Litter-fall, leaf litter nutrients, litter decomposition and seedling density at SAFE

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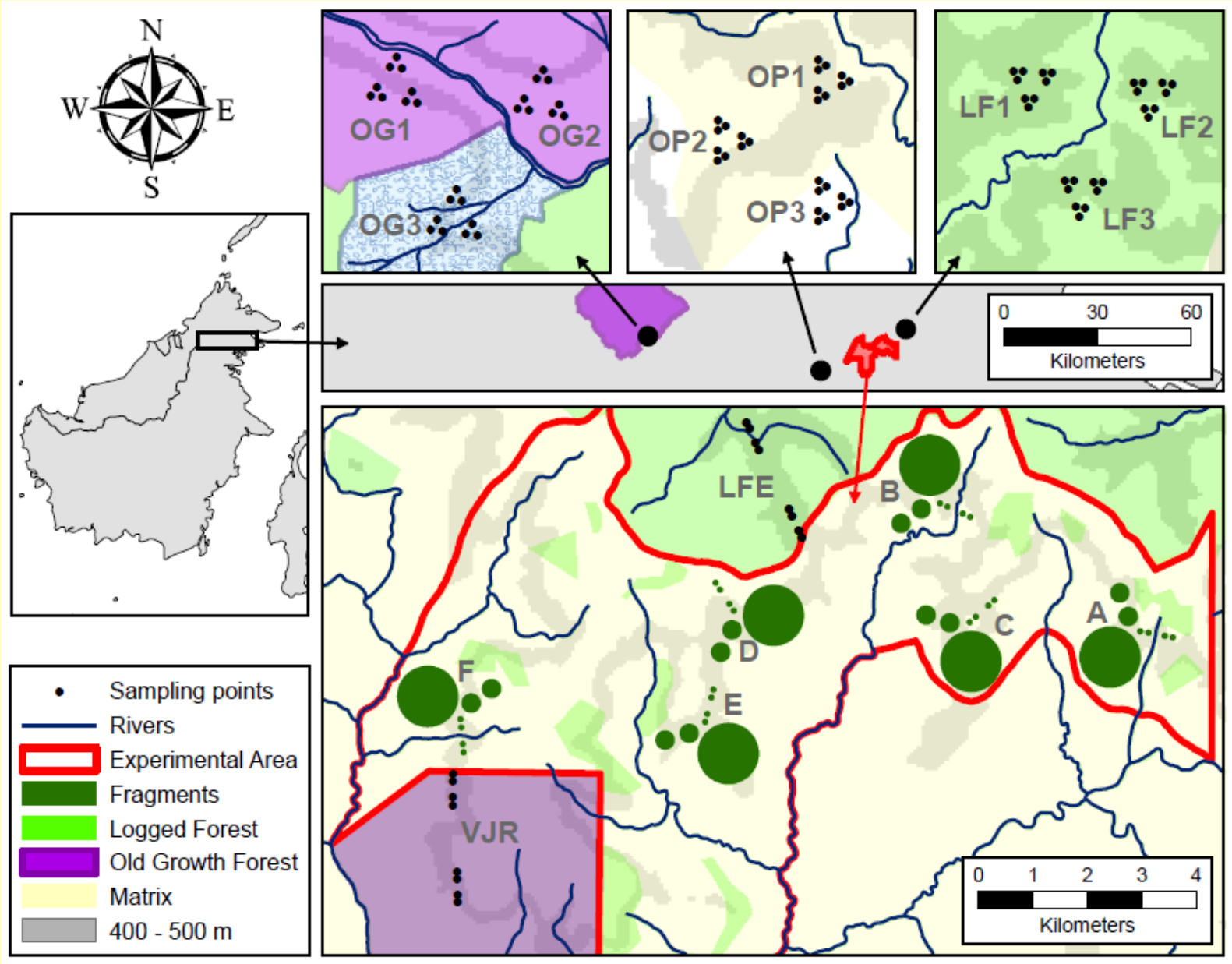
Stability of Altered Forest Ecosystems

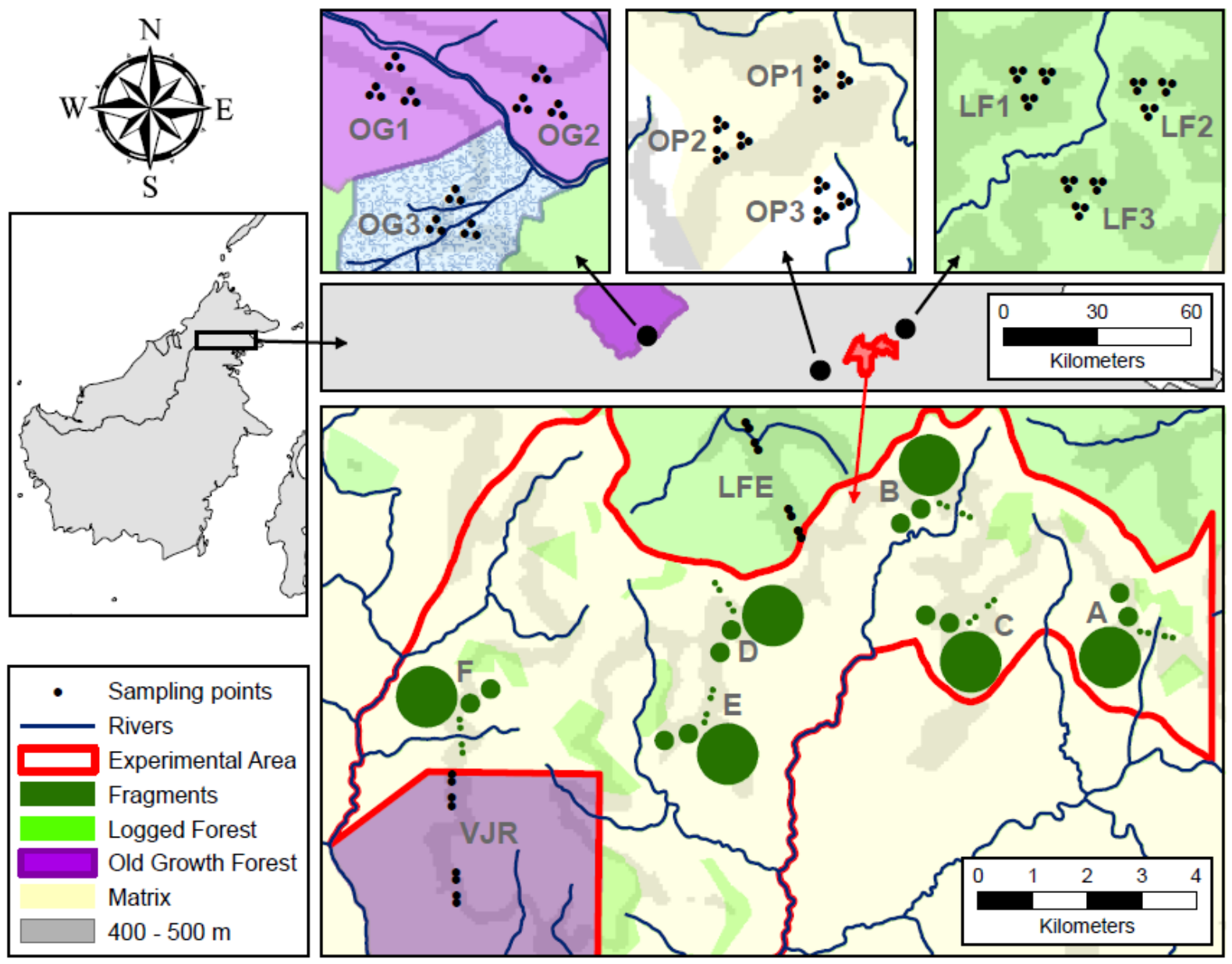
Introduction

- Data on litter-fall has been collected in the SAFE vegetation plots biannually since 2010
- This data as well as an additional study on litter C:N and seedling density formed part of Hamzah Tangki's thesis
- In 2011, a study was also carried out investigating leaf litter decomposition across the SAFE plots
- In this talk I will briefly introduce the methods used and key findings

SAFE Project design

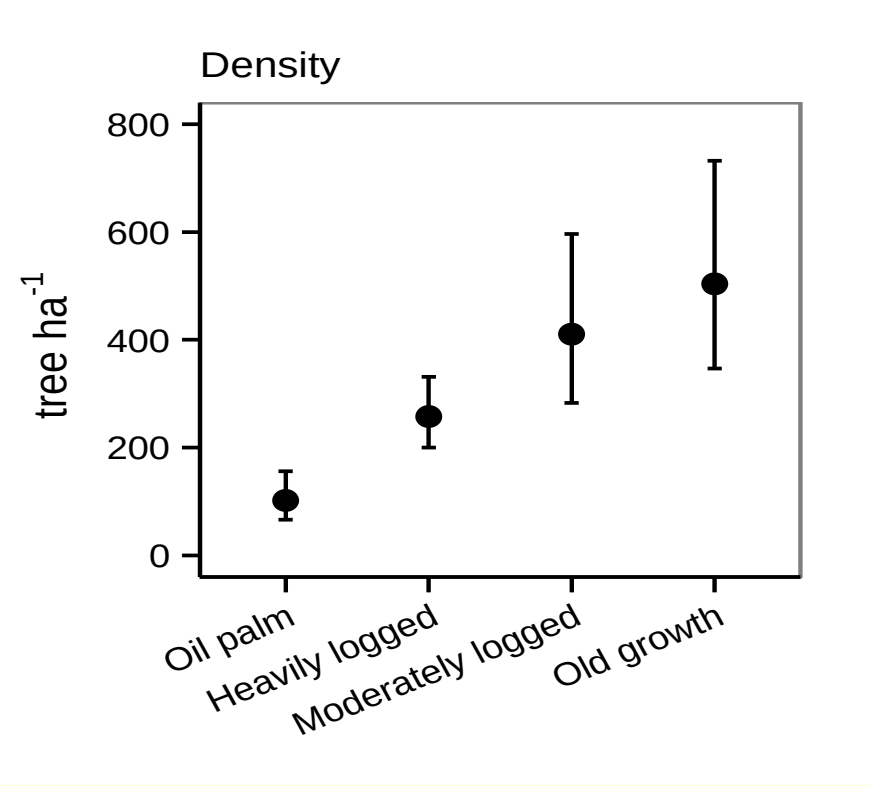


You all know this by now!



Vegetation plots

193 25x25m vegetation plots established across the SAFE landscape in 2010-11, encompassing a habitat degradation gradient



Vegetation plots

- Large (1m) litter trap set up at the centre of each vegetation plot in 2011
- Leaf litter collected over a two-week period, twice-yearly
- Leaf litter oven-dried, sorted into different fractions (leaf, twig, reproductive parts etc.), and weighed
- A subset of collected leaf litter pooled for each area (e.g. Fragment A, OG 1 etc..) to produce 50-60g samples
- These oven-dried and analysed for C:N using a high-temperature combustion process

Sub-sample for C and N analysis

Site	Disturbance level	Logging history	Block	Number of litter traps	Number of C and N samples
Old growth forest	Undisturbed	Never	OG1	9	3
	Undisturbed	Never	OG2	9	3
	Very low	Low intensity	OG3	9	3
	Low	Variable	VJR	8	4
Moderately logged forest	Intermediate	Twice	LF1	9	3
	Intermediate	Twice	LF2	9	3
	Intermediate	Twice	LF3	9	3
	Intermediate	Twice	LFE	8	4
Heavily logged forest	High	Twice	A	16	4
	High	Twice	B	16	4
	High	Twice	C	16	4
	High	Twice	D	16	4
	High	Twice	E	16	4
	High	Twice	F	16	4
Oil palm plantation	NA	Cleared	OP1	9	3
		Cleared	OP2	9	3
		Cleared	OP3	9	3

Leaf litter decomposition

- A subset of leaves also pooled for different areas and cut into ~2cm pieces
- 4g of these placed into course mesh litter bags
- 4 bags, containing the locally-sourced litter placed out into the centre of each plot
- 10cm cotton squares also placed in the same areas
- One bag and cotton square collected after 20 days in each site up to 100 days

Oil palm litter

Because of very low levels of litter-fall in the plantations and that most of the litter within plantations is made up of cut fronds, we used freshly-cut oil palm fronds from each plot to calculate C:N and to use in the litter decomposition experiment

Seedling densities

- Seedling plots established across eight SAFE sampling plots
- These to complement data on larger trees, collected at the 25m plot scale
- 5m^2 plot established for larger seedlings (>50cm height)
- 2m^2 plot for small seedlings (10-50cm height)

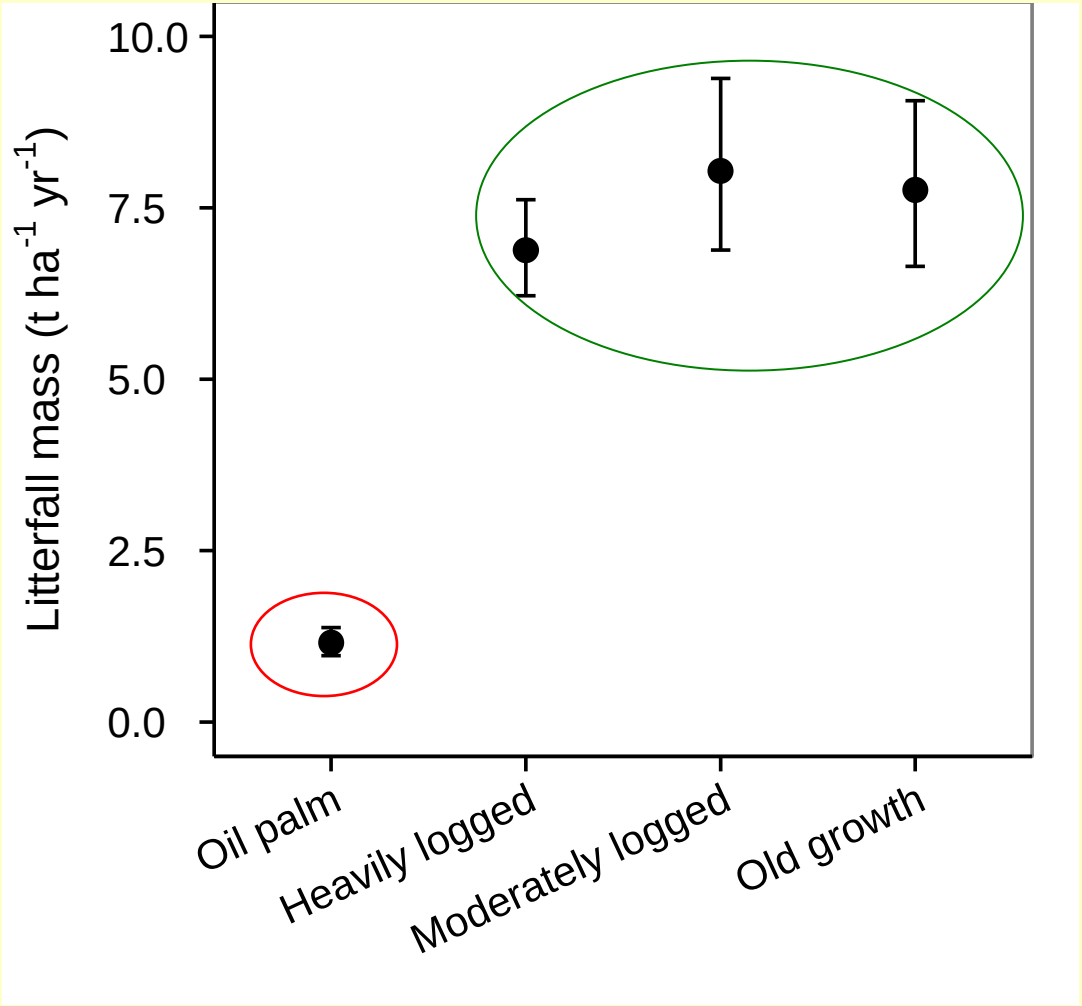
Sub-sample of plots used for seedling density study

Site	Logging history	Block	Canopy cover (%)	Number of seedling plots	Forest structure
Undisturbed forest	Never	OG1	100	9	Dominated by Dipterocarpaceae species
		OG2	100	9	
Moderately logged forest	Twice	LF1	100	9	Mixed forest
		LF2	86	9	
Highly logged forest	Twice	D	35	12	Mixed forest mostly dominated by pioneer trees
		A	26	12	
		E	21	12	
		C	16	12	

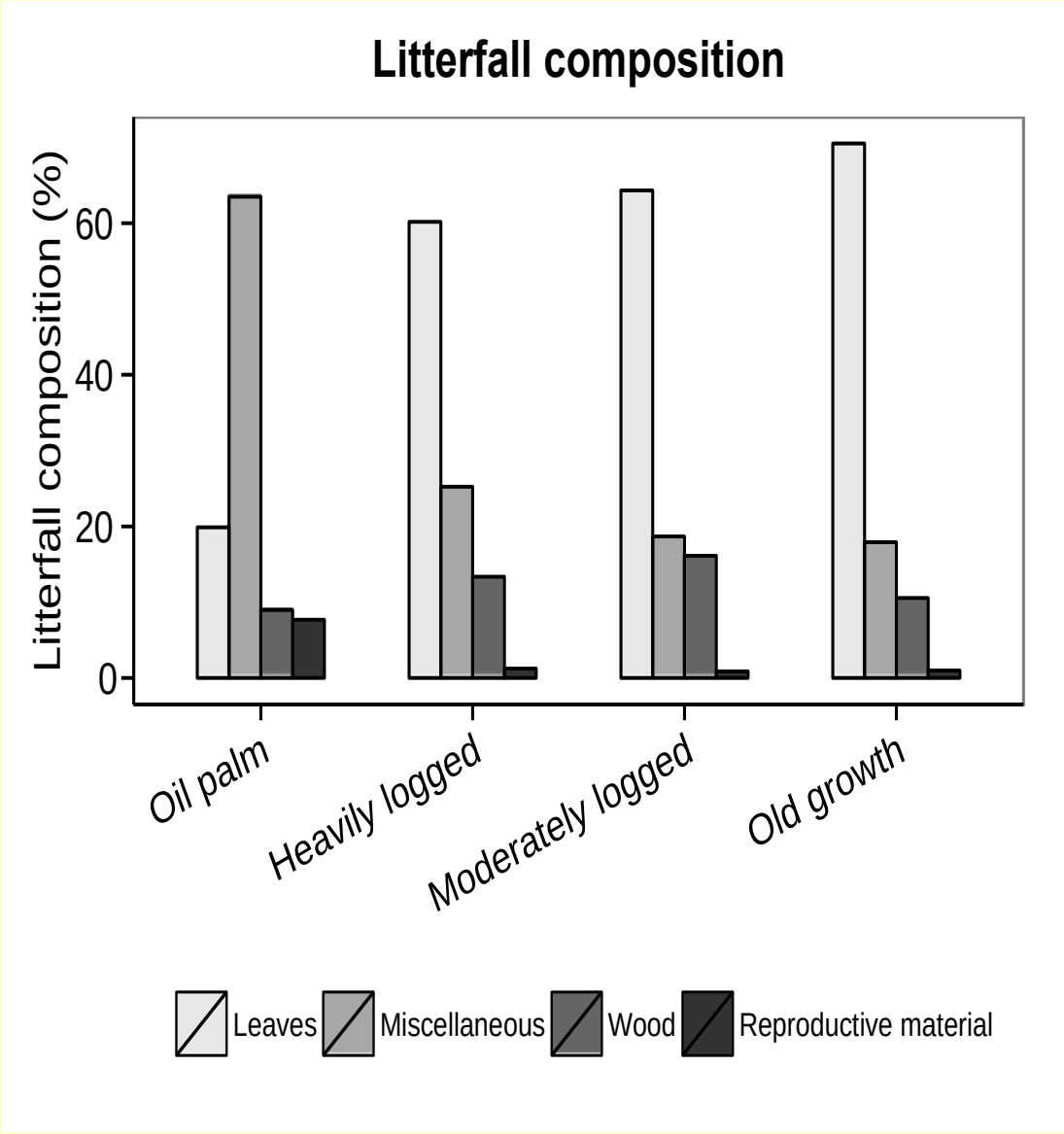
Results

Litter-fall is similar across forest types but significantly lower in oil palm plantation

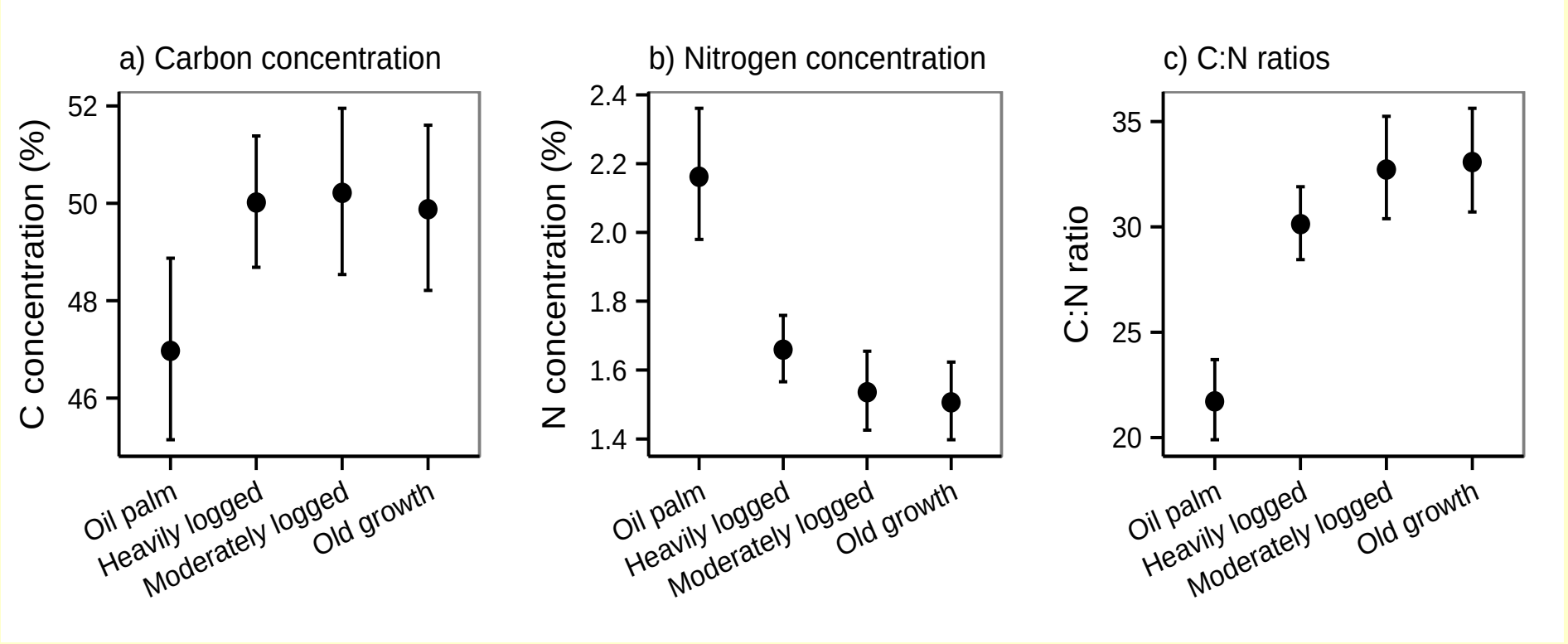
Pattern of litterfall mass across sites.
Black circles show means with 95% CI



Litterfall composition varies across habitat types



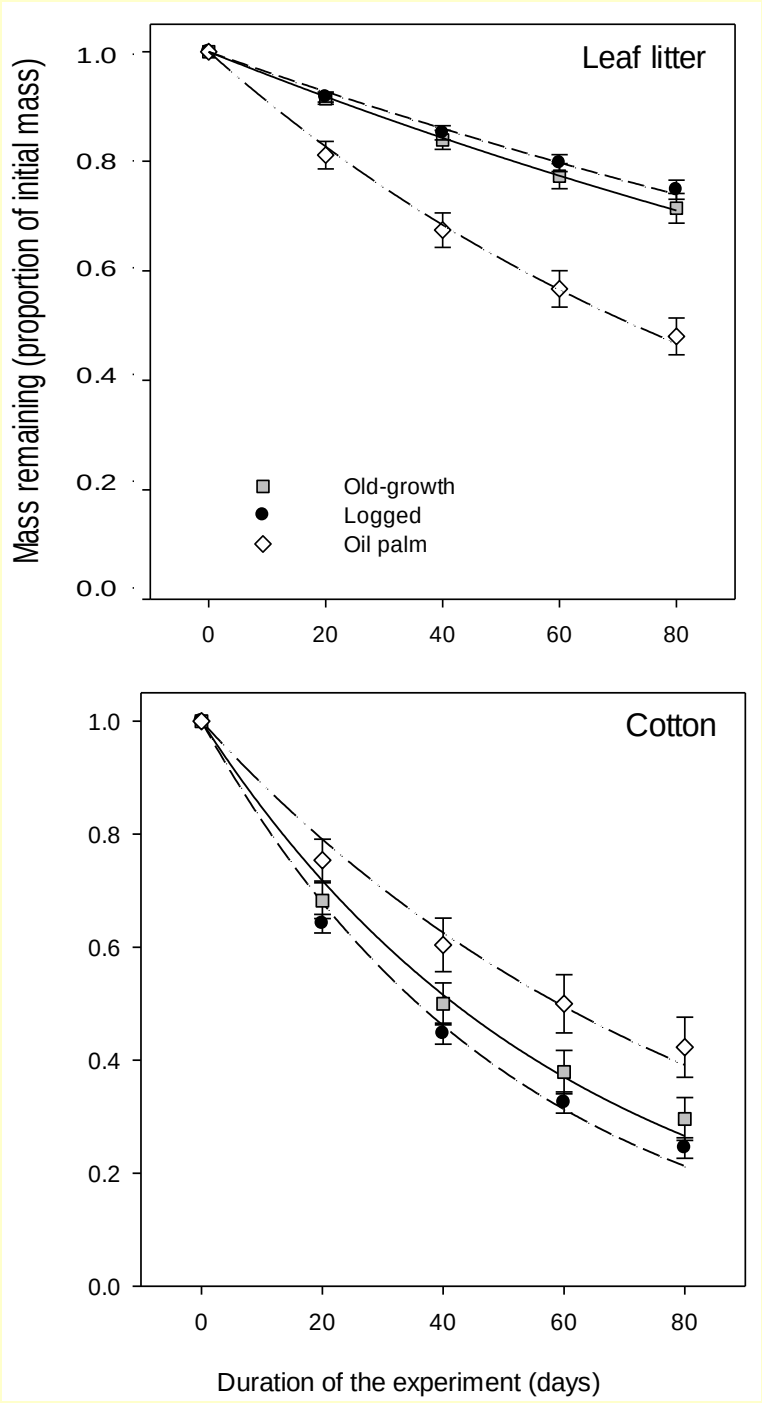
The C:N ratio of oil palm leaf litter is much lower than that of forest



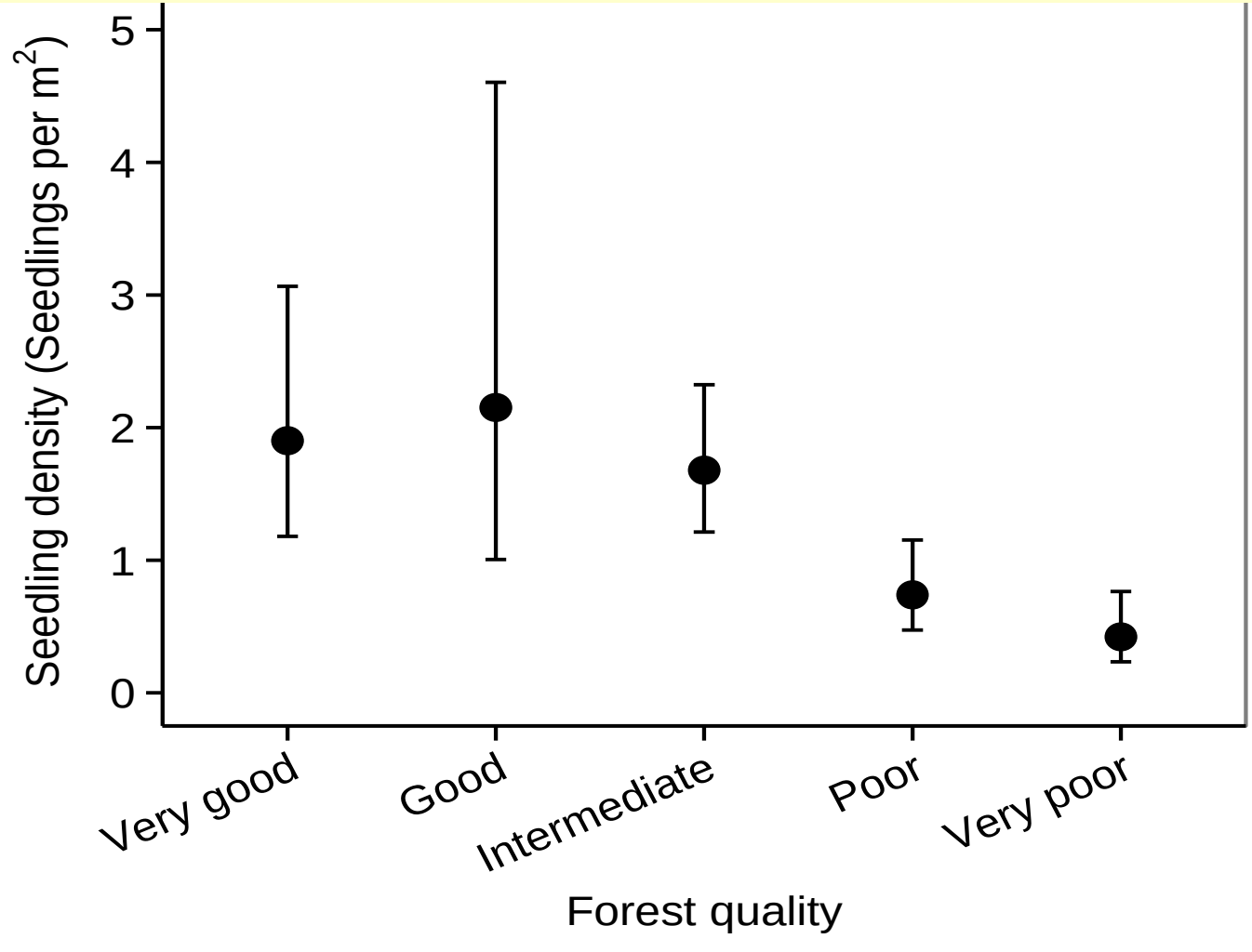
Pattern of leaf litter C:N ratio across sites. Black circles show means with 95% CI

Leaf litter decomposes faster in oil palm plantations than forest, but cotton squares slower

Plot based on mean of all the individual (plot based) decomposition curves. Standard errors of the mean are shown



Reflecting changes in the density of larger trees, more degraded forest areas also have a lower density of seedlings



Pattern of seedling density across to forest quality. Black circles show means with 95% CI

Conclusions

- Litter-fall, leaf-litter nitrogen, decomposition and seedling density all change across the habitat degradation gradient at SAFE
- This information represents core data that can be used to inform some of the planned data collection being carried out by the LOMBOK and BALI projects and by the wider SAFE community

Acknowledgements

Everyone who actually collected these data!