Dipterocarp Trees in Rubber Agroforestry: Interplanting Strategies for High-value Timber Production in Sumatra

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TRANSFORMING LIVES AND LANDSCAPES

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Figure 1. Meranti planting in rubber agroforest

Introduction

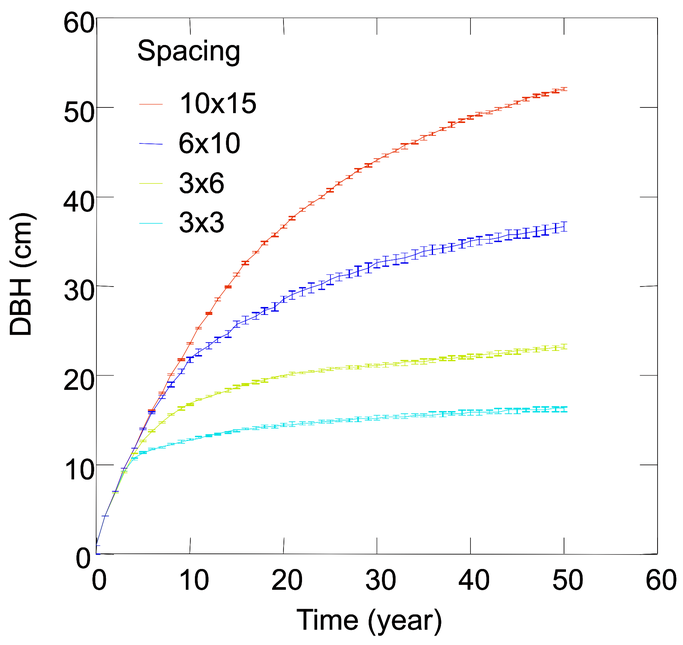
- Rubber agroforests in Sumatra (Indonesia) are managed by farmers under a range of management intensities. For trees other than Rubber farmers usually rely on natural regeneration, selecting useful trees (fruits, fire wood, spices, dye and timber) among many.
- With depletion of natural forests, the main source of timber, farmers are now interested in growing timber trees inside Rubber gardens (called *Kebun Karet*) both for domestic use and household income.
- Meranti, trade name for *Shorea* spp. (Dipterocarpaceae), is a high economic value timber, that can be inter-planted with Rubber. Some *Shorea* species, e.g. *S. fallax,* are shade tolerant; while others, like *S. leprosula*, *S. selanica* and *S. lamellata*, are light demanding.
- To support on-farm experimentation, we used the Spatially Explicit Individual-based Forest Simulator (SExI-FS) to explore options and planting strategies.

On-farm experiment (Tata, 2008)

- A researcher-led on-farm experiment of planting Meranti with Rubber to test the necessity of mycorrhiza inoculants for Meranti in Bungo and Tebo regency, Jambi (Indonesia).
- *Shorea selanica* and *Shorea lamellata* were transplanted at 5 sites with different history and age of Rubber tree
- Mixed diptercarp forest (MDF) plots were used as control. Meranti growth responded well to light; ectomycorrhiza formation did not (critically) depend on inoculation.
- A network of on-farm demonstration trials has now been initiated, within the CIFOR-ICRAF Landscape Mosaics project.

Growth prediction using SExI-FS model

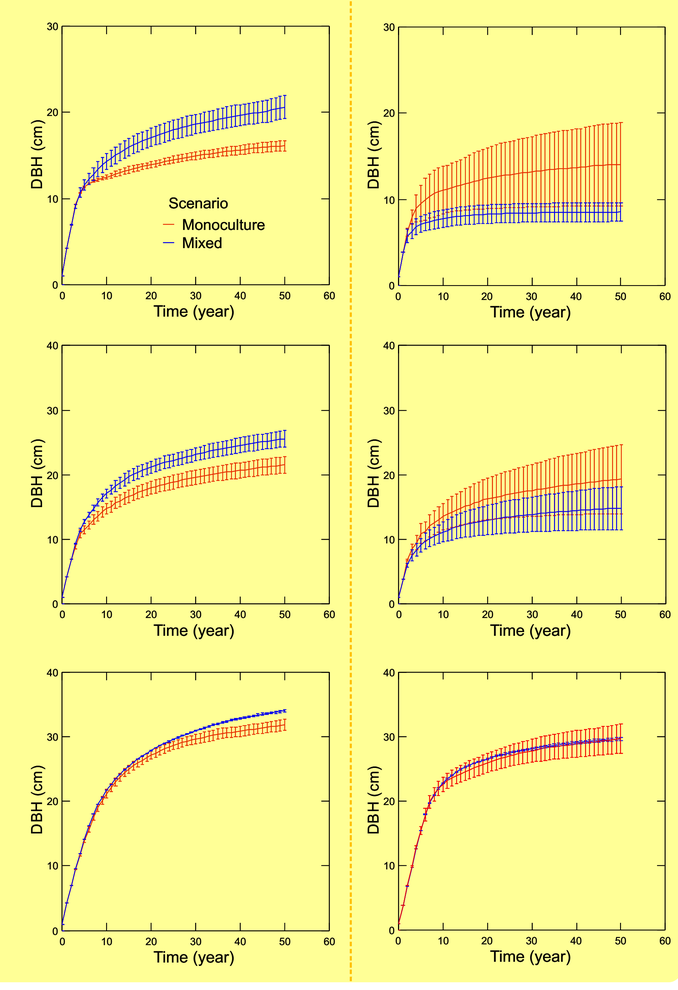
Growth rate of S. selanica (Hiratsuka et al., 2007) were used to calibrate the model. Strong effects of tree spacing on growth emerge after 4-8 years.



High density plantings may require thinning at 5 years of age.

Mixed Regular Plantation

- Tree spacings of 3x3 m, 3x6 m and 6x6 m were tested for both Meranti and Rubber monoculture, and for 50-50 mixtures, with Meranti and Rubber planted at the same time.
- In a dense plantation (3x3 m), Meranti grew better when mixed with Rubber than in monoculture; but Rubber was significantly suppressed.
- In a 3x6 m spacing, Meranti still dominated Rubber; however, the competitiveness of Meranti was much less than in a 3x3 m spacing.
- Competition effect of Meranti on Rubber almost disappeared at 6x6 spacing.
- According to growth simulation, despite its higher potential growth rate, Rubber is less efficient than Meranti in the use of space.



Mixed Random Plantation

Figure 2. Results of growth simulation for Rubber (blue) and Meranti (red)

Number in Scenario (0,1,2,3,4,5) refers to the years after planting Rubber when Meranti is inter-planted. Total tree density is 555 trees/ha, random distribution; Rubber:Meranti = 50:50, Rubber trees tapped regularly; assumed no mortality of trees.

Summary of simulation results:

1. Meranti is too aggressive for Rubber under Scenario 0.
2. Meranti growth very slow under Scenario 5.
3. In the 30-year simulation, Rubber is affected under Scenarios 0 to 2; and Meranti suffers from competition under Scenarios 3 and above.
4. Planting (gap refilling) Meranti around 2 years after Rubber may provide both Rubber and Meranti reasonable growth.

Meranti (e.g. *S. selanica* and *S. lamellata*) are light demanding species. In natural vegetation, Meranti emerges to the top of the canopy when gaps open.

The growth of Meranti in the field (left) and computer model (right); both suggest a requirement of sufficient light for Meranti to grow well.

Conclusion

- Faster growth rate does not make Rubber more competitive than Meranti, other properties such the space use efficiency (diameter-crown width relation) and diameter-height allometry are important in the model and probably in the field.
- Meranti grows well in gaps, but may be too competitive for Rubber if planted at the same time as Rubber at standard density.
- Allowing Rubber about 2 years to establish before planting Meranti offers a good compromise for the growth of both Rubber and Meranti.
- Inter-planting of Rubber gardens (e.g. after damage by white-root-rot disease) with Meranti may be more promising than mixtures at too high a tree density.

References

Hiratsuka, E., Toma, T., Mindawati, N., Heriansyah, I., Morikawa, Y. 2007. Long-term trends in trunk diameter and tree height growth in planted forests in the humid tropics of West Java, Indonesia. Tropics Vol. 17 (1).

Tata, H.L., 2008. Mycorrhizae on dipoterocarps in rubber agroforest (RAF) in Sumatra. PhD Thesis, University of Utrecht.

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