FARMERS PARTICIPATION ON DIPTEROCARP TREE PLANTING IN SMALLHOLDER RUBBER PLANTATION

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ABSTRACT

Introduction of rubber trees in Sumatra in early 1990's has transformed Sumatran landscape since many years ago. In Jambi, rubber trees are commonly planted and managed traditionally in agroforestry systems, which create heterogeneous vegetation but low latex productivity. Nowadays, rubber farmers have started to adopt technology on using good quality of rubber clone and managed their rubber intensively to increase rubber latex productivity. On the other hand, the more intensive rubber management, the less diverse the biological diversity. Enrichment planting in smallholder rubber plantation improved the diversity. Our study in Jambi showed that farmers had less interest on planting forest tree species, such as dipterocarp trees, mainly due to high price of good quality of seedlings and less experience on planting forest tree species. Planting *Shorea* trees in smallholder rubber plantation showed that *Shorea* spp. grew better in open area in one year old rubber plantation, compared with more than 10 years old rubber plantation. Light competition between dipterocarp trees and rubber trees can be minimized through wider space planting. Application of ectomycorrhizal inoculums for *Shorea* seedlings resulted better performance on early growth in nursery stage, however, less impact for *Shorea* growth after transplanted to the field. Successfulness of *Shorea* trees planting in smallholder rubber plantation in Jambi with farmers' participation is discussed in this paper.

INTRODUCTION

Dipterocarpaceae are dominant emergent trees in the lowland rain-forest of Sumatra. Although it is not as rich as Kalimantan tree species, Dipterocarpaceae tree dominates the forest and has contributed in economic development of Sumatra through forest logging company. In addition to primary forest, a century years ago in the colonial era, in northen part of Sumatra, commercial trees have been introduced in to the area, such as rubber tree (*Hevea brasiliensis*), was brought to North Sumatra in early 1990's. The *para* rubber trees were domesticated and grew well in the lowland of Sumatra. Since then, rubber has led to a dramatic change in the lowland tropical rainforest of Sumatra and Borneo, especially along the river with good accessibility (Tengwal, 1945; Joshi et al., 2002). For many years, rubber has played significant role in economic development of Indonesia. In June 2011, volume of Indonesian rubber export reached 1.72 million ton, and export value increased dramatically from USD 4.3 billion to USD 7.59 billion[1].
In the early of rubber agroforest development, rubber seeds were planted after opening up the forest by slash and burning, followed by planting dry paddy in the first year. In the second year, farmers planted crops, such as chili pepper, vegetables (such as long bean, cucumber, egg plants, and spices) and tree crops for their daily needs. Farmer lived in a hut inside their garden to maintain rubber trees for about three years, and protected the trees from pests, mainly wild pigs.

[1] http://nasional.kontan.co.id/v2/read/1312511287/74681/Nilai-ekspor-karet-melar-hingga-749

After three years, when the rubber trees grew up at the height about 2-3 m and stem diameter about 3-4 cm, trees are strong enough to survive from pest attack, the farmer and family left their garden. During the 'fallow' period, many other vegetation from seed banks and natural regeneration grew spontaneously. The farmer will return to their garden when rubber is being ready to be tapped at the age of 8 years after planting (Gouyon et al., 1993). Productivity of latex from rubber agroforest is very low, about 600 kg/ha/year, while productivity from smallholder monoculture rubber plantation yielded 1000-1200 kg/ha/yr (Leimona and Joshi, 2010).
Nowadays, intensification of rubber agroforestry in Bungo district has becoming common trend for farmers. Local government's movement on replanting smallholder rubber using rubber clone with intensive management aimed to increase rubber productivity and finally to enhance local income and revenue. However, intensification of rubber management decreases diversity of trees, as consequence. Enrichment planting in smallholder rubber monoculture plantation was objected to improve tree diversity and economy benefit from other trees planted in rubber smallholder rubber plantation.

Farmers Perception on Timber Tree Species

Smallholder rubber with agroforest system performs as multistrata canopy with diverse vegetation. Complex vegetation structure and high species composition in rubber agroforest in Jambi (Sumatra) have been reported (Michon, 2005; Tata et al., 2008). Farmers of small holder rubber with agroforest system allow other trees grow in their rubber garden, to get other benefit from fruits, fodder and wood. Farmers in two districts of Jambi (e.g. Bungo and Tebo districts) mostly have limited knowledge on native timber tree species. Native timber tree species that farmers know most were *Syzygium* sp. (kelat), *Shorea leprosula* (meranti batu), and *Litsea* spp. (medang). Introduction species, such as teak and mohogany, however, was more preferred as timber source than that of native species.Useful trees in smallholder rubber agroforest in Bungo district based on farmer's recognition, is shown in Table 1. Farmers use several native timber species grow in rubber garden for domestic purposes, such as house construction and furniture. The most preferred native timber tree species were *Ochanotachys amentacea* (petaling), *Syzigium* spp. (kelat), *Shorea* spp. (meranti) and *Litsea* spp. (medang). Some species were known as timber source, however farmers did not prefer to use them as timber source for construction, e.g. *Canarium* spp. (kedondong), *Dyera* sp. (jelutung), *Alstonia* spp. (pulai), *Santiria* sp. and *Lithocarpus* sp. (mempening).
In the development of smallholder rubber plantation, native tree species that grow in their land were selected based on their utilization, prior to land opening by slashing and burning. The selected timber trees were cut off and picked up by the farmer out of their land. Farmers with high capital collected most of valuable timber to be sold in local timber vendors. However, usually most timber and fallen trees were burnt, due to high cost extraction (including labour cost and chainsaw rental). Although, by selling timber from opening the land, farmers may get cash income in return to cover cost of land opening and planting.
Farmers in the two districts had less experience to plant timber trees. Only 12.5% of respondents planted teak in rubber smallholder and most of farmers did not have such experience. Several reason for not planting timber tree (mainly meranti) were high price of seedlings (62.5%), lack of technical skills on planting techniques (12.5%), and timber, particularly meranti species, could be found in the surroundings (25%). Although in reality, forest cover in Bungo district in 2005 remained about 31% of total area (Ekadinata and Vincent, 2008).

Meranti Enrichment Planting in Rubber Smallholder

In early interview, many farmers (75%) were not willing to plant timber trees in rubber smallholder. Farmers argued that rubber and timber trees compete for soil nutrient, which reduce latex productivity. Moreover, farmers understood that rubber is light demanding; enrichment planting with meranti will compete for light. On the other hand, farmers who were willing to plant timber trees in rubber smallholder, agreed that meranti (*Shorea* spp., Dipterocarpaceae) is a valuable timber. Timber price increases with the increasing demand for wood. Meranti, like most of Dipterocarpaceae species, has long life-cycle, about 30-40 years, that can be used as live deposit for family needs in the future. Farmers who planted the meranti trees expected their next generation, e.g children and grandchildren, would harvest the timber yield.

Three criteria were used to select collaborating farmers in the enrichment planting smallholder rubber with meranti, based on (1) their willingness to collaborate and maintain the planted trees; (2) age of rubber stands; and (3) history of rubber smallholder area, in regard of prior land use type (forest, rubber agroforest or shrub). Geographic position of rubber smallholder areas were recorded, which were used for double checking to land cover trajectory change. Collaborating farmers (8 participants) were provided with seedlings of meranti (*Shorea selanica* and *Shorea lamellata*) and received technical assistance during period of observation for two years. Farmers were responsible for regular seedlings maintenance, such as weeding when necessary. No fertilizer was allowed to be applied for meranti trees, except for rubber trees.

Meranti were planted on three different ages of rubber smallholder, e.g. ≤2, 5 and 10 years old), with different histories, viz rubber garden was derived from forest and rubber garden derived from old rubber agroforest (second replanting cycle). Meranti seedlings were inoculated with ectomycorrhizal fungi, and uninoculated seedlings were used as control. All farmers actively followed the transplanting meranti seedlings in their rubber garden. However, after seedlings transplantation to the plots, only two collaborating farmers (e.g. plot of age ≤2 year rubber garden derived from rubber agroforest and plot of age 5 year rubber garden derived from rubber agroforest) kept maintain the meranti seedlings in the plots. Circular weeding around the meranti seedlings was done regularly, and even fertilizer was applied along with rubber trees. Trees in other plots were not maintained regularly, however. In plot of age ≤2 year rubber garden derived from forest, meranti seedlings entrapped by liana (*Mikania micrantha*). Without regular weeding in older rubber age (5 and 10 years old), liana entrapped occasionally occurred, owing to closed rubber canopy.

Response of *S. selanica* and *S. selanica* on the history of land and ectomycorrhiza treatment has been reported (Tata et al., 2010). In nursery stage, inoculation of ectomycorrhizal inoculums (spore tablet) affected early growth (both height and stem diameter) of the two *Shorea* species. However, after outplanting to all plots of rubber smallholder, inoculation of ectomycorrhiza only increased survival in the period of 6-24 month. Moreover, Tata et al. (2010) concluded that with or without mycorrhizal inoculation to seedlings in nursery stage, can be used for enrichment planting.

CONCLUSION

Lesson learnt from farmer participation of enrichment planting with dipterocarp's seedlings in smallholder rubber was that successfulness of the activity was not caused by the object itself, e.g. treatment given to the meranti seedlings. Farmers in the activity have been considered as the main factor on successfulness of enrichment planting. To conclude, successfulness enrichment planting depend on several factors, such as:

1. Farmers interest was driven by awareness of local timber demand and local timber market.
2. Clarity of status of dipterocarp planted trees in the end of life cycle of dipterocarp trees.
3. Farmers' effort on regular maintenance, such as weeding and circular fencing around meranti seedlings to protect from animal attack (such as wild pig and goat).
4. Support rules and regulation for marketing of farm-grown dipterocarp timber.

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