REFOREST PROGRAMME POLICY BRIEFS – APRIL 2025

UGANDA

Utilization of Bamboo in Uganda: Addressing Challenges of Product Durability

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Introduction and Rationale

Bamboo is a woody herbaceous plant that provides ecological and economic uses. Bamboo provides a wide range of products, from construction to furniture and crafts. Despite its potential for production of these products, bamboo is prone to degradation from insects, fungi, and environmental factors. The production of durable bamboo products suffers from several bottlenecks. Bamboo processing is associated with poor preservation, as a major challenge to production of durable products. Without proper preservation, the use of bamboo products is limited in various high-value applications. Effective preservation is essential to extend the lifespan of bamboo products, increase their market value, and enhance their usability across multiple industries. This policy brief highlights bamboo utilization in Uganda, focusing on the challenges to production of durable products as illustrated in Figure 1.

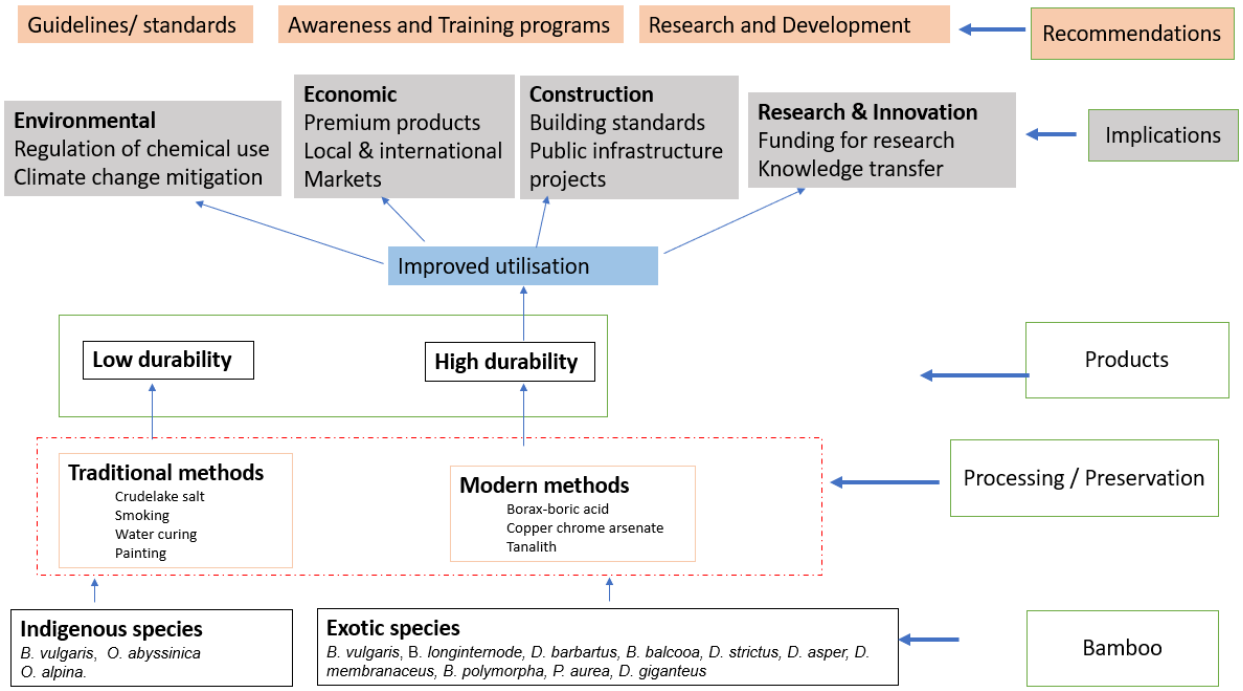

Figure 1: Options towards realization of durable bamboo products

Key findings and policy implications

Uganda has indigenous and exotic bamboo species that are exploited by artisans for various products as alternatives to slow-growing trees. Artisans employ both traditional and modern methods of preservation during processing of products.

Traditional methods include smoking, clump curing, surface application of paints and varnishes and treating with crude lake salt. While these methods are cost-effective and environmentally friendly, they do not provide long-term durability.

Modern methods involve the use of biocide compounds such as boron in borax-boric acid, copper in copper-chrome-arsenate, and Tanalith under pressure to improve bamboo's resistance to decay and insects. These biocides are effective in providing long-term durability to bamboo however, the chemicals are expensive and may have environmental and health concerns, limiting their acceptability in eco-conscious markets.

The choice of preservatives and methods of application have implications in terms of: (i) environmental sustainability; (ii) economic development; (iii) construction industry; (iv) research and innovation. These are discussed hereunder:

Environmentally, preservation extends the lifecycle of bamboo products, which contributes to a reduction in pressure on forests by providing a sustainable alternative. Supporting bamboo preservation aligns with national and international climate goals, through reducing carbon emissions and promoting renewable materials. The application of chemical preservation treatments can have varying environmental impacts. Standards should regulate the use of toxic chemicals like CCA (copper-chrome arsenate) and encourage eco-friendly preservation techniques to minimize environmental degradation.

Preserved bamboo products have higher **economic value** than unpreserved products. Preserved products have increased durability and can access both domestic and international markets competing with other materials like treated wood. Well-preserved bamboo can be positioned as a premium, durable, and sustainable alternative to traditional materials, opening new market opportunities. Bamboo artisans should be supported with resources and trained on effective preservation techniques to improve the quality of their products and increase their income.

Bamboo's durability is critical for its expanded use in **construction and infrastructure projects**. National building codes and standards need to incorporate preserved bamboo as a viable construction material. This involves setting guidelines for the use of preserved bamboo in structural applications, ensuring it meets safety and durability requirements. Public procurement policies could prioritize the use of preserved bamboo in public infrastructure projects, boosting demand for bamboo-based products.

The development of effective, sustainable bamboo preservation methods requires continued **research and innovation**. This is particularly important for discovering low-cost, non-toxic, and scalable preservation techniques that can be applied widely across industries. Public and private organizations should invest in research to develop new bamboo preservation technologies, focusing on eco-friendly and cost-effective methods. Public-private partnerships can also foster innovation in the field. Knowledge transfer and technology related to bamboo preservation from research institutions to industry players are essential. Establishing innovation hubs, conducting workshops, and fostering collaborations between researchers and businesses can accelerate the adoption of new preservation techniques.

Policy Recommendations

- The Uganda National Bureau of Standards (UNBS) and the Ministry of Water and Environment (MWE) should establish clear guidelines and standards for bamboo preservation that emphasize safety, durability, and sustainability. At the regional level, the East African Standards Committee (EASC) should harmonize preservation standards across the region in bamboo-growing countries. This will promote high-quality, preserved bamboo products and facilitate acceptance in regional and global markets.
- Research and academic institutions should strengthen research, education and capacity-building efforts on bamboo production and raise awareness about the benefits of preservation. Training programmes should focus on the proper implementation of traditional and modern preservation techniques, improving product quality and extending bamboo's usability.
- Support R&D initiatives focused on the development of new, affordable and sustainable bamboo preservation methods. Apply public-private partnerships to drive bamboo preservation innovations that are eco-friendly and accessible by small-scale bamboo producers.
- Engage private sector to increase investments in bamboo preservation technologies and promote bamboo-based products in the global markets. The growing demand for sustainable materials presents an opportunity to position preserved bamboo as a high-quality, durable alternative to conventional timber and synthetic products.

Acknowledgement

This Policy Brief is based on research results from a study entitled "Preservative Treatment of Bamboo: Analyzing the Effectiveness of Traditional and Modern Methods in Uganda" The study

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Balancing Biodiversity and Livelihoods: Policy Action for Timber and Biomass Recovery in African Tropical Forests

Kissa David Ocama:

Photo: Pitsawing of an Illegally harvested mahogany (*Entandrophragma angolense*) in Budongo Forest Nature Reserve, Uganda

Introduction, Rationale, and Methodology

Forests are vital for climate regulation, biodiversity conservation, and local livelihoods. Their composition and diversity reflect key ecological processes that can be altered by forest management. However, they face increasing pressure from unsustainable timber harvesting. In Uganda, forests like Budongo were mapped and selectively logged for high-value timber. After independence in 1962, Uganda expanded logging to support economic growth. Today, sawn timber from tropical forests supplies about 30% of Uganda's domestic market, contributing significantly to local and national incomes across Africa.

Rising demand for hardwoods has led to the depletion of famous timber species and widespread forest degradation. Although Uganda banned timber harvesting from natural forests in 2012, illegal logging persists. Much of the hardwood, especially mahogany, is still sourced illegally from forests like Budongo, Bugoma, and Mabira. Both legal and illegal selective logging degrade forest structure, hinder regeneration of timber species, alter species composition, and reduce aboveground biomass and thus, threatening the long-term sustainability of ecosystem services and timber

production. Although some natural recovery occurs, the extent of ecological and commercial restoration remains uncertain. Nevertheless, well-managed logged forests can retain conservation value and support biodiversity.

This policy brief presents findings from Budongo Forest, Uganda-an African tropical rainforest shaped by decades of selective logging and post-harvest silvicultural interventions. The study assessed how varying logging intensities and enrichment planting of mahogany species (*Khaya anthotheca*) influence forest recovery. The study employed a stratified comparative design across three logging intensities: unlogged, lightly logged, and heavily logged. Nine compartments were classified based on historical logging records, the volume of timber removed, and field observations of disturbance intensity, frequency, and ecological impact.

Key Findings and Policy Implications

- **Logging Reduces Biomass and Structural Diversity:** Heavily logged compartments had significantly lower aboveground biomass, stem density, basal area, and canopy cover. Structural diversity-a key driver of biomass was also reduced, impairing carbon storage and habitat integrity.

- **Changes in Species Composition:** Logging led to declines in both canopy and understory species diversity. Beta diversity analysis showed long-term shifts in species composition, with logged forests failing to recover their original species even after decades.

- **Enrichment Planting Boosts Timber Recovery:** Compartments enriched with *Khaya anthotheca* had significantly higher stem densities and timber volumes than naturally regenerating areas, demonstrating the potential of active restoration to enhance recovery.

- **Soil Nutrients Support Biomass Accumulation:** Biomass was positively correlated with nitrogen, carbon, and organic matter, with stronger interactive effects observed in unlogged forests and thus, highlighting the role of soil fertility in supporting tree growth and competition during regeneration.

- **Functional Traits Influence Biomass Response:** Functional richness was positively associated with biomass in lightly logged forests, suggesting that diverse trait combinations support recovery. In contrast, functional evenness declined in heavily logged areas, indicating that intense disturbance filters out certain traits, potentially limiting functional complementarity and slowing ecosystem recovery.

The findings from Budongo Forest highlight that passive regeneration, even after six decades, is insufficient to fully restore species composition and ecosystem functions. Strategic policy shifts toward integrated forest management i.e. combining low-impact harvesting, enrichment planting with native species, and biodiversity-sensitive planning, are essential to ensure sustainable timber production and long-term forest recovery. These insights provide a roadmap for forest managers and policymakers to align timber production with climate, biodiversity, and sustainable development goals.

Photo: Conducting tree inventory in Budongo Forest

Photo: Evidence of illegal timber harvesting in Budongo Forest

Policy Recommendations

- *Adopt Low-Impact Logging*: Implement Reduced Impact Logging (RIL) to minimize forest damage and preserve key species traits for recovery, while diversifying harvests to include underutilized species, easing pressure on overexploited species.
- *Expand Enrichment Planting*: Scale up planting of high-value species such as *Khaya anthotheca*, *Entandrophragma* spp., *Maesopsis eminii*, and *Albizia* spp. to enhance timber yields and accelerate ecosystem recovery in logged forests.
- *Integrate Biodiversity into Management:* Integrate monitoring of canopy and understory species into management plans to sustain biodiversity and ecosystem functions.
- *Strengthen Protection of Unlogged Forests*: Strengthen enforcement and increase funding to protect intact forests-critical for biodiversity and resilience while curbing illegal harvesting through improved monitoring, community engagement, awareness, alternative livelihoods, and incentives for sustainable practices that benefit local people.

- *Improve Soil Conservation:* Preserve soil fertility by minimizing compaction and limiting canopy openings to promote regeneration and biomass accumulation.
- *Invest in Long-Term Monitoring:* Establish new permanent sample plots in logged forests to complement existing networks, enabling long-term monitoring of recovery, biodiversity, and productivity for adaptive forest management.
- Review Uganda's forest policy to ensure inclusion of lessons from this study. Further, national and regional stakeholders should prioritize updating management guidelines, investing in capacity building and adopting ecologically sustainable practices to preserve forests for future generations.

This Policy brief was developed by **Kissa, D. O.**, and reviewed by Nzunda, E. F., Tweheyo, M., Lussetti, D., Ssekuubwa, E., & Sheil, D.

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Photo: increased protection supports recovery of logged sites in Budongo Forest