Appendix S1 – Details of methods used for literature search

We used the terms ("biomass" OR "carbon" OR "basal area" OR "damage" OR "snag" OR "non-target" OR "tree" OR "species richness" OR biodiversity) AND (selective logg* OR felling OR timber extraction OR reduced-impact logging OR degradation) AND tropical forest to search Web of Knowledge, Wiley Blackwell and Science Direct and used appendices of Clark and Covey (2012), Gibson et al. (2011) Picard et al. (2012) and Putz et al. (2012). The final literature search was undertaken on 20/06/2014. To minimise bias arising from the lack of publication of negative results (Pullin and Stewart, 2006) we used the same search terms in Google to find relevant grey literature, though we found no studies that were relevant. We also contacted researchers working on this subject directly to identify any unpublished datasets and added datasets on the recommendation of reviewers of a previous version of this manuscript.

Irrelevant articles were excluded, first if titles were deemed irrelevant, and then by examining abstracts. The remaining articles were read and retained only if they met the inclusion criteria. Where there was evidence that relevant data had been collected but were not presented in the publications, data were requested from the authors. Where data were presented in tables they were simply transferred to the database, but when data were graphical the program datathief (vIII) (Tummers, 2006) was used to extract them.

Methods used in calculation of effect size included weighted meta-analysis

Effect size calculation

The effect size we used in this study was the log response ratio which was calculated as:

$$lnR = \ln\left(\acute{X}_{logged}\right) - \ln\left(\acute{X}_{unlogged}\right)$$

Where $\acute{X}_{logged}$ represents the mean value of aboveground biomass or species richness in a logged stand and $\acute{X}_{unlogged}$ represents the equivalent value in an unlogged stand with the standard error of each paired site combination calculated as:

$$SE_{lnR} = \sqrt{V_{lnR}} = \sqrt{S^2_{pooled}\left(\frac{1}{n_1\left(\acute{X}_{logged}\right)^2} + \frac{1}{n_1\left(\acute{X}_{unlogged}\right)^2}\right)}$$

Due to the inherent differences between studies in the ecological literature true effect sizes were presumed to differ between studies and to test for heterogeneity between studies the weighted sum of squares, *Q,* was calculated as:

$$Q=\sum_{i=1}^{k} W_f g^2 - \frac{\left(\sum_{i=1}^{k} W_f g\right)^2}{\sum_{i=1}^{k} W_f}$$

This statistic was subsequently used to determine the weighted means of differences between logged and unlogged sites using a random effects model. Thus the weight (W_r) assigned to each study was the inverse of the within-study variance plus the between-studies variance:

$$W_r=\frac{1}{V+T^2}$$

T^2 was calculated as:

$$T^2=\frac{Q-df}{C}$$

where

$$df=number\ of\ independent\ datasets-1$$

$$C=\sum W_f-\frac{W_f^2}{W_f}$$

As such the weighted mean was calculated as:

$$M_r=\frac{\sum_{i=l}^{k} W_r g}{\sum_{i=l}^{k} W_r} \quad \text{or} \quad M_r=\frac{\sum_{i=l}^{k} W_r LnR}{\sum_{i=l}^{k} W_r}$$

with the standard error of the mean effect size calculated as:

$$SE_r=\sqrt{\frac{1}{\sum_{i=1}^{k} W_r}}$$

and the upper and lower 95% confidence intervals for both effect sizes calculated as:

$$UL_{M_r}=M_r+1.96\times SE_r$$

$$¿_{M_r}=M_r-1.96\times SE_r$$

Goodness of fit was estimated by calculating the pseudo-R^2

$$pseudo\ R^2=1-\left(\frac{T^2_{unexplained}}{T^2_{total}}\right)$$

Where $T^2_{unexplained}$ is the variance left unexplained after fitting a model and T^2_{total} is the total variance when fitting an intercept only model.

Methods used in unpublished study included in meta-analysis (Pfeifer et al 2015)

The study was conducted within the SAFE Project, established in Malaysian Borneo in 2010 (4 38' N to 4 46' N, 116 57' to 117 42' E) within land owned and managed by Yayasan Sabah, a Sabah State government organisation. The project takes advantage of a 7200 ha area of forest, where current deforestation to provide land for oil palm is creating an experimental forest fragmentation landscape of different sized fragments (Ewers *et al.* 2011). The SAFE landscape encompasses 14 'stands' of forests and three stands of existing oil palm plantations: two stands of pristine forest that have never been logged (*OG1, OG2*), two slightly logged old growth forests (*OG3* and a Virgin Jungle Reserve (*VJR*)), of which *VJR* will become isolated during the on-going deforestation, three sites within twice logged forests (*LF1, LF2, LF3*), one site within twice logged forest that will soon be adjacent to the forest edge (*LFE*), six sites within twice logged forest that will become forest fragments (*A, B, C, D, E, F*) and oil palm plantations *OP1, OP2* and *OP3* planted in either 2000 or 2006.

PAST LOGGING REGIME

All twice logged sites were selectively logged, once during the 1970s followed by a second logging round from the late 1990s to the early 2000s. Companies predominantly removed medium hardwoods (*Drybalanops* and *Dipterocarpus*), and lighter hardwoods (*Shorea* and *Parashorea*). The two logging rotations at *A* to *F* were implemented under a modified uniform system, removing around 113 m^3 ha^{-1} under the first rotation; timber restrictions were lifted during the second rotation and the forest was re-logged three times with a cumulative extraction rate of 66 m^3 ha^{-1} (Struebig et al., 2013). These stands are heavily degraded and feature a high density of roads and skid trails, a paucity of commercial timber species, few emergent trees and the dominance of pioneer and invasive vegetation (e.g. *Macaranga*). Twice logged stands *LFE*, *LF2* and *LF3* had been subject to similar timber extraction during the first logging rotation, followed by around 37 m^3 ha^{-1} extraction during the second rotation, which was subject to timber quotas (Struebig et al., 2013).

SAMPLING DESIGN

A total of 193 vegetation plots were established across the landscape (see Table 1) according to a hierarchical sampling design based around a triangular fractal pattern, with clusters of plots placed $10^{1.75}$, $10^{2.25}$ and $10^{2.75}$ m apart. The sampling design was chosen to facilitate spatial analyses of biodiversity (Ewers et al., 2011; Marsh and Ewers, 2013) and ensured unbiased decisions on where to establish vegetation monitoring plots. In 2011, stand and deadwood measurements were collected in 25 m x 25 m vegetation plots according to RAINFOR protocols (http://www.rainfor.org/en/manuals, last accessed 16/08/2013). Thus, total survey area across the 193 plots equated > 12 ha. Plots within stands are located at roughly equal altitude and stands are oriented to minimize potentially confounding factors such as slope, latitude, longitude and distance to forest edges (Ewers et al., 2011).

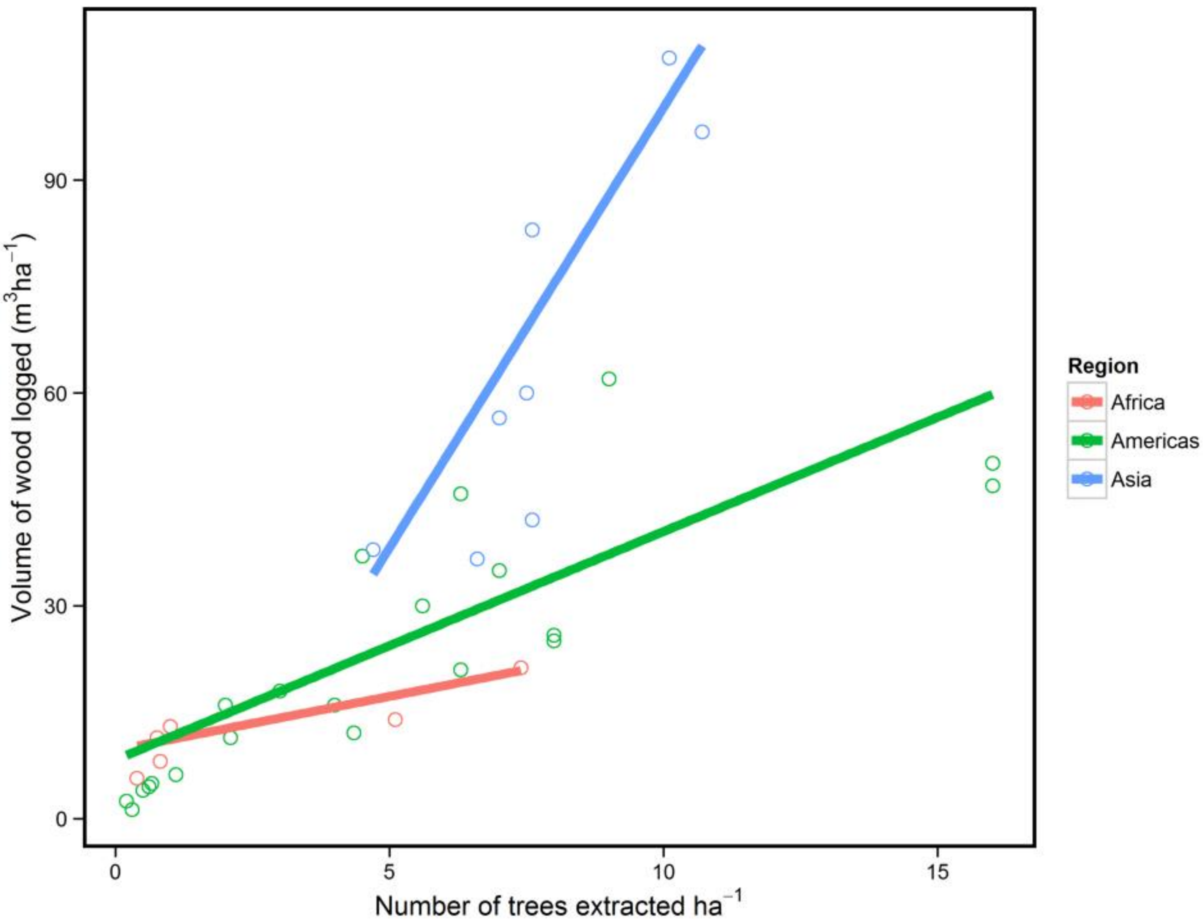

Figure S1 – Relationship between the number of trees extracted per hectare and the volume of wood logged per hectare (n=33). Points refer to individual sites, with red points representing sites from Africa, green points sites from the Americas, and blue points sites from Asia. Solid lines represent fit of the model with lowest AICc which was much better than any other model, with all other models having a ΔAICc>7.

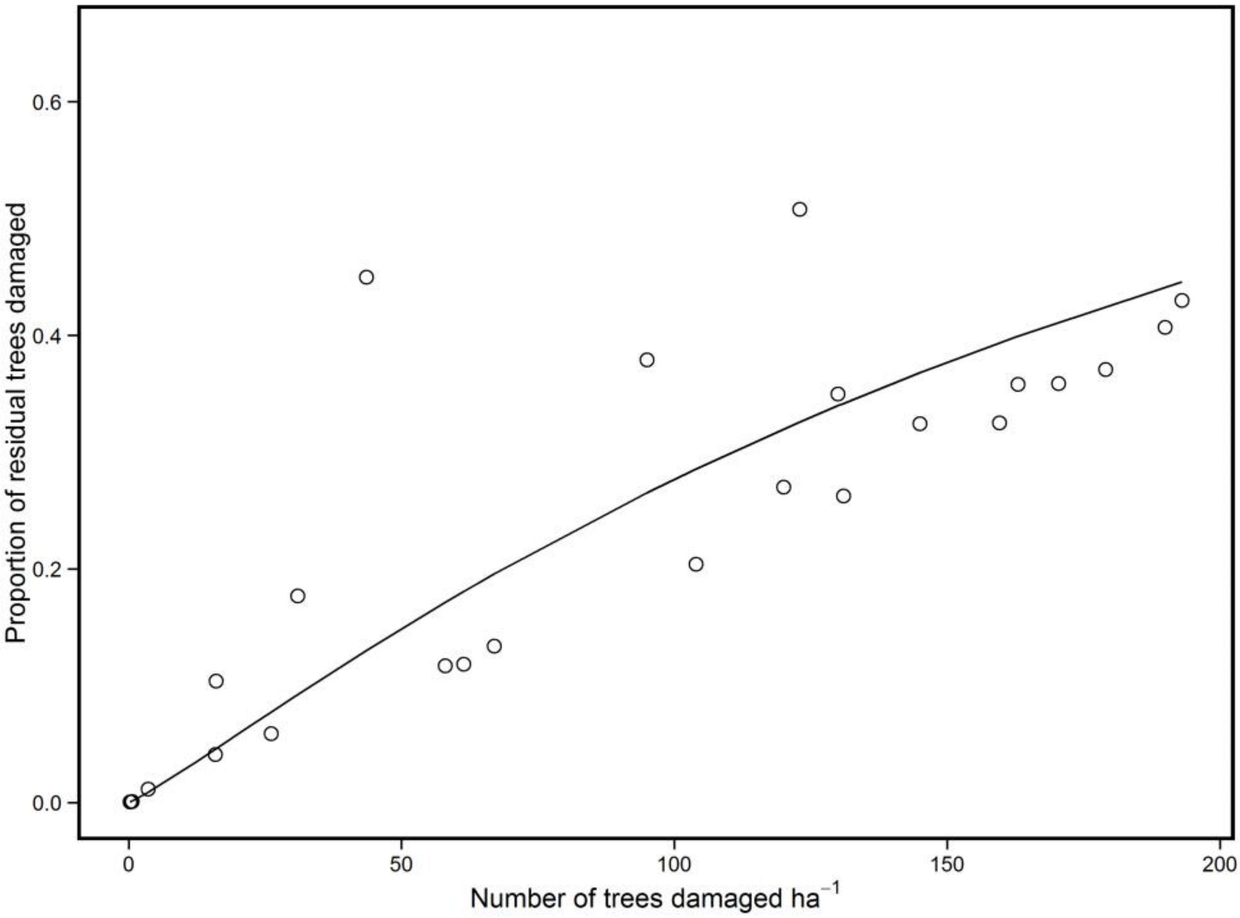

Figure S2 – Relationship between the number of trees damaged per hectare and the proportion of trees damaged per hectare (n=24). Points refer to individual sites. The solid line represent fit of the model with lowest AICc which was much better than any other model, with all other models having a ΔAICc>7.

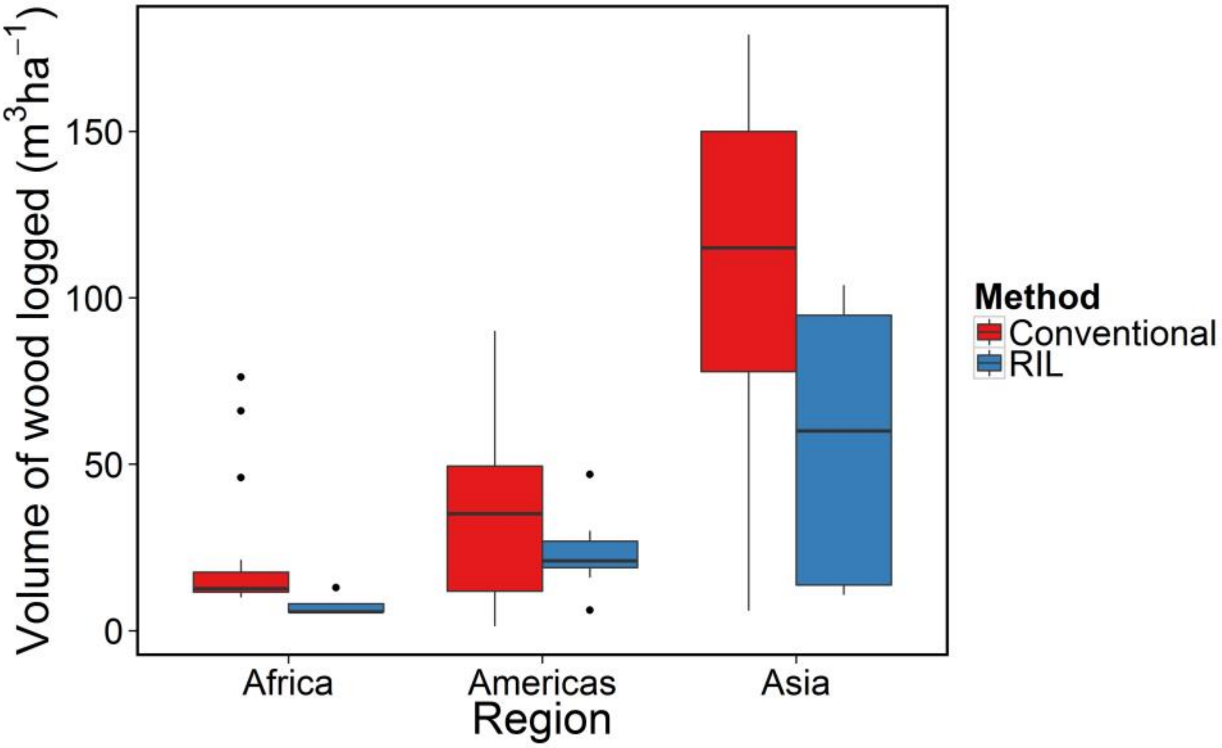

Figure S3 – Variation in logging intensity (measured as volume of wood extracted per hectare) by region and logging method for all studies used in our meta-analyses. Note that Conventional logging tends to have higher logging intensity in all regions and Asia has much higher logging intensity than the two other regions.

Table S1 – Models tested to describe differences in damage to residual trees amongst sites

Variables	df	Log-Likelihood	AICc	Delta AICc	weight	R^2
log(Intensity)*Method	6	-35.25	85.20	0.00	0.99	0.46
log(Intensity)*Method+ log(Intensity^2*Method	8	-36.64	94.25	9.05	0.01	0.05
Intensity	4	-43.82	96.86	11.66	0.00	0.33
Method	4	-45.54	100.30	15.09	0.00	0.00
Null model	3	-48.28	103.26	18.06	0.00	0.45
Intensity+Intensity^2	5	-51.73	115.34	30.14	0.00	0.40
Intensity*Method+ Intensity^2*Method	8	-60.01	140.99	55.79	0.00	0.40

Table S2 – Models tested to describe differences in biomass loss following selective tropical logging

Model variables	AICc	Delta AICc	weight	R^2
Intensity*Method	11.82	0.00	0.56	0.96
Intensity*Method+Intensity^2	14.63	2.82	0.14	0.96
Intensity*Method+Intensity*Age	15.07	3.25	0.11	0.97
Intensity	15.93	4.12	0.07	0.67
Intensity*Age	16.37	4.56	0.06	0.74
Intensity*Region	18.07	6.25	0.02	0.97
Intensity*Method+Intensity^2*Method	18.33	6.51	0.02	0.96
Intensity+Intensity^2	18.39	6.57	0.02	0.69
Null model	33.45	21.63	0.00	0.00
Method	34.70	22.88	0.00	0.21
Age	40.04	28.22	0.00	<0.01

Table S3 - Models tested to describe differences in species richness change following selective tropical logging

Model variables	AICc	Delta AICc	weight	R^2
Intensity	-1.02	0.00	0.88	0.36
Intensity+Intensity^2	3.39	4.41	0.10	0.42
Null model	17.09	18.11	0.00	0
Age	21.55	22.58	0.00	<0.01

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