

Supplementary_Text1: Detailed description of each of the habitat sub-types identified through spatial analyses present within our study site and the larger Rungan-Kahayan landscape in Central Kalimantan.

i. Kerangas black soil

This forest sub-type is characterised by a thin surface peat layer (11.9 ± 8.2 cm), followed by a large white sand horizon. It occurs on elevated plateaus (55-65 m asl) and gentle slopes (1.7^0 - 2.7^0) and represents one of the most extensive habitat types in MBERF. Soil moisture in this habitat type is fairly low (mean = $15.8\% \pm 10.2$) owing to thin peat layer over porous sand. This habitat sub-type has the highest species richness ($n=82$) and the second highest diversity of species (56.0 ± 17.0) compares to other habitat types and dominated by the trees of the families Myrtaceae and Dipterocarpaceae, constituting 32% of all trees in this habitat type. The average tree height in this habitat is 18.6 ± 5.7 m with the trees of Dipterocarpaceae and Clusiaceae dominating the tallest canopy (>30 m in height), which includes *Shorea ulginosa*, *Shorea teysmanniana*, the endemic *Dipterocarpus borneensis* and *Calophyllum* sp. This habitat sub-type is also characteristic of trees with fairly large DBH and has the second highest basal area of all habitat sub-types in the study area (Mean DBH = 19.1 ± 11.4 cm and basal area = 32.44 ± 15.5 m²/ha). It contains high seedling and sapling densities (14.6 and 9.9/m² respectively). This habitat is also the most abundant in lianas (0.102/m²) and large rattan (*Calamus* sp.) (0.013/m²) and the second most abundant in pitcher plants (0.019/m²) and orchids (0.007/m²) after low canopy pole and stream edge habitat respectively. A unique characteristic to this habitat sub-type is the tree *Agathis borneensis* that is found only in the kerangas habitat in the study area and listed as Endangered under the IUCN Red List (Farjon, 2013). It is one of three endemic species of tropical conifers in Borneo, i.e., *Dacrydium beccarri* and *Gymnostoma nobile* also found most in the kerangas habitat type. Undergrowth in this habitat sub-type is sparse and dominated by large thorned pandan (*Pandanus* sp.) and saplings.

ii. Kerangas White Soil

This habitat sub-type is characterised by a very thin peat layer (6.6 ± 4.9 cm). The porous white sand horizon dominates the soil structure resulting in low water retention and soil moisture content ($11.9\% \pm 8.1$). They occur on relatively steeper slopes ($2.7^0 - 2.9^0$) with high drainage potential compared to kerangas black soil habitat and in disturbed areas where the top soil has been exposed to erosion. It constitutes a significant proportion of land cover in the study area

occurring at elevations between 54-64 m asl. A fairly structured and medium to tall forest, it contains a relatively average tree species diversity (47.6 ± 13.1) mainly dominated by trees belonging to the families Dipterocarpaceae, Myrtaceae and Clusiaceae constituting 58.7% of all tree species in this habitat sub-type. Compared to other sub-types, this is the only sub-type with the highest abundance of tree species belonging to the family Fabaceae (54% of all trees belonging to the family across all sub-habitat types) which is well known for the nitrogen fixation ability through rhizobia in their specialised root nodules (Soltis et al., 1995). The average DBH of trees, 18.7 ± 9.3 cm is slightly lower and a basal area of 25.11 ± 5.82 m²/ha, considerably lower than that of kerangas black soil habitat. However, average tree height of 17.6 ± 5.3 m is similar to the kerangas black soil habitat sub-type, although only a few trees are above >30m belonging to the genus *Shorea*, *Vatica* and *Palaquium* are present. This sub-type has the highest abundance of seedlings (19.8/m²), ferns (1.7%) and shrubs (0.026/m²) constituting the forest undergrowth. This is the only habitat sub-type to have no pneumatophores, *Pandanus* sp. or any palms. However, orchid abundance (0.009/m²) is the highest in this habitat sub-type as compared to the other habitats.

iii. Low canopy pole swamp forest

This is a very low open canopy peat soil forest sub-type with average tree height of 16.2 ± 5.2 m. It is characterised by a fairly thick layer of peat (59.5 ± 77.1 cm), spongy underfoot consisting of a network of roots on the peat surface. The area has a relatively high perennial water-table, with large pools and a high soil moisture content of $77.1\% \pm 13.4$. The forest is characteristic of densely packed poles due to trees with DBH between 10-20 cm constituting 89.5% of tree cover. There are only two distinct canopy layers, where only 10.2% of trees are above 25m in height, dominated by *Combretocarpus rotundatus*, which is also a species fairly unique to the low pole swamps. This sub-type has the least tree species diversity (32.8 ± 10.7) and shares the highest percentage of dissimilarity with respect to tree species with the other habitat sub-types ($J= 0.87$). This sub-type is heavily dominated by tree species belonging to the family Myrtaceae and Calophyllaceae that comprises 53.7% of all tree species present. Low pole swamp has the smallest basal area compared with all other sub-types of 19.77 ± 12.80 /m² with a mean DBH of 14.9 ± 8.7 cm, although it has the second highest density of trees after mixed swamp forest (0.085/m²). Pneumatophores (0.11/m²) and hummocks (57%) are abundant in this forest sub-type owing to a high percentage of stand water ($24.2 \pm 23.3\%$). Due to its open short canopy, the incident light reaching the forest floor is more than other forest sub-types, therefore providing suitable conditions for dense undergrowth cover dominated by

Pandanus sp. and an abundance of bryophytes on the moist peat surface. Pitcher plants (*Nepenthes* sp.) are one the most characteristic undergrowth of this sub-habitat type with the highest abundance ($0.05/\text{m}^2$) compared to other habitat sub-types.

iv. Transitional/Mixed swamp forest

Mixed swamp forest sub-type is scarcely represented in the study area, and mainly occurs as a transitional forest type between kerangas and low pole swamp or between kerangas and stream edge habitats. Due to its transitional positions in the mosaic, this forest sub-type shares similarities in biotic and abiotic characteristics with its neighbouring habitat sub-types. Its soil profile combines an irregular peat horizon (121 ± 64 cm), with white sand underneath and a high soil moisture content ($82.8 \% \pm 4.7$). It is characteristic to relatively high diversity (51.3 ± 14.5) and is the densest sub-type with 8.8% of trees per square metre. The most dominant tree species belong to the families Hypericaceae, Sapotaceae and Myrtaceae. Other common families include Clusiaceae, Euphorbiaceae, Dipterocarpaceae and Rutaceae. The average height of the canopy is 18.3 ± 39.4 m with the tallest trees reaching up to 39 m in height. The canopy is stratified with an open upper layer above 25 m (*Shorea uliginosa*, *Calophyllum hosei*, *Dyera polyphylla*, *Cratoxylon arborescens*, *Combretocarpus rotundatus*, *Dactylocladus stenostchys* and *Palaquium* sp.), a dense close layer between 15-25 m (*Palaquium leiocarpum*, *Xylopia fusca*, *Calophyllum hosei*, *Madhuca motleyana* and *Rubroshorea teysmanniana*) and a fairly closed lower layer between 10-20 m. Most trees in this sub-type grow on stilted roots and/or on hummocks interspersed with hollows as this forest sub-type is seasonally inundated, resulting in the highest abundance of pneumatophores ($0.28/\text{m}^2$) compared to other sub-types. This sub-type is also characteristic of the largest number of vines ($0.085/\text{m}^2$) and abundance in liana, although has sparse undergrowth compared to other habitat sub-types, dominated by pandans (*Pandanus* sp. and *Freycinetia* sp.) and tussocks in the transition to low canopy pole forest. Pitcher plants are present but considerably lower in abundance compared to low pole swamp and kerangas sub-types and are most common in transitional areas to low pole swamp forests. However, in the transitional areas between kerangas and stream edge habitat sub-types, saplings are abundant in the forest understory ($4.84/\text{m}^2$). Interestingly, this habitat sub-type has the lowest abundance of orchids ($0.0004/\text{m}^2$).

v. Stream edge forests

Stream edge forests occur in strips and patches next to perennial streams and adjacent to slopes, where seasonal streams occur. Accumulation of organic litter carried by recurrent floods results

in varied peat horizons (49.8 ± 60.5 cm) under which there is a white sand horizon. Stream edge habitat sub-type is found on slopes between $2.1^0 - 2.5^0$ and has an average soil moisture content of $25.9\% \pm 27.7$ in the thicker peat soils of the sloped stream edge areas. On average this habitat sub-type has the tallest canopy (19.9 ± 6.4 m), where 13% of all measured trees in this sub-type are above 26 m in height. *Rubroshorea uliginosa*, *Dipterocarpus* spp., *Dyera polyphylla*, *Anglesia splendens*, *Calophyllum* sp.3 and *Gonystylus macrophyllus* are the common trees above 35 m in height in this sub-type. Other species that make up the top canopy are *Garcinia beccarii*, *Dryobalanops rappa*, *Madhuca motleyana*, *Mezzetia parviflora* and *Dactylocladus stenostchys*. It has the largest basal area (34.52 ± 9.99 m²/ha) with a highest mean DBH of 20.4 ± 12.5 cm. Tree diversity in the stream edge forest sub-type is the highest (58.3 ± 16.5) and is dominated by trees belonging to the families Dipterocarpaceae, Myrtaceae and Sapotaceae. Other common families in this forest sub-type are Clusiaceae, Annonaceae, Rutaceae, Anacardiaceae and Thymelaceae. The undergrowth is relatively diverse with moderate abundance of most understory flora –shrubs/sedge (*Thorachostachyum bancanum*), tussocks, seedlings, saplings and *Freycinetia* sp. However, the highest abundance of ferns ($2.3\%/m^2$) and palms and the lowest abundance of *Pandanus* sp. is observed in this habitat sub-type.