

GUEST EDITORIAL

Assessing the potential of smallholder teak for resilient tropical forest landscapes

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BACKGROUND: SMALLHOLDER TEAK AS A LANDSCAPE OPPORTUNITY IN THE TROPICS

Teak (*Tectona grandis*) is one of the world's most valuable tropical hardwoods, with sustained demand for furniture, construction and high-value wood products. Global planted teak is estimated at about 4.85 million ha, concentrated mainly in Asia but also established across Latin America and Africa. Smallholders manage approximately one quarter of the world's planted teak—around 1.2 million ha—and ownership is becoming increasingly private and decentralized (Kollert et al., 2024). Their significance is particularly visible where teak is grown on farms and outside state forests. In Java, for example, many farm households integrate teak into mixed tree-based agroforestry systems supplying domestic wood industries. Such systems can make a substantial contribution to rural livelihoods; in the Indonesian cases examined by Roshetko et al. (2013), agricultural and timber crops together accounted for approximately 40% of household income. In Myanmar, home to the world's largest natural teak forests, degradation of natural teak resources has reinforced the importance of well-managed plantations, including stronger support for private teak growers (Oo et al., 2020). Smallholders should therefore be viewed as a structural component of the teak economy.

Smallholder teak differs fundamentally from large-scale industrial plantation forestry. Trees are often integrated with crops and other species, retained as household assets, and harvested selectively when cash is needed for education, housing, health care or other major expenditures. Teak can therefore function simultaneously as timber, savings, and risk management. Research in Indonesia and Lao PDR shows that smallholder tree growing responds not only to biological productivity but also to tenure security, market demand, regulation, finance and practical silvicultural support (Newby et al., 2012, 2014; Rohadi et al., 2012; Smith et al., 2017; Race et al., 2020).

This perspective shifts the question from how to expand teak plantations to how to realize the potential of smallholder teak within resilient tropical forest landscapes. That potential

should be assessed through three linked dimensions: economic viability for households, social and institutional viability for producer participation, and environmental viability at farm and landscape scales (Rohadi et al., 2012). The central proposition of this editorial is that environmental benefits are more likely to endure when smallholders can obtain reasonable returns, manage production risks and participate fairly in accessible markets.

The analysis draws primarily on the Global Teak Resources and Market Assessment 2022 (Kollert et al., 2024), established research on smallholder teak in Indonesia and Lao PDR, and recent implementation experience from the ITTO-BMLEH Teak Project (ITTO-BMLEH Teak Project, 2024, 2026). The Proceedings of the 5th World Teak Conference (WTC), held in Kochi, Kerala, India, on 17–20 September 2025, are used selectively to reflect recent developments in teak investment, markets, genetics, management and landscape resilience (Sandeep et al., 2025).

QUALITY PLANTING MATERIAL FOR QUALITY TIMBER PRODUCTION

Smallholder competitiveness depends on timber quality as well as the number of trees grown. Planting material from unknown or unsuitable seed sources, low survival, poor stem form, or susceptibility to pests and diseases can lock farmers into low-value markets for decades (Shin et al., 2024). By the time deficiencies become visible, much of the investment period has already passed.

Advances in provenance testing, clonal selection, tissue culture and genomic tools offer opportunities to improve growth and stem form (Piananurak, 2022). Yet genetic gains create value only when farmers can obtain authentic, affordable and site-specific material together with the adequate knowledge to manage it (Goh et al., 2013). The practical priority is therefore a delivery system linking research institutions, quality-assured nurseries, extension services and farmer demonstration sites.

Evidence from Indonesia illustrates the gap. Smallholder teak in Gunungkidul has often relied on unselected seedlings and limited silvicultural intervention, contributing to variable

growth and timber quality (Pramono et al., 2011; Roshetko et al., 2014). The ITTO-BMLEH project is testing improved genetic material, nursery systems and community demonstration plots in Yogyakarta. Project estimates suggest substantial productivity gains under intensive management, but such figures should be treated as technical potential rather than universal smallholder benchmarks (ITTO-BMLEH Teak Project, 2026).

Genetic improvement must also be balanced with diversity, site matching and resilience to pests, disease and climatic stress. The IUFRO assessment cautions against extrapolating exceptionally high growth rates from ideal sites to large areas; in most countries reported mean annual increment does not exceed about 12 m³/ha/year (Kollert et al., 2024). The appropriate principle is therefore “the right material for the right site,” embedded in an integrated package of nursery quality, establishment, maintenance and risk management.

SILVICULTURAL PRACTICES FOR ENHANCING TEAK VALUE AND SMALLHOLDER RETURNS

For smallholders, silviculture interventions should enhance tree value and household returns rather than simply maximize timber volume. Diameter, straightness, knots, heartwood percentage and log grade strongly influence price. Spacing, pruning, thinning and pest management should therefore be matched to site conditions, expected products and markets.

Studies in Indonesia show that improved pruning and thinning can significantly increase the economic potential of smallholder teak. Stewart et al. (2021) found teak profitable under a 20-year scenario in Central Java, while practical guidance from Gunungkidul emphasizes simple interventions adapted to uneven-aged stands, difficult sites and need-based harvesting (Pramono et al., 2011).

Experience from Thailand and other participating countries under the ITTO-BMLEH Teak Project similarly highlights timely pruning and thinning, appropriate stand management and harvesting decisions as keys to producing high-value logs (Vacharangkura, 2022). Management intensity, rotation periods and harvesting objectives vary with household needs and market conditions; guidance should therefore be flexible and locally adapted rather than based on uniform plantation regimes (ITTO-BMLEH Teak Project, 2026).

Economic rotation will consequently vary. Urgent cash needs may favour earlier harvesting, while price premiums for larger logs can justify retaining selected trees for longer rotations. Farmers may therefore combine intermediate harvesting with longer retention of well-formed trees for higher-value markets.

Practical extension can focus on a few value-oriented messages: manage spacing and crown development, prune and thin at the right time, monitor pests and diseases, and relate harvesting decisions to expected log quality and price. Demonstration plots and farmer-to-farmer learning can make these economic benefits visible.

VALUE ADDITION, MARKET ACCESS AND CERTIFICATION CHALLENGES

The scale of smallholder participation does not necessarily translate into equitable returns. Farmers often enter the formal value chain only at the point of sale, when they have limited

information on grading, current prices, processing margins and final demand. Small volumes, dispersed production and urgent cash needs further increase dependence on intermediaries. Research in Indonesia has repeatedly identified limited market knowledge and weak bargaining power as constraints on smallholder profitability (Perdana, 2012; Rohadi et al., 2012).

Evidence from Lao PDR illustrates how value can become concentrated beyond the farm gate. In Paklay District, returns per cubic metre captured by downstream manufacturing were substantially higher than those received by growers (Maraseni et al., 2018). A broader value-chain assessment of teak plantations in Northern Laos similarly identified regulatory complexity, fragmented value chains and limited coordination among growers, traders, processors and service providers as constraints on more efficient and equitable market participation (Smith et al., 2018).

Improving value capture therefore requires both better-quality timber and stronger producer capacity. Larger-diameter and higher-quality logs can attract substantial price premiums, but farmers need transparent grading and price information to realize these benefits. Producer organizations can aggregate supply, reduce transport and transaction costs, and strengthen bargaining power. Where commercially viable, local processing can retain a greater share of value within rural economies.

Private–smallholder partnerships can also contribute when they reduce risk without creating dependency. Contract farming and out-grower arrangements should provide transparent pricing, equitable allocation of risk, technical support and sufficient market choice. The objective should be commercially viable relationships in which farmers retain agency and receive a fair share of the value created. The public-private partnership (PPP) was successfully promoted for several economic species such as *Eucalyptus*, *Pinus*, *Cupressus lusitanica*, *Tectonia grandis* and *Gmelina arborea* in Eastern Africa (Kiplongi Cheboiwo et al., 2018).

As natural-forest teak supply declines and plantation-grown timber assumes a larger market role, the central policy question is not whether smallholders matter to future supply, but whether they can capture sufficient value to sustain investment in teak and resilient rural landscapes.

Certification should be considered within this market context. Most smallholder teak is sold in local and domestic markets; sophisticated certification and traceability systems designed for international supply chains may therefore offer limited immediate benefits while imposing disproportionate costs for documentation, mapping, audits and administration.

The priority is simple, affordable and nationally appropriate assurance that creates tangible market value. Simplified standards, group approaches, farmer registries and basic documentation of timber origin can improve buyer confidence and market access without excessive compliance costs. Certification should ultimately support better market opportunities, sustainable management and viable rural livelihoods rather than become an end in itself.

AGROFORESTRY AND RESILIENT TROPICAL FOREST LANDSCAPES

Assessing smallholder teak potential requires looking beyond timber production. Farm teak commonly occurs in

mosaic landscapes of crops, settlements, remnant forests and other planted trees. Its contribution to resilience depends on how it is integrated with household livelihoods, land-use diversity and ecological functions rather than on teak area alone.

Teak-based agroforestry can help spread risk and provide interim income during a long timber rotation. Research in Indonesia shows that diversified systems can combine commercially valuable timber with crops and other farm outputs, while market and production uncertainty itself can encourage diversification (Roshetko et al., 2012). This is particularly important for households that cannot wait many years for a single timber payment.

Environmental claims also require caution. Expansion of planted teak can raise concerns over biodiversity, water, soil and landscape simplification when it replaces diverse ecosystems or is established as poorly matched monoculture. The IUFRO global assessment therefore supports attention to the wider environmental and social services associated with teak expansion (Kollert et al., 2024). For smallholders, mixed agroforestry, retention of other useful species, soil and water conservation and site-appropriate planting offer a more resilient pathway than uniform teak expansion.

Climate change strengthens the case for diversification. Drought, fire, pests and disease can affect both growth and household income. Risk can be spread through site-suitable genetic material (Onuma et al., 2025), mixtures of species and crops, different tree age classes, better soil and water management and access to climate and pest information. Resilience should thus be understood as a property of the household–farm–landscape system, not simply of an individual teak genotype.

This framing clarifies the relationship among economic, social and environmental sustainability. Smallholders cannot reasonably be expected to retain trees for carbon, biodiversity or restoration benefits if doing so undermines household viability. Secure rights, diversified income and credible future timber value create stronger incentives to maintain trees and invest in their management. Economic and social viability are therefore enabling conditions for durable environmental outcomes.

LONG-TERM INVESTMENT OPPORTUNITIES: BRIDGING THE FINANCING GAP

The distinctive economic challenge of teak is the mismatch between a long biological production cycle and the short cash-flow horizon of rural households. A farmer may understand that larger, better-formed logs command higher prices but still be unable to wait. School fees, medical expenses, debt repayment or crop failure can trigger premature harvesting. Rotation length is therefore not only a silvicultural choice but also a household liquidity decision.

Research in Gunungkidul, Indonesia, found that farmers frequently harvest trees when cash is urgently required and that limited access to alternative finance weakens their ability to wait for higher-value timber (Rohadi et al., 2012). Similar work on commercial tree growing shows that secure tenure

and market demand are necessary but generally insufficient: finance, policy consistency, technical support and other enabling conditions determine whether smallholder forestry can expand sustainably (Race et al., 2020).

Finance should expand farmer choice rather than prescribe a universal rotation. Microfinance, savings products, staged harvesting, contract finance and carefully designed tree-collateral lending can help households bridge the waiting period. RECOFTC's work in Lao PDR, for example, developed a valuation approach for using standing teak as loan collateral, illustrating how accumulated tree value can be recognized by rural finance systems (RECOFTC, 2015). Agroforestry provides an additional buffer by generating food or cash income before teak reaches commercial size.

The ITTO–BMLEH Teak Project is exploring microfinance and related mechanisms across participating countries and planned a regional workshop in Yogyakarta in 2026 on financing smallholder and community teak systems (ITTO–BMLEH Teak Project, 2026). Because these mechanisms are still being tested, the key lesson is not a single financing model but recognition of liquidity as a core production constraint. A resilient teak system should allow farmers to balance short-, medium- and long-term returns without being forced to liquidate their best trees too early.

FROM POTENTIAL TO ACTION: AN INTEGRATED SMALLHOLDER TEAK AGENDA

The constraints affecting smallholder teak are mutually reinforcing. Poor planting material lowers future quality; weak silviculture reduces value; lack of finance induces early harvest; fragmented markets weaken bargaining power; complex requirements raise transaction costs; and insecure rights discourage long-term investment. Isolated interventions will therefore have limited effect. The relevant policy unit is the whole smallholder teak system—from rights and planting material through management, finance and producer organization to market access and landscape outcomes.

This integrated approach is consistent with broader evidence on smallholder commercial tree growing, which identifies tenure and market demand as foundational conditions supported by finance, technical capacity, institutions, and workable regulation (Race et al., 2020). Recent project experience similarly combines demonstration plots, improved planting material, field training, value-chain analysis, legality support and financing dialogue. The important lesson is convergence around the same farmer rather than a collection of disconnected programmes (ITTO–BMLEH Teak Project, 2026).

The integrated priorities that follow translate this systems perspective into practical areas for policy and programme action (Table 1). They connect enabling conditions, production and management, producer organization, market access, finance, and landscape resilience, while keeping the smallholder at the centre of intervention design.

Table 1. Priority directions for realizing smallholder teak potential in resilient tropical forest landscapes.

Priority area	What needs to change	Practical instruments	Expected outcome
1. Secure rights	Reduce uncertainty over ownership, harvest and transport.	Clear tree ownership; predictable rules; simplified permits.	Greater willingness to plant, retain and manage trees.
2. Improve planting material	Make genetic gains accessible and site-suitable.	Quality-assured community nurseries; hedge gardens; provenance/clonal testing; demonstration plots.	Higher survival, better stem form and more reliable productivity.
3. Enhance teak value and returns	Link silviculture to log quality and household objectives.	Site matching; pruning; thinning; pest management; practical extension.	Higher returns per tree, not volume alone.
4. Strengthen producer power	Reduce fragmentation and information asymmetry.	Producer groups; aggregation; grading and price information; multiple buyers.	Lower transaction costs and a larger farmer share of value.
5. Make certification accessible	Keep assurance credible, proportionate and relevant to domestic markets.	Simplified standards; group approaches; farmer registries; basic origin records.	Lower compliance costs and broader market participation.
6. Build fair partnerships	Share risk while preserving farmer agency.	Transparent contracts; open-market options; extension; clear pricing.	More durable producer–buyer relationships.
7. Long-term investment opportunities	Treat liquidity as a production constraint.	Microfinance; savings; tree collateral; staged harvests; agroforestry income.	Less distress harvesting and more higher-value logs.
8. Integrate landscape resilience	Connect timber, livelihoods and ecological functions.	Diversified agroforestry; site matching; soil/water conservation; restoration incentives.	Income, timber supply and resilience pursued together.

CONCLUSION: EMPOWERING SMALLHOLDERS AS FUTURE INVESTORS AND LANDSCAPE PARTNERS

The potential of smallholder teak should be assessed by more than planted area. Its long-term significance depends on whether farm households can produce quality timber, bridge the waiting period, meet proportionate market requirements, reach competitive buyers and retain a fair share of value. These conditions determine whether teak remains an attractive household asset and whether farmers continue investing in trees.

Three shifts are especially important. First, smallholder teak should be recognized as a substantial, decentralized production system. Second, productivity policy should move from maximizing volume toward quality, value and risk-adjusted household returns. Third, genetics, silviculture, finance, producer organization, market access and landscape management should be designed as an integrated support architecture.

Under this approach, smallholders are not merely beneficiaries of sustainable teak policy. They are investors, timber producers, land managers and business partners whose decisions shape future wood supply and tropical rural

landscapes. Strengthening their economic and social viability can create incentives to retain trees, diversify farms, improve timber quality and contribute to restoration and climate resilience. This provides a practical basis for realizing smallholder teak potential within resilient tropical forest landscapes.

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