Effect of logging and optimum sampling design in the tropical forests of **Papua New Guinea**

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33Mha 70% country 6% world biodiversity

11.000 plant species

15% deforested (1972-2002) **8.8%** degraded (1972-2002) **392-1247** km²y⁻¹

REDD+

Conservation and Sustainable Management

COP16 (2010) Cancun safeguards

 Rights of indigenous people
Conservation of biological diversity

3) Prevention of leakage

UN-REDD PROGRAMME PILOT COUNTRY SINCE 2008

Permanent Sample **Plot network 135** PSPs **2** forest types (**P** and **H**) 1 ha 25 subplots 15 years 449 censuses 160.455 trees (> 10 cm DBH) 592 taxa





Methods

Effect of selective logging on tree biodiversity and structure

3 diversity indexes

Richness, Shannon's diversity, Pielou's evennes

2 structural indexes

Stem density, Basal area

Species composition

logged/unlogged Multivariate analysis (PERMANOVA, CAP)

Diversity and structure

logged/unlogged, time Univariate analyses (ANOVA, Ims)

Different **species** in **unlogged H type** PSPs

No differences in **diversity**

Greater stem density in unlogged PSPs p < 0.01 (421 ± 153 stems ha-1 / 308 ± 110 stems ha-1)

Greater **basal area** in **unlogged H type** PSPs **p<0.01** (30.28 ± 4.45 m2 ha-1 / 15.52 ± 4.04 m2 ha-1)



Both forest types **Richness p<0.01**

0.55 ± 0.19 taxa ha-1 yr-1

Diversity p<0.01 0.01 ± 0.05 units ha-1 yr-1

H type forests **Stem density** p<0.001 9 ± 1 stems ha-1 yr-1

Basal Area p<0.001 0.42 ± 0.06 m2 ha-1 yr-1



Methods

Optimum plot and sample sizes for carbon stock and biodiversity estimation

Richness Carbon fraction

C= ½ AGLBi = ½ 0.0776[piDi^2Hi]^0.94 **Simulated sampling** 20mx20m subplots, 1000 rand **Coefficient of variation** CV = (s/m) × 100%

Non-linear models

carbon/richness, logged/unlogged y = a + b × X^-c

Optimum plot size

carbon/richness, logged/unlogged yl = -1

Optimum sample size

carbon/richness, logged/unlogged N = $(CV \times t(a, n-1)/e)^2$



CV **decreased** with **increasing** plot size

Initial **steep** decline and slower reduction between **0.2** and **0.3** ha

Higher CV in **logged** PSPs

Higher CV for **Carbon**



Optimum plot size 0.08 – 0.32 ha

Optimum sample size 75 – 164 PSPs

319 PSPs 0.2-0.3 ha

efficient sampling scheme for carbon stock and richness

Conclusions

1.

Logging affected PNG forests' composition and structure

vidence of recovery

3. Improved sampling design for richness and carbon stock

Thank you!