

Why RIL won't work by minimum-diameter cutting alone

RIL guidelines need to recognise that logging is the first and most important silvicultural act in tropical forests

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ACCORDING to the mean diameter cutting limit (MDCL) rule applied in the mixed dipterocarp forests of Southeast Asia, any tree with a diameter at breast height (dbh) above the specified limit of 60 cm may be felled. In the lowland dipterocarp forests, this rule leads to felling intensities as high as 10–20 trees/hectare or 100–150 m³/hectare. With such high extraction rates, reduced impact logging (RIL) is unable to significantly reduce damage to the stand. Moreover, foresters and ecologists generally agree that RIL operations based only on MDCL can neither sustain timber yields in the long term nor maintain forest ecological and functional integrity.

Here, I propose four silvicultural rules which aim to: 1) keep extraction rates below an acceptable threshold compatible with timber yield capability; 2) limit the impact of harvesting on tree species' diversity and composition; and 3) maintain timber species' populations by reducing the impact of logging on their ecology.

Rule 1

Minimum diameter cutting limit based on stand structure: three main types of population structure can be distinguished in mixed dipterocarp forest (Figure 1). For dipterocarp species, which belong to Structure I, an MDCL of 60 cm could still apply but should be modified by a rule that maintains an extraction rate threshold for all classes above 60 cm dbh based on growth model simulations.

In Structure II, the minimum diameter limit should be increased to 80 cm to leave sufficient adults to ensure reproduction and population maintenance after logging. Moreover, rare species should not be logged when the number of adult trees (ie dbh ≥ 50 cm) is below five individuals within a 100-hectare compartment.

Applying the MDCL of 60 cm to species of Structure III would result in very low extraction, even if the overall tree density was similar to that in the other structure types. In these populations, trees probably reach their sexual maturity at a dbh lower than 60 cm; it might therefore be possible to decrease the minimum diameter cutting limit to about 45 cm.

Rule 2

Minimum spacing distance of 35 m between harvested trees: this rule aims to reduce both felling intensity and gap size. Experiments in East Kalimantan, Indonesia have demonstrated that logging damage can only be significantly reduced if RIL techniques are used under a moderate felling intensity of 8–9 trees/hectare. A spacing of 35 m between felled trees ($d = \frac{100}{\sqrt{x}}$, where d = distance in m and x = number of trees per hectare) would achieve this density.

Rule 3

Single-tree felling gaps: the growth of seedlings and saplings of climax dipterocarps is stimulated by canopy openings not exceeding 600 m². However, within the dipterocarp family there is a continuum from the most light-demanding species (eg *Shorea leprosula*) to understory species (eg *Vatica* spp) that grow in continuous shade. Single-tree gaps of different sizes are likely to promote and maintain post-logging species' diversity, at least within the dipterocarps.

Rule 4

Maximum diameter cutting limit: one possible method for limiting gap size to an area that would not compromise dipterocarp regeneration is to avoid harvesting trees with dbh ≥ 100 cm. In the dipterocarp forests of Southeast Asia, the density of harvestable trees with dbh 60–100 cm reaches 10–11 stems/hectare, a rather high density compared to the rainforests of Africa and South America. Limiting harvesting to commercial trees within this dbh range should not therefore be a significant production constraint.

Concluding comment

Contrary to the common understanding of RIL, reducing damage to the stand is not its objective; rather, it is only one of many requirements for maintaining the forest's productive capacity and ecological function—that is, its sustainability. Harvesting guidelines should not only tell us how to plan skid trails and implement directional felling, they should specify how many trees should be felled, which species can be harvested, which should be protected, and what will be the future timber yield. On the latter, logging is indeed the first and most important silvicultural treatment. The integration of silvicultural principles and guidelines is essential for improving RIL techniques towards sustainable harvesting practices.

Structural adjustment

Figure 1: The three main types of tree population structure in mixed dipterocarp forest (Type I = dipterocarp-dominant; Type II = eg *Agathis borneensis*, *Dyera costulata*; Type III = *Scaphium macropodum*). Arrows show the suggested minimum diameter cutting limit (MDCL) for each structure.

