5.2 The Significance of Planted Teak for Smallholder Farmers

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5.2.1 Introduction

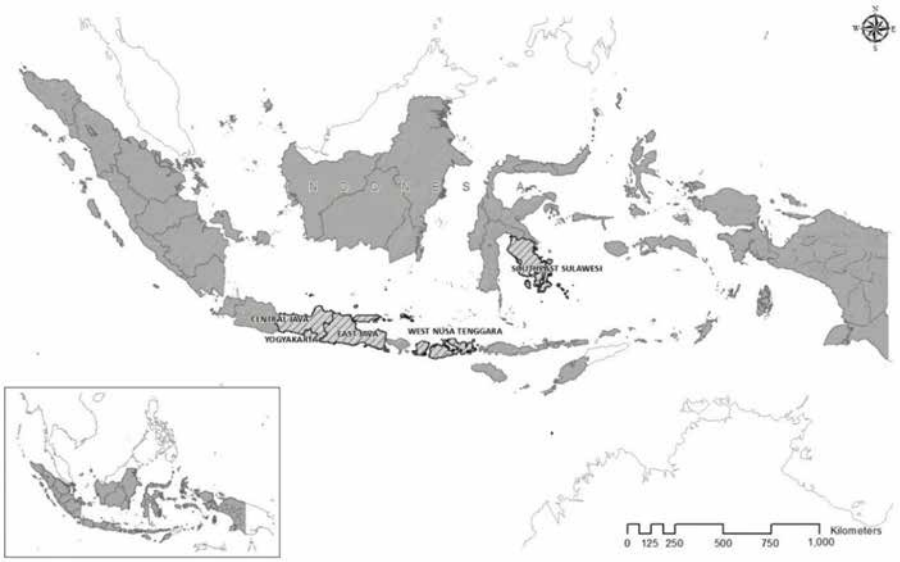
Teak (*Tectona grandis*) is most widely known as an industrial plantation species. There is a minimum of 4.3 million hectare of teak plantations across the world; 83% are found in Asia, primarily in India, Indonesia, and Myanmar. Smallholder farmer plantings are currently a minor component of the global teak estate, comprising 19% of the area in Africa and Asia, 31% in Central America, and 34% in South America (Kollert and Cherubini, 2012). With market demand exceeding the sustainable yield of large-scale plantations and natural forests, smallholder production holds potential as an important source of teak for industry. The second largest producer of teak behind India, Indonesia, has a very well developed smallholder teak farming sector, which is concentrated in Central Java, where farmers have been growing teak for over fifty years (Roshetko *et al.*, 2013). On Java there are approximately 1.5 million farmers cultivating 444,000 ha of tree-based agroforestry systems, where teak is the dominant tree crop; an additional 800,000 ha of smallholder agroforestry systems, in which teak is a component, occur in other parts of the country (Nawir *et al*., 2007; Figure 1). Smallholder-produced logs (diameters less than 30 cm) account for up to 80% of the teak used by small to medium industrial producers (Achdiawan and Puntodewo, 2011), which represent over 90% of the Indonesia's main teak furniture industry in Jepara (Yovi *et al.*, 2013). Indonesia is a compelling case regarding the significance of smallholder farmers to the teak industry, as well as of teak cultivation to smallholder farm families.

This chapter summarizes common and best practices regarding the sustainable and productive management of smallholder teak systems. It focuses on the example from Indonesia and encompasses relevant information from other countries. Recommendations and guidance are provided.

5.2.2 Socioeconomics and Culture

Teak is grown by smallholders in mixed farming systems in many tropical countries. These systems enable farmers to diversify production, reduce farm risk, contribute to food security, and generate much needed income. In Indonesia, Javanese farmers started growing teak in the 1960s. Average family landholdings are about 1 ha, varying from 0.5 to 3.0 ha, and consist of multiple parcels. Rohadi *et al.* (2011) report, that on 10% of farmland teak woodlots have been established, with other parcels containing teak in mixed systems. For families in central Java, teak is a valuable asset and a cultural icon. Half of farmers plant teak for family savings; a quarter planted teak primarily as cultural heritage; only 15% of farmers planted teak to maximize income. The management of teak systems is a shared responsibility between men and women. Women are primarily responsible for the management of agricultural companion crops and fuelwood collection, while men are responsible for timber tree management and sales (Roshetko *et al.,* 2013). Teak agroforestry systems provide 40% of household income – 25% from agricultural production, 12% from teak, and 3% from other tree products (Rohadi *et al.* 2011).

Locations of major smallholder teak systems in Indonesia Figure 1



Map: Elissa Dwiyanti

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In Thailand and Laos, teak is also a component of integrated perennial-annual systems which reduce risks, diversify production, and raise income for smallholder families. Those systems transform barren and swidden land into tree cover, reducing labor needs compared to annual cropping systems (Mittelman, 2000; Midgley *et al.,* 2007; Newby *et al.,* 2012). Teak and other tree farming systems enable households to pursue off-farm opportunities (Newby *et al.,* 2014), including temporary migration to and employment in urban centers (Roshetko *et al.,* 2008). While demand for teak is high and prices attractive in Southeast Asia, many farmers needed assistance to adopt teak cultivation due to their limited capital, limited technical capacity, and limited market knowledge.

In dry ecosystems of Benin (Aoudji *et al.,* 2011), Togo (Kenny *et al.,* 2014), and Nigeria (Osemeobo, 1989) teak competes with agricultural crops and household land and labor are scarce. Yet smallholders are willing to grow teak on short-rotations to rehabilitate soils, diversify crop production and increase incomes. In the humid American tropics, specifically Panama (Zanin, 2005) and Costa Rica (De Vriend, 1998), biophysical and market conditions make teak cultivation an attractive option for farmers. However, to avail those opportunities farmers require support to access land, technical and market information, and quality planting material.

5.2.3 Production and Silvicultural Systems

In Central Java, farmers cultivate teak in four systems: kitren, tegalan, pekarangan, and line plantings. Kitren are teak dominated woodlots. Tegalan are mixed upland systems of trees and annual crops. Pekarangan are home gardens, with annual crops cultivated in the understory. Line plantings can be borders or across annual cropping systems. Farmers generally have more than one teak system or parcel. Tegalan are the most common and largest, accounting for half of the teak systems and averaging a half ha. Kitren accounted for a quarter of the systems, averaging a third ha. Pekarangan also accounted for a quarter of the systems, but are smaller, of a quarter ha. Kitren have the highest tree density and the least species diversity (Table 1). Home gardens have the greatest species diversity. Teak accounted for 55.9% of the trees (Figure 2) and 47.2% of the regeneration across all systems.

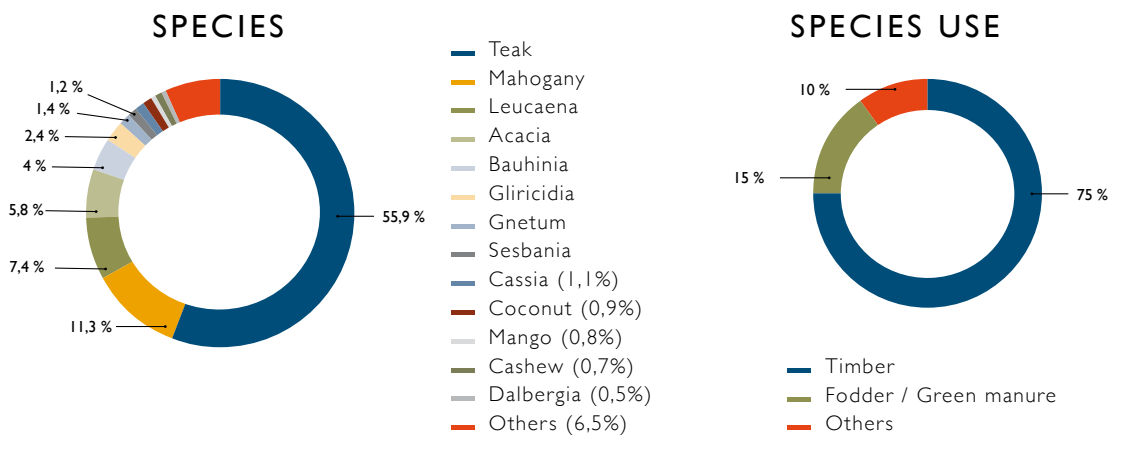
Most farmers (82%) manage their teak systems for both tree and annual crop production; over half of tegalan

Types and composition of smallholder teak systems in central Java. Table 1

Teak system	Percent of teak systems	Farm size (ha)	Tree density (trees/ha)	Number of tree species (system)
Tegalan (intercropping)	50.6%	0.47	1072	8
Pekarangan (home garden)	21.9%	0.24	1177	13
Kitren (woodlot)	21.9%	0.31	1532	5
Line plantings (agric. land)	4.8%	0.31	138	7

Source: Roshetko et al. 2013

Species composition of smallholder teak systems in Central Java Figure 2



and one-third of home gardens are intercropped annually. Kitren may also be intercropped. The most common intercrops are cassava, peanuts and upland rice, with soybeans, long beans and other vegetables also cultivated. The traditional Indonesian intercropping practice is called *tumpangsari*. It differs significantly from the taungya system where seedlings are intercropped with annual crops for 1-3 years to improve plantation establishment and early growth of trees. Tumpangsari is not limited to the tree establishment phase but is practiced with trees of all ages. It is a crop production and income generation strategy. Decisions regarding when and what to intercrop are based on prevailing market prices for agricultural crops, and available household labor and capital. The positive impact on tree growth is a welcomed benefit, but not considered in decision making (Roshetko *et al.,* 2013).

Smallholder teak systems in Indonesia have been described as overstocked, slow growing and of sub-optimal quality and production (Roshetko and Manurung, 2009). Initial tree spacing is 2.5x2.5 m to 3x3 m. These spacings are appropriate, if thinning is implemented on five-year cycles to reduce densities as trees grow (Pramono *et al.,* 2010; Pramono *et al.,* 2011). However, most farmers are reluctant to thin as the removal of trees is considered a loss of future income. Farmers' thinning operations are generally harvests that remove the best quality trees. Pruning is implemented to harvest branches for fuelwood, leaving behind branch stubs of 10-15 cm. Coppice is commonly used by farmers (20%) to establish a second rotation, but coppice thinning is not practiced. Few farmers (12%) have used improved quality germplasm to establish teak systems, most rely on wildlings (72%) or local seedlings (30%). Weeding and fertilizer application are only practiced in association with intercropping (Roshetko *et al.* 2013).

Poor silvicultural management of smallholder teak systems is also common in Laos (Midgley *et al.* 2007; Newby *et al.,* 2012), in Thailand (Mittelman, 2000), in Panama (De Vriend, 1998; Zanin, 2005), and for smallholder teak systems in general (Bhat and Ma, 2004). Similar to Indonesia, farmers in Laos (Midgley *et al.,* 2007), Panama (Zanin, 2005) and Togo (Kenny *et al.,* 2014) primarily use wildlings or local seedlings of unknown origin to establish their teak systems.

Participatory on-farm trials in Indonesia demonstrate that silvicultural treatment has enhanced growth of smallholder teak systems. Over a 2-year period, thinning and pruning treatments increased incremental diameter breast height (dbh) by 60% and incremental tree height by 124%. Coppice thinning increased incremental dbh by 45%. Recommendations suggest thinning should occur in 5-6 year-old stands to reduce tree density to 625 per ha. If initial spacing is 3 x 3 m or 2.5 x 2.5 m, the appropriate thinning intensity would be 40% and 60%, respectively. Pruning to 60% of total tree height is recommended also when trees are 5-6 years old (Roshetko *et al.,* 2013). Intercropping was also found to improve diameter increment and is recommended when crop production is supposed to be profitable.

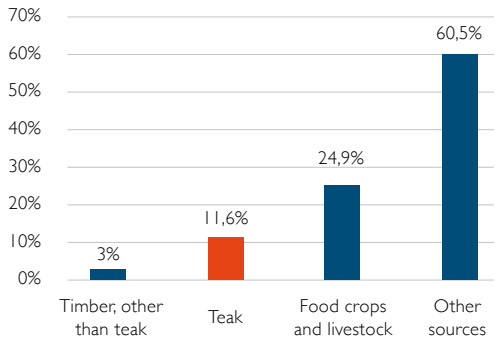
Based on the trials and related extension activities, local farmers recognized the advantage of silvicultural management. 70 % of the participating farmers and 30% of the non-participating farmers on the project site adopted some silvicultural practices (Rohadi *et al.,* 2011). Farmers with access to larger areas of land, higher on-farm income, and more assets are more likely to adopt silvicultural management (Sabastian *et al.,* 2014; Kallio *et al.,* 2011). Farmers with less income and small landholdings are more cautious and less able to shoulder the risks involved with a change of management. Involvement with farmer groups, access to information, and education level often enhance farmers' ability to adopt new (silvicultural) practices by expanding their knowledge.

5.2.4 Finance, Economics, and Marketing

Smallholder farmers have limited capital and household labor. They deploy those resources to generate the best returns with emphasis on the short-term. Teak is not prioritised. Farmers do not take loans to finance the establishment or management of tree farming systems; neither are private nor government banks interested to provide loans for smallholder timber production (Rohadi *et al.,* 2011). Fortunately, the cash costs to develop smallholder teak systems are generally low. As stated, most farmers depend on self-sourced local germplasm to establish teak systems. Fertilizers and weeding costs are only incurred with cultivating annual crop. Planting and other tree management activities are conducted when opportunity costs are low for other on-farm or off-farm activities (Perdana *et al.,* 2012). Similar finance approaches to smallholder teak production are reported in Laos (Newby *et al.,* 2014).

Farmers' limited investment approach is reasonable, as rotation ages are long and tree crops are not a main source of household income. Cash investment is only marginally profitable, partially due to limited market incentives and restrictive government policies (Perdana *et al.*, 2012). The contribution of teak to household income is only around 11.6%. The share is significantly greater

Contribution of teak sales to household income. Figure 3



Prices for smallholder teak in Gunungkidul district, Yogyakarta. Table 2

Age (year)	DBH (cm)	Price accepted by farmer (USD/standing tree)	Log volume after processing by traders (m^3)	Log price collected by traders (USD/m^3)
10	12–18	3–6	0.045–0.189	3–25
15	13–31	5–30	0.060–0.515	6–123
20	21–45	10–265	0.307–1.061	57–284
25	29–49	20–296	0.320–1.321	54–329

Source: Roshetko et al. 2013

than for other tree species such as mahogany (*Swietenia macrophylla*) and sengon (*Paraserianthes falcataria*) (3.0%), but far below the income generated from food crops and livestock (24.9%) (Figure 3). Farmers generally cultivate teak as living saving accounts where teak is harvested to finance significant cash needs such as weddings, school fees, large medical expenses, social commitments or emergencies (Perdana *et al.,* 2012).

Value-chains for smallholder teak in Indonesia include farmers, local traders, large-scale traders (wholesalers), and processors. The farmers' role is limited to producer. Standing trees are the standard unit of sale for farm-grown teak. Price negotiation is based on individual or blocks of trees. Negotiation is done without clear quality or value standards. The market rewards larger trees with higher prices (Table 2), but few farmers harvest trees based on economic maturity.

Both farmers and traders are motivated by higher prices for higher quality timber. However, most farmers are price takers. When selling timber, most farmers seek market information from other farmers who recently sold trees or improve their negotiation position by offering the trees to more than one buyer. But regardless of the approach taken, farmers usually obtain prices that are well below market rates because of their limited access to market information and weak negotiating position. Traders also face challenges, where they manage various activities, such as the physical possession and ownership of teak logs, promotion to potential buyers, negotiation with buyers and smallholders, attending to government permits, and risk of possible loss and quality of product over time. Traders also provide financing related with debt bondage to farmers who are willing to use their trees for mortgage. Each activity represents costs that may not be recovered for various reasons (Perdana and Roshetko, 2015). These activities resulted in high risk and high transaction costs, leading to lower prices for farmers.

5.2.5 Recommendations and Guidance

Smallholder teak systems enable farmers to diversify farm production, reduce risk, support food security, and generate income. They are also an important alternative source of quality timber for the teak industry. Unfortunately, the potential of smallholder teak systems is limited by poor silvicultural management, limited market access, and policy disincentives. These impediments must be addressed.

Smallholders' tendencies in some countries to manage and harvest teak to meet their financial needs has an important function as part of their social and economic safety net. However, silvicultural management of smallholder systems requires improvement. Chief among these is the adoption of thinning to enhance incremental diameter growth. While specifics may vary by location, the following is provided as a general recommendation. When plantings are 5-6 years old, they should be thinned to 625 trees per ha. To overcome farmers' reluctance to thinning, plantings can be established with alternating rows of teak and a short-rotation timber species (e.g. *Gmelina arborea*, *P. falcataria*) that can be harvested in 5-8 years. Similarly, pruning to 60% of total height is recommended for 5-6 year old trees. Subsequent thinning and pruning should be considered on a 5 year basis. As intercropping generally has a positive influence on tree growth, intercropping is encouraged with crops that meet local market demand. Most important, trees should be retained until the age of 20 to 30 years, when they reach a diameter size that is compensated with a lucrative market price.

Limited market access greatly hinders farmers' incentive to produce quality teak. A shared-value model, which is a business strategy focused on creating economic value in a way that also creates economic value for farmers, would improve the knowledge of teak farmers and local traders. These interactions could be further expanded to become farmer-industry partnerships where farmers produce trees to meet market specifications. Farmers could engage in group marketing to reduce transaction costs and improve timber supply.

Governments could provide incentives to smallholder teak farmers, and indirectly to the teak industry, by simplifying timber trade regulations to minimize transaction costs and eliminate extra-legal fees. They could also regularly publish market information on teak prices and quality. Government and support agencies can provide silvicultural training and extension services to enhance smallholders' technical knowledge and capacity. With research agencies and industry, they could facilitate farmers' access to sources of quality germplasm.

5.2.6 References and Further Reading

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