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# Appendix B. Quantification and detailed responses of species diversity.

## Quantification of tree species diversity

Highly dynamic, rich assemblages such as in tropical secondary forests are inevitably incompletely sampled if subjected to experimental manipulations, and thus it is impossible here to completely separate species richness from assemblage evenness. Therefore, we report three intuitive measures that are relatively robust with small sample sizes (Magurran 2004), and which emphasize species richness, assemblage evenness, and the variance of the species abundance distribution, respectively.

For the purpose of comparing tree species richness in mature forest of the present study area with other tropical regions, Nepstad (1989) identified 171 tree species among the 780 individuals with dbh>20 cm in a 5 ha inventory of mature forest on the same ranch.

To compare species richness among observations (i.e., plot-by-census combinations), the observed high variation in tree densities (ranging from 14 to 162 $plot^{-1}$) needed to be accounted for by individual-based rarefaction curves (Denslow 1995, Chazdon et al. 1998, Gotelli and Colwell 2001). The resulting 'rarified species richness' ($R_{13}$) gives the number of species found by randomly subsampling a constant number of individual trees $n$ from the total number of individuals $N$ found in each observation. Constant $n$=13 was chosen as the smallest $N$–1 in the dataset ($n$=min($N$)–1).

We report the widely used Complement Simpson Diversity Index (1–D), which captures the variance of the species abundance distribution, and is robust at relatively small sample sizes (Magurran 2004). It is an integrative measure of species diversity, but strongly weighted towards evenness. 1–D is the complement of the probability D of any two individuals drawn at random from a finite assemblage belonging to the same species:

$$D = \sum\left(\frac{n_i[n_i - 1]}{N[N - 1]}\right)$$

where

$n_i$ = the number of individuals in the *i*th species

$N$ = the total number of individuals

A pure measure of the evenness of abundances across species in the assemblage is the intuitive Simpson Evenness Measure ($E_{1/D}$, based on the inverse Simpson Diversity 1/D), as it is mathematically independent of species richness (Smith and Wilson 1996):

$E_{1/D} = (1/D)/S$

where

$S$ = number of species in sample

**TABLE B1. Fitted equation for rarified species richness $R_{13}$** (fixed effects displayed in Fig. 2a), with

$$\log(R_{13}) = \alpha + \beta_1 \cdot \text{time} + \beta_2 \cdot \text{time}^2 + \beta_3 \cdot t_0 + \beta_4 \cdot \text{time} \times t_0 + \gamma_j + \gamma_k + \varepsilon$$

(for explanations and definitions of notation, see Appendix A)

| *i* | $\alpha$ | $\beta_1$ | $\beta_2$ | $\beta_3$ | $\beta_4$ |
|---|---|---|---|---|---|
| treatment | intercept | time | $\text{time}^2$ | $t_0$ | $\text{time} \times t_0$ |
| Control | 1.07 | 1.72E-02 | -8.71E-05 | 1.44E-01 | -1.29E-03 |
| N | 1.07 | 9.80E-03 | -1.37E-06 | 1.44E-01 | -1.29E-03 |
| P | 1.04 | 9.20E-03 | 2.74E-05 | 1.44E-01 | -1.29E-03 |
| NP | 1.05 | 9.40E-03 | 4.83E-06 | 1.44E-01 | -1.29E-03 |

**TABLE B2. Fitted equation for Simpson Evenness Measure $E_{1/D}$** (fixed effects displayed in Fig. 2b), with

$$E_{1/D} = \alpha + \beta_1 \cdot \text{time} + \beta_2 \cdot \text{time}^2 + \beta_3 \cdot \text{density} + \beta_4 \cdot \text{time} \times \text{density} + \beta_5 \cdot \text{time}^2 \times \text{density} + \gamma_j + \gamma_k + \varepsilon$$

(for explanations and definitions of notation, see Appendix A)

| *i* | $\alpha$ | $\beta_1$ | $\beta_2$ | $\beta_3$ | $\beta_4$ | $\beta_5$ |
|---|---|---|---|---|---|---|
| treatment | intercept | time | $\text{time}^2$ | density | $\text{time} \times \text{density}$ | $\text{time}^2 \times \text{density}$ |
| Control | 6.37E-01 | 3.21E-03 | -1.32E-05 | -8.00E-03 | 7.18E-05 | -3.70E-07 |
| N | 6.50E-01 | -6.73E-03 | -8.05E-05 | -5.79E-03 | 1.95E-04 | -3.70E-07 |
| P | 6.64E-01 | -1.54E-03 | 2.46E-05 | -4.17E-03 | 3.36E-05 | -3.70E-07 |
| NP | 5.00E-01 | -1.65E-03 | 3.87E-05 | -1.55E-03 | 1.84E-05 | -3.70E-07 |

**TABLE B3. Fitted equation for Complement Simpson Diversity Index 1–D** (fixed effects displayed in Fig. 2c), with

$$1–D = \alpha + \beta_1 \cdot \text{time} + \beta_2 \cdot \text{time}^2 + \beta_3 \cdot t_0 + \beta_4 \cdot \text{time} \times t_0 + \beta_5 \cdot \text{time}^2 \times t_0 + \gamma_j + \gamma_k + \varepsilon$$

(for explanations and definitions of notation, see Appendix A)

| *i* | $\alpha$ | $\beta_1$ | $\beta_2$ | $\beta_3$ | $\beta_4$ | $\beta_5$ |
|---|---|---|---|---|---|---|
| treatment | intercept | time | $\text{time}^2$ | $t_0$ | $\text{time} \times t_0$ | $\text{time}^2 \times t_0$ |
| Control | -4.04E-02 | 1.66E-02 | -1.20E-04 | 1.08 | -1.46E-02 | 8.75E-05 |
| N | 1.40E-02 | 1.30E-02 | -5.92E-05 | 0.97 | -1.54E-02 | 7.38E-05 |
| P | -1.30E-03 | 1.14E-03 | 8.13E-05 | 1.00 | -5.72E-04 | -9.54E-05 |
| NP | -1.03E-01 | 1.90E-02 | -1.42E-04 | 1.13 | -2.22E-02 | 1.69E-04 |

## LITERATURE CITED


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