculture and Animal Resources should mobilize funds for more research on WIFTs and financial incentives for farmers who are willing to adopt them in their farms.

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