Biodiversity-rich rubber agroforest (RAF) contains a large share of the original forest plant and animal species of lowland Sumatra. It may be feasible to get market recognition for the forest-like production conditions, initially targeting ‘niche markets’. Any form of certification, however, requires an operational definition of species-rich rubber agroforest. In fact there is a continuum of management intensities and species richness. Our goal is to define quantitative criteria that are:

- easy to understand
- easy to measure
- reliable
- clearly distinguishing ‘jungle rubber’ from ‘rubber monoculture’ (or intensively managed rubber agroforest with only little biodiversity values left).

### Candidate criteria

This review suggests the following candidate criteria which provide threshold indicators for when RAF species and forestic structural complexity reasonably approaches natural forest. The data suggesting these indicators is shown below. We review the available data for forest (incl. not currently tapped RAF), currently tapped RAF and intensive rubber systems/monoculture (RM).

1. Number of tree species more than 10 cm dbh (diameter at breast height or 1.3 m above ground) in an 8 m circle around a random starting point
2. Relative rubber basal area, measured as a percentage of the total sum of diameter$^2$ of all trees in a sample area
3. Number of large trees (more than 40 cm dbh)
4. Number of seedling (shrubs, woody plants less than 2 m height) and sapling (woody species with dbh less than 10 cm and height more than 2 m) species in a defined sample area

### Data sets

A number of datasets of rubber agroforests have been collected in Jambi (Sumatra, Indonesia) that can be used to explore thresholds:

- ASB2 surveys led by Dr. Suryo Hardwinto (Gadjah Mada University, Yogyakarta) in Rantau Pandan, Muara Kuamang, Sapunggar, Muara Buat and Pinus Tuo 1998 – 16 transects (87 plots).
- Recent surveys for the Belowground Biodiversity project in Rantau Pandan, Muara Kuamang and Kuamang Kuning (Bungo district, Jambi). Total area of forest, RAF and RM surveyed were 0.32 ha, 0.32 and 0.20 ha, respectively. Other data (incl. PhD Thesis Saida Rasnovi) did not use full characterization of the tree flora.

4. **Number of tree bigger than 40 cm dbh (Tree Density)**

Old rubber agroforest includes large trees, that may have been left when the land was initially cleared for rubber planting, or that have grown since that time. Biodiversity in birds, mammals, insects and epiphytes is disproportionately associated with large trees. The lowest number of trees >40 cm dbh encountered at RAF in Muara Kuamang (MK) was 6 stems per ha (1 stemplot of 20' * 100 m or circle of 25 m radius), while we found 25 stem per ha (4 stem/plot of 20' * 100 m or circle of 25 m radius) in Rantau Pandan (RP).

5. **Number of Seedlings and Saplings**

Presence of seedlings and saplings in an ecosystem imply its regeneration. Diversity of seedling and sapling in RM was lower than in forest and RAF, but plot-to-plot variability was high. Seedlings are still abundant in rubber monocultures as well, so a seedling criterion will not help to differentiate management intensity. Therefore, in some cases seedling diversity could be as nearly as high in rubber monocultures as RAF. However, at the sapling stage forest and RAF show higher diversity. Sapling diversity is important because it indicates that the system allows survival of tree diversity. High tree diversity is important to faunal biodiversity because it produces structural canopy diversity providing many different niches. Proposed threshold: at least 4 species of sapling (> 2 m high, < 10 cm dbh) in the circle of 8 m radius.

**Proposed criteria as ‘proxies’ for (agro)biodiversity.**

**Trees of the present**
- > 4 samplings species/200m²
- > 1/3 relative BA of rubber
- > 4 tree species/200m²

**Trees of the past and/or future**
- > 4 samplings species/200m²
- > 1/3 relative BA of rubber
- > 8 tree species

**Trees of the future and future as above**
- > 4 samplings species/200m²
- > 1/3 relative BA of rubber
- > 12 tree species

Next steps:
- Discuss the proposed criteria in the villages that are interested to certify their old rubber agroforests. Test whether or not farmers can make reliable assessments on the basis of these (or modified) criteria.
- Explore other data sets to get further empirical basis for the criteria as ‘proxies’ for (agro)biodiversity.
- Discuss the draft criteria with certifying agencies to ascertain acceptability.