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Floristics and above-ground biomass (AGB) in Peatlands in Peruvian Lowland Amazonia, Loreto – Peru

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Abstract

Amazonian forests comprise almost 10% of stored carbon (C) in the world's land ecosystems. This C is held both in above-ground biomass (AGB) and in the soil. AGB in an individual plant depends on plant size, often measured in trees as height (H) and diameter (D), and the density of plant tissues, often approximated in trees by wood density (WD). Soil C storage depends on the balance between inputs from AGB due to mortality and senescence and outputs due to decay and erosion. Peatlands, wetlands recently described in northern Peruvian Amazonia, show unusually high rates of soil C accumulation. For these habitats information on C budget contributions from peatland plants is unavailable. In this study I estimated AGB in various peatlands of northern Peruvian Amazonia, and asked why some of these peatlands store more AGB than others. I first set out to estimate the relative contribution of inter- and intra-specific variation to variation in AGB among individual peatland trees. I found that 80% of the variation in AGB among individual trees was due to inter-specific variation. Then I assessed the extent to which the three traits that determine AGB (i.e., D, H and WD) contribute to inter- and intra-specific variation in AGB among peatland trees. I found variation in D and the interaction between D and H contributed most to inter- and intra-specific variation in AGB among trees. Last, I estimated the extent to which variation in AGB among peatland locations was due to variation in species composition, stem density and intra-specific variation in AGB. I found that species composition and intra-specific variation, but not stem density, explained nearly equal amounts of variation in AGB among peatland locations. In summary, detailed knowledge of tree size can provide good estimates of species level biomass estimates in the peatlands of northern Peruvian Amazonia. Additionally, what species are present, as well as how their biomass varies (intra-specifically) from site to site drives AGB variation among peatland locations.

INTRODUCTION

Accumulation of carbon dioxide (CO_2) and methane (CH_4) in the atmosphere are contributing to global climate change (Sha et al., 2011). An understanding of important habitats providing carbon (C) sinks can help in setting conservation priorities to mitigate further climate shifts. Undisturbed Amazonian forests account for approximately 10% of the C stored above-ground in the world's land ecosystems (Anderson, 2012) with woody plants providing short to medium-term C sinks (they can live from 40 to 100 years or more; Vieira et al., 2005) and therefore their C content best governs the above-ground C storage and dynamics in the forest.

Peatlands are poorly drained wetlands that accumulate high quantities of partially decomposed plant organic matter. These habitats are known to play a critical role in storing C from senesced material, but under altered conditions, they could release large amounts of CO_2 (Page et al., 2002) and CH_4 (Urbanová et. al., 2013) to the atmosphere. Peatlands have recently been described for the north side of Peruvian Amazonia; they represent approximately 14% of the total area estimated for the entire Amazonian basin and C accumulation rates in the soils (26 to 195 gCm^{-2}/y) are similar to those in Indonesia and higher than those in boreal zones (Lahteenoja and Roucoux, 2010). While below-ground C storage has already been described for these habitats (Lahteenoja et al., 2009a; Lahteenoja and Page, 2011); information on C budget contributions from living plants above-ground is not currently available. Here I focus on live standing above-ground biomass (AGB) in the peatlands of northern Peruvian Amazonia, and particularly on three non-exclusive, general, working hypotheses that may explain spatial variation in AGB among peatland locations.

The "floristic composition" hypothesis proposes that variation in AGB across sites results from differences in species composition (e.g. differences in the presence of species and their relative abundance) across sites, because different species are characterized by contrasting AGB values. For example, variation in AGB among eastern and western Amazonian sites was found to be related to variation in the abundance of plant families characterized by relatively high AGB values, such as Lecythidaceae and Sapotaceae, and others with relatively low AGB values, such as Arecaceae and Myristicaceae (Baker et al. 2004). Variation in environmental conditions (e.g. soil richness and exposure to flooding) and stochastic events across peatland locations (Lahteenoja et al., 2009b) may lead to differences in the composition of species assemblages; and these differences may result in variation in AGB across peatland locations. Some peatlands can be floristically similar to seasonal flooded forests and others to palm forests where *Mauritia flexuosa* (Arecaceae) is common (Lahteenoja et al., 2009a). This variation is thought to influence spatial variation in AGB across sites (Baraloto et al., 2011, Ward et al. 2009). For instance, given that palms are different from other angiosperm trees in growth and tissue structure, the variation in their frequency across sites also may drive variation in biomass estimates. In an exploratory work, Honorio et al. (2009) observed that in forests where the proportion of palms per area was high the total AGB was low.

The “stem density” hypothesis posits that variation in AGB across sites results from site differences in stem density, because increasing the number of stems per area increases AGB. A positive relationship between stem density and AGB has been documented across terra firme forests (Rutishauser et al., 2010). Although such a relationship might seem intuitive, it may not occur when other factors override any potential effect of stem density on AGB. For example, Hawes et. al., (2012) found no association between stem density and AGB across flooded forests; perhaps because variation in exposure to flooding strongly determined AGB via the size of the trees, rather than via the number of trees.

Last, the “intra-specific variation” hypothesis suggests that variation in AGB across sites results from intra-specific variation in AGB among trees in different sites. This hypothesis assumes that at least some species occur in more than one site, and that AGB varies within species from site to site, as illustrated by the aforementioned study of flooded forests (Hawes et. al., 2012). Thus, in sites where species have high AGB values compared to the norm for that species will have high total AGB; conversely, sites where species have low AGB values will have a correspondingly low total AGB. Intra-specific variation in plant traits can determine important characteristics of species assemblages (Clark 2010, Messier et. al., 2010), but it may not have received as much attention as it deserves (Violle et al., 2012).

In this study I estimated AGB in various peatland locations in northern Peruvian Amazonia, and tested predictions from the three hypotheses above to understand why some of these peatland locations store more AGB than others. To set the tests of these predictions in context, I first estimated the relative contribution of inter- and intra-specific variation to variation in AGB among individual peatland trees. Then I assessed how inter- and intra-specific variation in AGB among peatland trees arises from variation among trees in three traits that determine AGB: height (H) diameter (D) and wood density (WD). Last, I estimated the extent to which variation in AGB among peatland locations was explained by three working hypotheses above.

METHODS

Study site

This project was carried out from May to September 2012 in Western Amazonian Peatlands in Loreto, Peru (Appendix; Figure 1). Peatland habitats are distributed along the Pastaza - Marañón basin and the Amazon River and tributaries. The total area of peatlands in this part of Amazonia is unknown but the area in the Pastaza – Marañón basin is approximately 21,929km^2 (Lahteenoja et al., 2011).

For this study, I chose three peatlands (Appendix; Figure 2 a, b, c): San Jorge (SJ, located near the Amazon river, 701852S 9551562W UTM 18 S), Buena Vista (BV, near the Tamshiyacu - Tahuayo river, a tributary of the Amazon, 698280S 9531598W UTM 18 S) and Quistococha (Q, near the Itaya river, another tributary of the Amazon, 686484S 9576261W UTM 18 S). In SJ, the topography is domed and consequently it does not flood. Soils have low nutrients; the forest is swampy and the palm *M. flexuosa* is very common. In both BV and Q, topography is relatively flat, flooding lasts from two to three months yearly and the forest is swampy. The two forests differ in soil characteristics and floristic composition. BV has rich soils and *M. flexuosa* is almost absent. Q has poor soils and *M. flexuosa* is very common. Detailed soil and topography information has previously been published (Lahteenoja and Page, 2009; Lahteenoja et. al., 2011).

In these peatlands humans hunt mammals (rodents, anteaters) and birds. At San Jorge, villagers from Nueva Vida and San Jorge and nearby villagers at Quistococha use the peatlands mainly to harvest fruits from female *M. flexuosa* palm trees.

Climate

Climate in this part of Amazonia is aseasonal. Total annual precipitation is between 2400 - 3100 mm; the rainiest months are February - April. Minimum temperatures are 20 - 22°C and maximum temperatures are 29 - 31°C. Relative humidity is 80 - 90% (Marengo, 1998).

Sampling methods

The modified Gentry plot design was used for sampling both floristic composition and AGB (Baraloto et al., 2013) with 10 (10 x 50 m) transects summing to a 0.5 ha plot (Appendix; Figure 3). Eight 0.5 ha plots were located in each peatland and were separated by at least 500 m from one another (coordinates of plot locations in Universal Transverse Mercator coordinate system are listed in Appendix, Table 1).

Within each plot all trees with diameter at breast height (DBH) ≥ 10 cm were recorded, and their diameter and height measured. Specimen collections were identified to species or separated into morphospecies in the field (e.g. *Pouteria* sp. 1, Myrtaceae sp. 2); at least one voucher specimen per species/morphospecies was preserved for identification at the herbarium. Height was estimated visually to the top of the crown. Trunk core samples were obtained for a subset of individuals following Chave’s protocol (2005). Trunk samples were extracted at breast height (1.3 m) for the first 5 individuals (as available) of each species/morphospecies encountered within each plot. It was impossible to reach the pith for all trees (25% lacked pith in cores) as: 1.

increment borers were smaller than the radius of some trees, and 2. some trunks had hollow centers. Length of wood cores varied according to tree diameter from 4 cm - >20 cm. Samples were put into plastic drinking straws, sealed, labeled and stored for later processing.

Laboratory work

Species were identified at the Herbarium Amazonense (Herbarium AMAZ) at the Universidad Nacional de la Amazonia Peruana (UNAP) in Iquitos, Peru. Family names followed the APG III (2009) classification. Voucher specimens were deposited following the series Valderrama, E. et al. 1157-1219.

Wood density estimates (oven dry mass/fresh volume) were obtained at the Facultad de Ingenieria Forestal at UNAP. To be consistent across cores, the core's pith section of all samples was excluded. Core samples were broken into one to eight segments depending on the DBH with each segment 2.5 cm in length. Segments were placed in water within a labeled drinking straw and left for 72 hours to hydrate. Fresh volume (cm^3) was estimated using the water displacement method (Chave, 2005; Osazuwa-Peters and Zanne, 2012). To determine dry mass, samples were oven dried during three contiguous cycles, each one of 72 hours to ensure a constant mass. Wood density values were estimated for each segment, and mean values across segments were determined for trees with more than one segment.

Above-ground biomass estimation

Above-ground biomass (AGB) was calculated for each tree in the 0.5 ha plots as:

$$AGB = 0.0509\, WD \cdot DBH^2 \cdot H \qquad \text{(equation 1)},$$

where AGB is above-ground biomass in kg, WD is wood density in g/cm^3, DBH is diameter at breast height in cm, and H is height in m. Equation 1 is an allometric equation, derived from direct measurements of harvested trees (Chave et al. 2005). The coefficient 0.0509 is an empirical parameter, sometimes called a "form factor" in the forestry literature, used to fit the model to the data. Wood density was not measured on every tree recorded in all 0.5 ha plots (see above); thus the calculated mean wood density per species per plot was assigned to all individuals of that species within the plot. AGB values were summed across individual trees to obtain total AGB per plot. To facilitate comparison with other studies, values of total AGB per plot were transformed to mega grams per hectare (Mg ha^{-1}).

Data analyses

Contribution of inter- and intraspecific variation to AGB variation among peatland trees – A variance component analysis that incorporates a random effect for the response variable was used to estimate the amount of total variance in AGB among individual peatland trees that was attributable to variance across and within species.

Contribution of three plant traits to inter- and intraspecific variation in AGB among peatland trees – According to equation 1 (above), AGB is determined by three plant traits: height (H), diameter (DBH) and wood density (WD). I examined how much the variance in each of these traits, and the covariances among traits, contributed to inter- and intra-specific variation in AGB among peatland trees. To do so by way of a simple additive analysis, I first expressed equation 1 in a logarithmic scale:

$$\log(AGB) = \log(0.0509) + \log(WD) + 2 \cdot \log(DBH) + \log(H) \qquad \text{(equation 2)},$$

According to well-known properties of the variance of sums (Adler, 1998), the contribution of the variance in each trait, and the covariances among traits, to variance in AGB on a logarithmic scale is:

$$\begin{aligned} Var[\log(AGB)] = {} & Var[\log(WD)] + 4 \cdot Var[\log(DBH)] + Var[\log(H)] + \\ & 4 \cdot Cov[WD, DBH] + 2 \cdot Cov[WD, H] + 4 \cdot Cov[DBH, H] \end{aligned} \qquad \text{(equation 3)},$$

where $Var[\log(AGB)]$ is variance in AGB on a logarithmic scale, $Var[\log(WD)]$ variance in wood density on a logarithmic scale, $Var[\log(DBH)]$ is variance in diameter at breast height on a logarithmic scale, $Var[\log(H)]$ is variance in height on a logarithmic scale, and the remaining terms are the three respective covariances. I applied equation 3 to examine intra-specific variation in each species for which I had at least three measurements of wood density. In the case of inter-specific variation, mean values of each variable were assigned to each species, such that:

$$\begin{gathered} Var\left[\log\left(\overline{AGB}\right)\right] = Var\left[\log\left(\overline{WD}\right)\right] + 4 \cdot Var\left[\log\left(\overline{DBH}\right)\right] + Var\left[\log\left(\overline{H}\right)\right] + \\ 4 \cdot Cov\left[\overline{WD}, \overline{AGB}\right] + 2 \cdot Cov\left[\overline{WD}, \overline{H}\right] + 4 \cdot Cov\left[\overline{DBH}, \overline{H}\right] \end{gathered} \quad \text{(equation 4),}$$

where $Var\left[\log\left(\overline{AGB}\right)\right]$ is the variance in mean AGB across species on a logarithmic scale, $Var\left[\log\left(\overline{WD}\right)\right]$ is the variance in mean wood density across species on a logarithmic scale, $Var\left[\log\left(\overline{DBH}\right)\right]$ is variance in mean diameter at breast height across species on a logarithmic scale, $Var\left[\log\left(\overline{H}\right)\right]$ is variance in mean height across species on a logarithmic scale, and the remaining terms are the three respective covariances. Mean values for each species were calculated based only on trees whose wood density was measured.

Testing predictions from three hypotheses about variation in AGB among peatland locations – I used one or more simple linear regression models to represent each of the three working hypotheses proposed to explain variation in AGB among peatland sites. For each hypothesis I derived predictions in terms of the statistical significance of regression coefficients and, in some cases, the sign of those coefficients (Table 1).

The floristic composition hypothesis was represented by four regression models. In models 1 and 2, the explanatory variables (NMDS1 and NMDS2) represent the overall species composition. For this, I ran a Non-metric multidimensional scaling analysis (NMDS) to determine the similarity in species composition between plots. I used the Bray-Curtis dissimilarity index (this index takes into account presence and absence of species and also the relative abundance of them). I set the maximum number of random starts at 50 in search of a stable solution and number of dimensions to three. The stress value obtained in the ordination was 0.0756. The two sets of scores per plot (NMDS1 and NMDS2; for plot scores in each ordination see Appendix; Table 2) were extracted from the NMDS ordination and were included as explanatory variables. The floristic composition hypothesis predicts that the regression coefficients for NMDS1 (in model 1) and NMDS2 (in model 2) are statistically significant (Table 1). No prediction about the sign is possible because the direction of the ordination axes is arbitrary. Models 3 and 4 represent a subset of the overall species composition. In model 3, the proportion of all palms per plot was taken as the explanatory variable and in model 4, only the proportion of *M. flexuosa* was included. The floristic composition hypothesis predicts that the regression coefficients for models 3 and 4 should be statistically significant and negative (Table 1), given previous work suggesting that high relative abundance of palms is associated with low total AGB (Baker et al. 2004, Honorio et al., 2009).

The stem density hypothesis was represented by a single model in which stems density (number of stems/plot) was the explanatory variable. This hypothesis predicts that the regression coefficient of the model should be statistically significant and positive (Table 1).

The intra-specific variation hypothesis was represented by a single regression model in which mean AGB deviation per plot ($\overline{AGBdeviation}$) was the explanatory variable. $\overline{AGBdeviation}$ values represent the intra-specific variation in AGB across plots. To estimate this, records of all species were considered across all plots. For each species, AGB mean values per plot and across all plots were estimated. Species mean AGB per plot was subtracted from species mean across all plots. Differences of all species within each single plot were summed and divided by the number of species in the plot. Thus, $\overline{AGBdeviation}$ for a given plot "*k*" with "*s*" species is:

$$\overline{AGBdeviation}_k = \frac{1}{s} \cdot \sum_{i=1}^{s} \left(\overline{AGB_{ik}} - \overline{AGB_i} \right) \qquad \text{(equation 5),}$$

where $\overline{AGB_{ik}}$ is the mean *AGB* for species *i* in plot *k* and $\overline{AGB_i}$ is the mean *AGB* for species *i* across all plots. A negative $\overline{AGBdeviation}$ for a given plot indicates that, on average, species at that plot have AGB mean values higher than their respective mean values across all plots. Therefore, the intraspecific variation hypothesis predicts a statistically significant regression negative coefficient for $\overline{AGBdeviation}$ (Table 1).

Relative importance of the three hypotheses about variation in AGB among peatland locations – I estimated the relative merit of the three hypotheses of interest using two approaches. First, relative empirical support for regression models representing the three hypotheses was gauged using the Akaike Information Criterion in its corrected form for small sample sizes (AICc; Hurvich and Tsai, 1989). Second, I built an *ad hoc* multiple regression model that contained explanatory variables from simple regression models that were significant and also had low AICc values. Different explanatory variables in this *ad hoc* model represented different hypotheses, and thus the relative importance of each hypothesis represented by the model was estimated by the partial coefficient of determination (r^2). The correlation between explanatory variables in the *ad hoc* model was low (r^2 = 0.07), so collinearity was not a concern.

Test of spatial dependence – to explore if the results obtained from regression models were affected by spatial dependence, potentially yielding spurious results, I conducted Moran I test for spatial autocorrelation in regression residuals (Anselin, 2003; Laurent et al., 2012). I applied this test only to the regression models for which I found empirical support.

Outlier plot – Plot 6 at SJ had an unusually high value for total AGB. Careful examination revealed no measurement or analysis errors that could explain this particularly high value. Nonetheless, since it may have high leverage on the analyses, I ran two sets of analyses, including and excluding this plot.

RESULTS

Peatland species assemblages – One hundred thirty eight species and morphospecies were identified across the 24 plots with 113 identified to species (82.61%), 18 morphospecies identified to genus (12.32%) and 3 to family; 4 remained undetermined. Identified taxa were grouped into 94 genera and 42 families (Appendix, Table 3). The clades with the highest species richness were Fabaceae and *Inga* within Fabaceae (Appendix, Table 4A, 4B). Across the 24 plots, I located 7831 individuals, and *M. flexuosa* in the Arecaceae had by far the greatest number of individual stems (Appendix, Table 5A, 5B, 5C). The total number of species per plot ranged from 11 - 45 and stem density per plot ranged from 233 - 513 (Appendix, Table 6).

The NMDS1 ordination (non-metric multidimensional scaling) explained the bulk of variation in species composition among peatland plots (Figure 1). This axis separated the different peatland locations in the study. BV was quite different floristically with plots loading on the negative end of the ordination axis. SJ and Q were more similar to one another than to BV; they loaded on the positive end of the first ordination axis. Plots at Q and SJ separated along the second ordination axis with Q loading negatively and SJ loading positively.

Variation in total AGB per plot was substantial, ranging from 68.0 to 189.8 Mg ha^{-1} (Appendix, Table 6), with BV having the lowest values and SJ having the highest values. Plot 6 at SJ had a remarkably high AGB value in comparison to the other plots. This was due to the presence of many large trees, with high DBH and H values (most had DBH>28 cm and H>16 m). *Platycarpum* sp. nov. was the major contributor since it was the most abundant species (172 out of 355 individuals) and represented 75% of the total AGB in this plot. Further analyses were run with and without this data point included.

Contribution of inter- and intra-specific variation to AGB variation among peatland trees – Eighty percent of the total variance in AGB was attributable to differences among species and 20% to intra-specific variability (Appendix, Table 7).

Contribution of three plant traits to inter- and intra-specific variation in AGB among peatland trees – The greatest contribution to inter-specific variation in AGB came from variance in diameter and positive covariance between diameter and height (Appendix, Table 8, Figure 2a). On the other hand, for intra-specific variation, for 86 out of 98 species included in the analysis, the greatest contribution to variation in AGB came from variance in diameter. For 79 out of those 86 species, the positive covariance between diameter and height also contributed strongly (Appendix, Table 9, Figure 2b).

Tests of predictions from three hypotheses about variation in AGB among peatland locations – In general, I found empirical support for predictions from the floristic composition and intra-specific variation hypotheses, and no support for predictions from the stem density hypothesis. In particular, the regression coefficient for one model representing the floristic composition hypothesis (model 1, where NMDS1 is the explanatory variable representing one axis of the overall species composition across plots) was statistically significant (Table 2, Figure 3a). Likewise, the regression coefficient for the model representing the intra-specific variation hypothesis (model 6, where $\overline{AGBdeviation}$ is the explanatory variable) was statistically significant and negative (Table 2, Figure 4a). The regression coefficients for all other models were not statistically significant (Table 2).

The overall results change little after excluding the outlier plot 6 at SJ. Empirical support was still restricted to predictions from the floristic composition and intra-specific variation hypothesis, as represented by models 1 and 6, respectively (Table 2, Figures 3b and 4b). Nonetheless, when the outlier was excluded, the regression coefficients of two additional models representing the floristic composition hypothesis were positive and statistically significant, thus opposite in sign to the respective predictions. These were models 3 and 4, in which the proportion of palms and the proportion of *M. flexuosa* palm trees, respectively, $\overline{AGBdeviation}$ were positively related to AGB (Table 2, Figures 5a, b and 6a, b).

Relative importance of the three hypotheses about variation in AGB among peatland locations – For models determined *a priori*, in both sets of models with and without inclusion of the outlier, the lowest AICc corresponded to model 1 (Table 3) meaning that floristic composition was the best predictor of variation in total AGB among peatland plots.

Based on *P* and AICc values, variables from models 1 (NMDS1) and 6 $\overline{AGBdeviation}$ were selected and as the correlation between them was low (r^2 = 0.07) they were included in an *ad hoc* model. When retaining the outlier, the overall model was significant (Table 2) explaining 46% of the variation in AGB and with both variables explaining almost the same amount of the variation (partial correlations: NMDS1: r^2 = 0.25, *P* = 0.003; $\overline{AGBdeviation}$: r^2 = 0.22, *P* = 0.008). When the outlier was removed, the same pattern was obtained for the entire model (NMDS1: *r* = 0.27, *P* = 0.002, $\overline{AGBdeviation}$: *r* = 0.22, *P* = 0.008). AICc values in both data sets including and excluding the outlier were lower for the multivariate ad hoc model than were those for models that were determined *a priori* (Table 3).

Test of spatial dependence – Spatial autocorrelation was low for all models (Appendix, table 10) with model 7 having the lowest value.

DISCUSSION

The variation in above-ground carbon storage in living biomass at the plot level was largely supported by two of the hypotheses (1 and 3) tested in this study. Between and within species differences in AGB largely determined the variation in AGB across study sites, both explaining almost the same amount of variation in the response variable. Additionally, most of the variation in AGB among trees was attributable to the variation among species. Diameter and the positive covariance between D and H had the greatest contribution to inter and intra-specific variation in AGB.

***Support for hypotheses about variation in AGB among peatland locations* –** I found empirical support for the floristic composition and the intra-specific variation hypotheses, but not for the stem density hypothesis. The floristic composition and intra-specific variation hypotheses explained similar amounts of the variation in AGB among peatland locations.

The overall variation in floristic composition was a good predictor of the variation in AGB across plots. When taking the top 24 species at extreme ends of the NMDS1 axis (species scores listed in Appendix, Table 12), mean AGB values were significantly different between the two groups (Kruskal-Wallis chi-squared= 7.2963, *df*= 1, *p*= 0.007). Species composition and the differences in construction of those species should underpin variation in AGB. An interesting example is *M. flexuosa.* At the high end of NMDS1 (plots at Q and SJ), this palm is frequent, is in the top ten species for highest mean H and D values, and in most of the plots it constitutes >30% of the total amount of AGB (Appendix, Table 13). Even if the proportion of this species was not the best predictor of the variation in AGB, it constitutes an important element of the overall species composition as its distribution was significantly correlated with NMDS1 (Z=2.73, *p*=0.006, tau=0.41) and NMDS2 (Z=-2.13, p=0.03, tau=-0.321) and consequently a potential driver of the high AGB values at these plots. This is contrary to what was reported for palm forests where this species was also very common (Honorio et al., 2009). One explanation for these differences may be that I also took into account sites having a different floristic composition (plots at BV) to that of palm forests, and these had lower AGB values at the low end of NMDS1.

I found no support for the stem density hypothesis. The amount of biomass varied independently of the total number of individual stems per area across plots. The variation in environmental conditions already reported for these peatlands (Lahteenoja et al., 2009b) e.g., soil richness, exposure to flooding, could have had an effect, over time, on the growth of trees. In previous studies (Hawes et al., 2012), the size of the trees varied in relation to the time of exposure to flooding. I did not measure these variables; however, I noticed that some plots having relatively high number of stems did not have large biomass values since the trees that were there were small in size. The opposite was observed for some plots having few stems. Additionally, it is important to mention that during the year I did my sampling an atypical increase in the level of flooding took place in Amazonia. This event had an important effect on the standing biomass. Some plots had small to big fallen, but still living trees. These fallen trees were not taken into account in the study, as I only considered standing living trees for my biomass estimations. The inclusion of the fallen trees in the analysis could have altered the results.

Intra-specific variation in AGB across plots was also a strong predictor of plot level AGB with species able to make large plants in particular locations driving high total AGB at a given plot. The variation in the size of the trees could be a response to the variation of the environmental factors across sites already mentioned in the paragraph above. This phenotypic variation can be thought to be related, on the one hand, to phenotypic plasticity (which may also be a response to the variation in the genotypes of individuals) meaning that some species are capable of responding to local conditions and producing large individuals, consequently leading to high AGB values. However these species may be unable to produce large individuals in all conditions. On the other hand, stochastic (e.g. local storms) and non-random (e.g. seed dispersal limitation) processes occurring at different strengths across plots may have also determined, through time, the variation in the size of individuals. If stochastic processes are at work, intra-specific AGB differences across plots may be strongly related to changes in site-level soil characteristics (e.g. nutrient content, drainage, peat thickness) and frequency of flooding.

Contribution of three plant traits to inter- and intraspecific variation in AGB among peatland trees – Variance in diameter and the (positive) covariance between diameter and height were the components contributing most to the variance in AGB within and across species. For both among and within species variation in AGB, D was the main driver of the variation in AGB. As this trait is squared in the equation, any unit shift in D has greater effect on AGB than does a unit shift in H and WD. On the other hand, according to the covariance between variables, the overall variation in volume (in the equation represented by D times H) should be driving the variation in AGB, with D exerting the strongest control on this variation. Therefore, an overall shift in size of the trees should have a relatively large impact on biomass and thus the carbon stored.

These results may not be directly comparable to those reported in other studies, where D was also determined as having a strong control on the variation in AGB (Chave et al., 2001; Baraloto et al., 2011; Hawes et al. 2012) because of the differences in the numerical scales (logarithmic in this work). However, it is interesting that I was able to recover a similar pattern. This can be considered a first simple approximation of decomposing an AGB equation to determine which traits are drivers of variation in AGB.

Some general aspects - Values of total AGB reported in this work were lower than those for other habitats in Amazonia (Baker et al., 2004) but similar to those documented for forests where palms, including *M. flexuosa,* are common (Honorio et al., 2009; Appendix, Table 11).

The high AGB in the outlier plot (plot 6) seems to be due to the presence of trees that are relatively large in size with *Platycarpum* sp. nov contributing more to this given that it was the most common species in this plot. Species of *Platycarpum* tend to occupy habitats having poor soil conditions (King, 1984) and some tend to attain large sizes; for example, *Platycarpum orinocense* is an endemic and common canopy species in white sand forests (Vriesendorp et al., 2006). *Platycarpum* sp. nov. was also reported at Jenaro Herrera in Peruvian lowland Amazonia, another palm forest, where *M. flexuosa* is very common (Davila *com. pers*). While this species is also common in other locations, its biology is still relatively unknown and under study (Davila, *in press*). Other species that also were big and contributed, although to a lesser extent, to the extremely high AGB values in this plot were *M. flexuosa* and *Ficus guianensis,* the first one representing 9.48% of the total AGB and the second having the biggest tree in the plot (D = 56 cm). Many of the species in this plot were also found in other plots. Various biotic and abiotic characteristics at plot 6 in SJ likely allowed individuals of these species to attain higher sizes in D and H than those of the same species in other plots.

CONCLUSIONS

In this first study of AGB in Peruvian peatlands, I showed that most variance (80%) in AGB among peatland trees is attributable to differences among species; that stem size is a major determinant of variation in AGB among peatland trees, both among and within species; and that variation in total AGB among peatland locations is equally determined by floristic composition and intra-specific variation in AGB. I also showed that *M. flexuosa* is an important element of the overall species composition and is a potential driver of the high AGB values in plots where it occurred.

I sampled a subset of the northern Peruvian peatlands that differed in flooding frequency and nutrient content in the soils. In future work, it would be useful to collect information across a greater breadth of Peruvian peatlands in order to see if patterns observed in this work are maintained. Additionally, a better understanding of variation in AGB across the landscape can be gained by understanding the drivers of species distributions, as well as what leads to phenotypic plasticity in species construction. The results from this study can be used to better parameterize site C budgets beyond just the amount of C stored in the soil. Future studies of C budgets should also include estimates of C stored in fallen and standing dead trees as well as decomposition rates both for woody debris and leaf litter, as well as the soil (Větrovský et al. 2011). Finally, to prioritize sites for forest management, species composition, the presence of *M. flexuosa,* and tree size are among the variables that should be taken into account.

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Table 1: Regression models for testing variation in Above-ground biomass. $\overline{AGBdeviation}_{\text{plot}}$ = mean AGB deviation per plot. $\text{NMDS1}_{\text{plot}}$ and $\text{NMDS2}_{\text{plot}}$ = plot scores that were extracted from the NMDS ordination (the first and second axes) of species composition. $\text{Ppalms}_{\text{plot}}$ = proportion of palms per plot. $\text{Pmauritia}_{\text{plot}}$ = proportion of *M. flexuosa* per plot. $\text{logTsdensity}_{\text{plot}}$ = logarithm of total number of stems per plot. $\text{TotalAGB}_{\text{plot}}$ = total above-ground biomass per plot.

Hypothesis	**Linear regression model**	**Prediction about b**	
Floristic composition	$\text{TotalAGB}_{\text{plot}} = a + b\ \text{NMDS1}_{\text{plot}}$	Significant	
	$\text{TotalAGB}_{\text{plot}} = a + b\ \text{NMDS2}_{\text{plot}}$	Significant	
	$\text{TotalAGB}_{\text{plot}} = a + b\ \text{Ppalms}_{\text{plot}}$	Significant	-
	$\text{TotalAGB}_{\text{plot}} = a + b\ \text{Pmauritia}_{\text{plot}}$	Significant	-
Stem density	$\text{TotalAGB}_{\text{plot}} = a + b\ \text{logTsdensity}_{\text{plot}}$	Significant	+
Intraspecific variation	$\text{TotalAGB}_{\text{plot}} = a + b\ \overline{AGBdeviation}_{\text{plot}}$	Significant	-

Table 2: *a priori* and *ad hoc* models predicting plot level aboveground biomass including and excluding the outlier plot 6 at SJ. $\overline{AGBdeviation}_{plot}$ = mean AGB deviation per plot. NMDS1$_{plot}$ and NMDS2$_{plot}$ = plot scores that were extracted from the NMDS ordination (the first and second axes) of species composition. Ppalms$_{plot}$ = proportion of palms per plot. Pmauritia$_{plot}$ = proportion of *M. flexuosa* per plot. logTsdensity$_{plot}$ = logarithm of total number of stems per plot. TotalAGB$_{plot}$ = total aboveground biomass per plot.

Hypothesis	**Linear regression model**	**Including the outlier**					**Excluding the outlier**				
		F	***df***	***R^2***	***B***	***P***	***F***	***df***	***R^2***	***b***	***P***
	a priori										
Floristic composition	1: TotalAGB$_{plot}$ = a + *b* NMDS1$_{plot}$	7.2	1, 22	0.25	10.4	0.01	7.69	1, 21	0.27	8.25	0.01
	2: TotalAGB$_{plot}$ = a + *b* NMDS2$_{plot}$	0.009	1, 22	4E-04	0.98	0.9	1.85	1, 21	0.08	-10.38	0.18
	3: TotalAGB$_{plot}$ = a + *b* Ppalms$_{plot}$	1.09	1, 22	0.05	0.25	0.31	4.69	1, 21	0.18	0.38	0.04
	4: TotalAGB$_{plot}$ = a + *b* Pmauritia$_{plot}$	1.16	1, 22	0.05	0.39	0.29	4.33	1, 21	0.17	0.54	0.05
Stem density	5: TotalAGB$_{plot}$ = a + *b* logTsdensity$_{plot}$	2.32	1, 22	0.1	0.13	0.14	2.61	1, 21	0.11	0.10	0.12
Intra-specific variation	6: TotalAGB$_{plot}$ = a + *b* $\overline{AGBdeviation}_{plot}$	4.63	1, 22	0.17	-0.24	0.04	4.05	1, 21	0.16	-0.17	0.05
	ad hoc										
Floristic composition and Intra-specific variation	7: TotalAGB$_{plot}$ = a + *b* NMDS1$_{plot}$ + $\overline{AGBdeviation}_{plot}$	9.04	2, 21	0.46		0.001	9.67	2, 21	0.49		0.001

Table 3: AICc values of *a priori* and *ad hoc* models that explain variation in AGB among peatland plots when including and excluding the outlier. $\overline{AGBdeviation}_{\text{plot}}$ = mean AGB deviation per plot. $\text{NMDS1}_{\text{plot}}$ and $\text{NMDS2}_{\text{plot}}$ = plot scores that were extracted from the NMDS ordination (the first and second axes) of species composition. $\text{Ppalms}_{\text{plot}}$ = proportion of palms per plot. $\text{Pmauritia}_{\text{plot}}$ = proportion of *M. flexuosa* per plot. $\text{logTsdensity}_{\text{plot}}$ = logarithmic form of total number of stems per plot. $\text{TotalAGB}_{\text{plot}}$ = total aboveground biomass per plot.

Hypothesis		**Linear regression model**	***AICc***
Including the outlier		***a priori***	
	Floristic composition	1. $\text{TotalAGB}_{\text{plot}} = \text{a} + b\ \text{NMDS1}_{\text{plot}}$	224
		3. $\text{TotalAGB}_{\text{plot}} = \text{a} + b\ \text{Ppalms}_{\text{plot}}$	229.6
		4. $\text{TotalAGB}_{\text{plot}} = \text{a} + b\ \text{Pmauritia}_{\text{plot}}$	229.6
	Intra-specific variation	6. $\text{TotalAGB}_{\text{plot}} = \text{a} + b\ \overline{AGBdeviation}_{\text{plot}}$	226.2
		ad hoc	
	Floristic composition and intra-specific variation	7: $\text{TotalAGB}_{\text{plot}} = \text{a} + b\ \text{NMDS1}_{\text{plot}} + \overline{AGBdeviation}_{\text{plot}}$	217.9
Excluding the outlier		***a priori***	
	Floristic composition	1. $\text{TotalAGB}_{\text{plot}} = \text{a} + b\ \text{NMDS1}_{\text{plot}}$	201.68
		3. $\text{TotalAGB}_{\text{plot}} = \text{a} + b\ \text{Ppalms}_{\text{plot}}$	204.22
		4. $\text{TotalAGB}_{\text{plot}} = \text{a} + b\ \text{Pmauritia}_{\text{plot}}$	204.55
	Intra-specific variation	6. $\text{TotalAGB}_{\text{plot}} = \text{a} + b\ \overline{AGBdeviation}_{\text{plot}}$	204.8
		ad hoc	
	Floristic composition and intra-specific variation	7: $\text{TotalAGB}_{\text{plot}} = \text{a} + b\ \text{NMDS1}_{\text{plot}} + \overline{AGBdeviation}_{\text{plot}}$	195.31

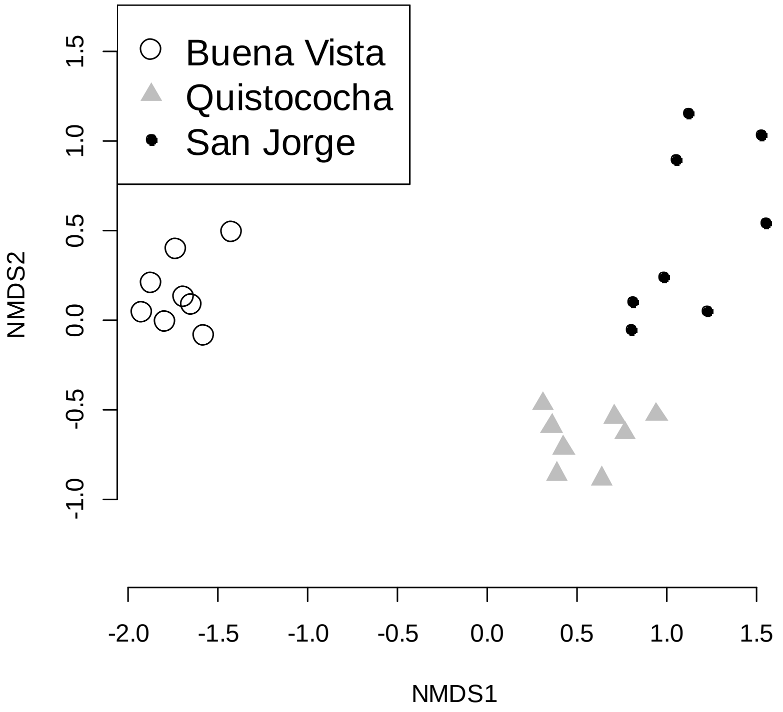

Figure 1: NMDS ordination biplot of floristic composition dissimilarities among peatland plots. The stress value of the ordination was 0.075.

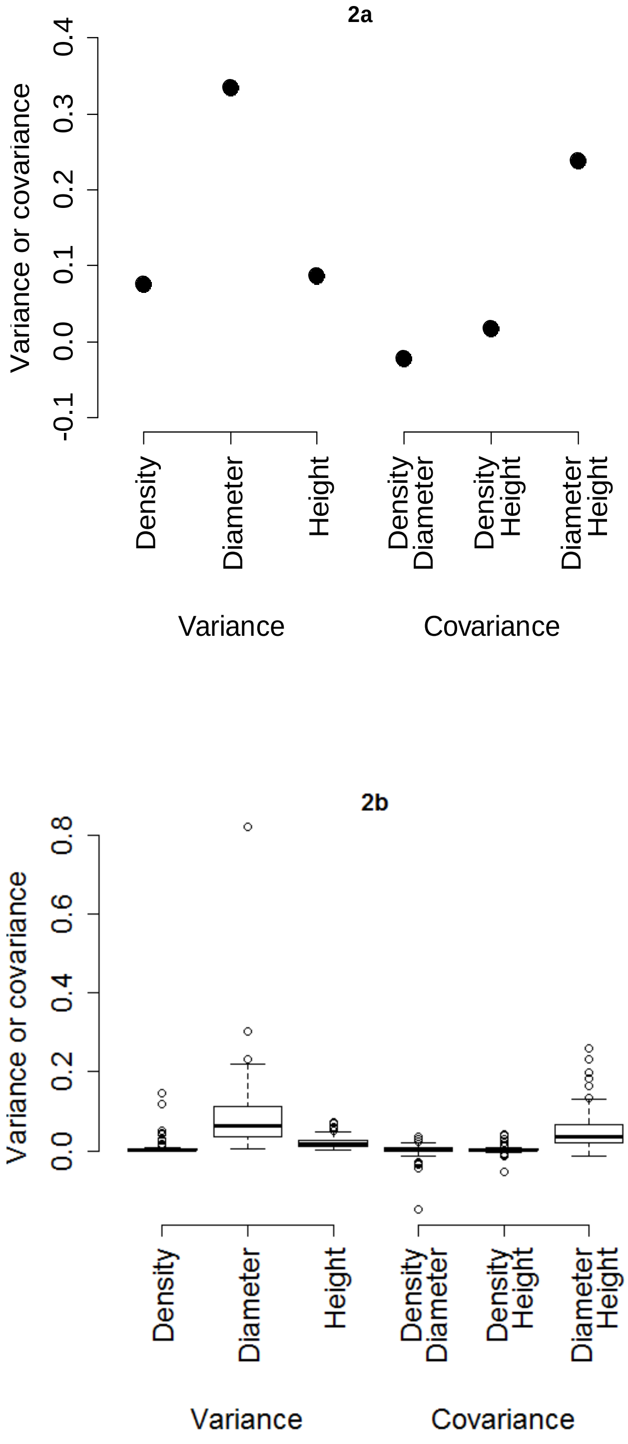

Figure 2: Variance and covariance between variables from the equation for estimating AGB. ***a* –** Inter-specific variation, one single value is shown per each trait. ***b* –** Intra-specific variation, mean values across the 98 species are shown per each trait, Density = wood density.

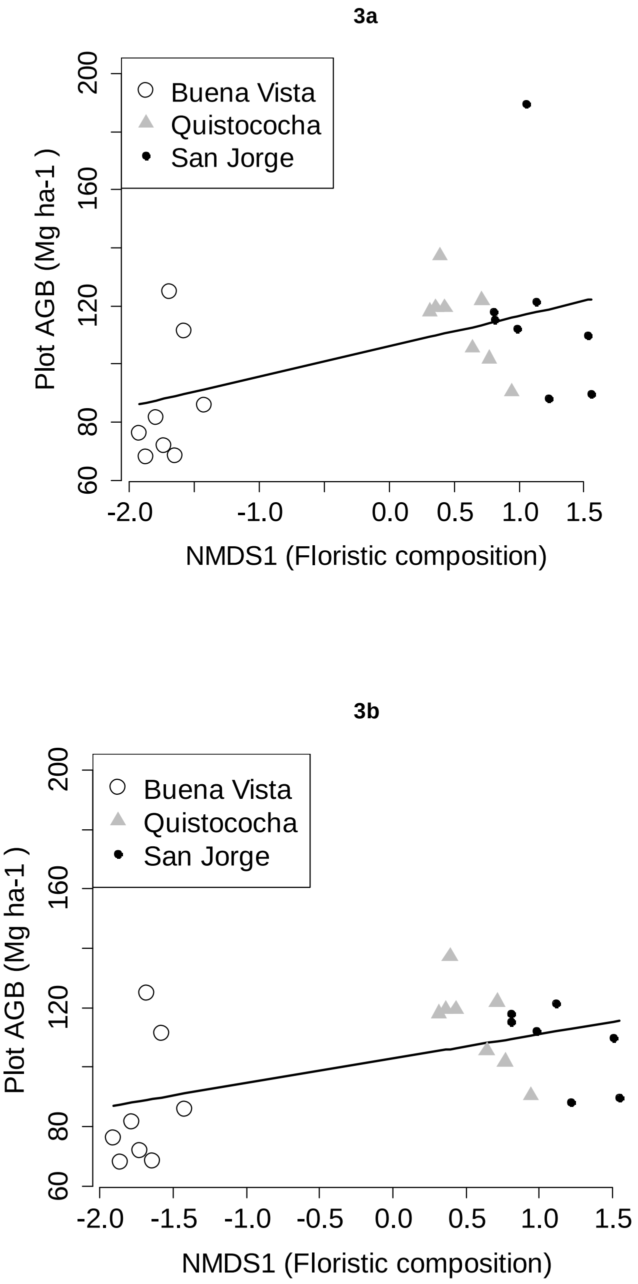

Figure 3: Linear regression between total plot AGB and the overall floristic composition (NMDS1). ***a -*** When the outlier (Plot 6 at SJ) is included, ***b*** - When the outlier is excluded.

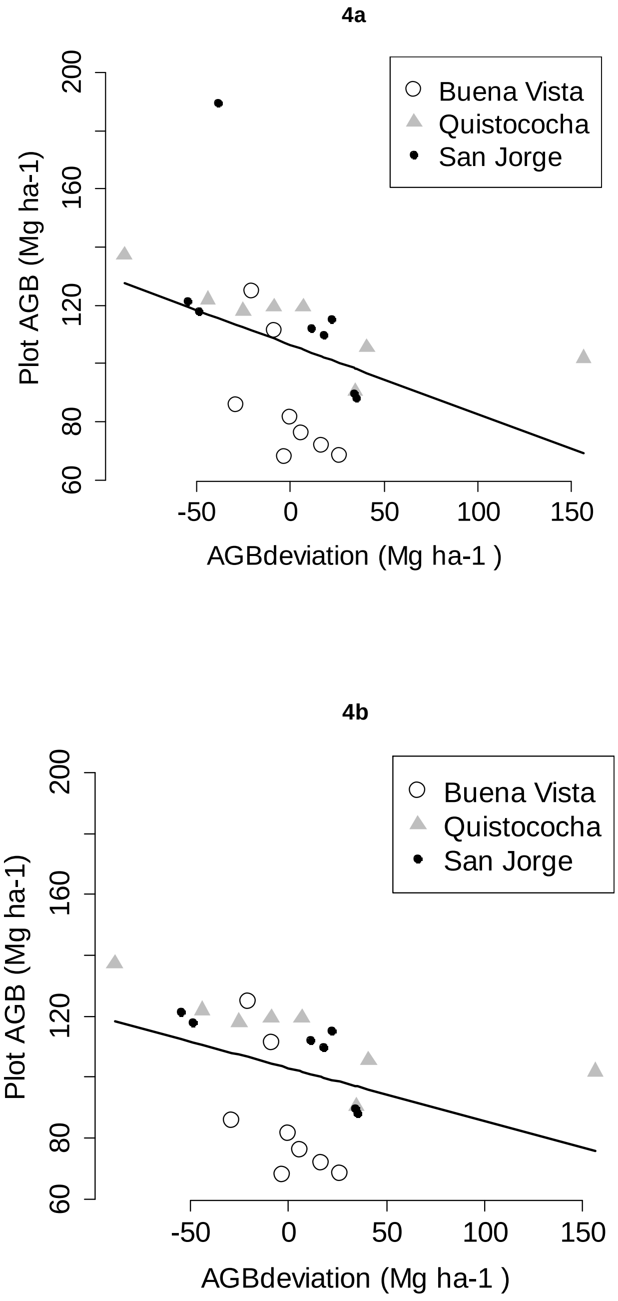

Figure 4: Linear regression between total plot AGB and intra-specific variation in AGB ($\overline{AGBdeviation}$). ***a*** **-** When the outlier (Plot 6 at SJ) is included, ***b*** - When the outlier is excluded.

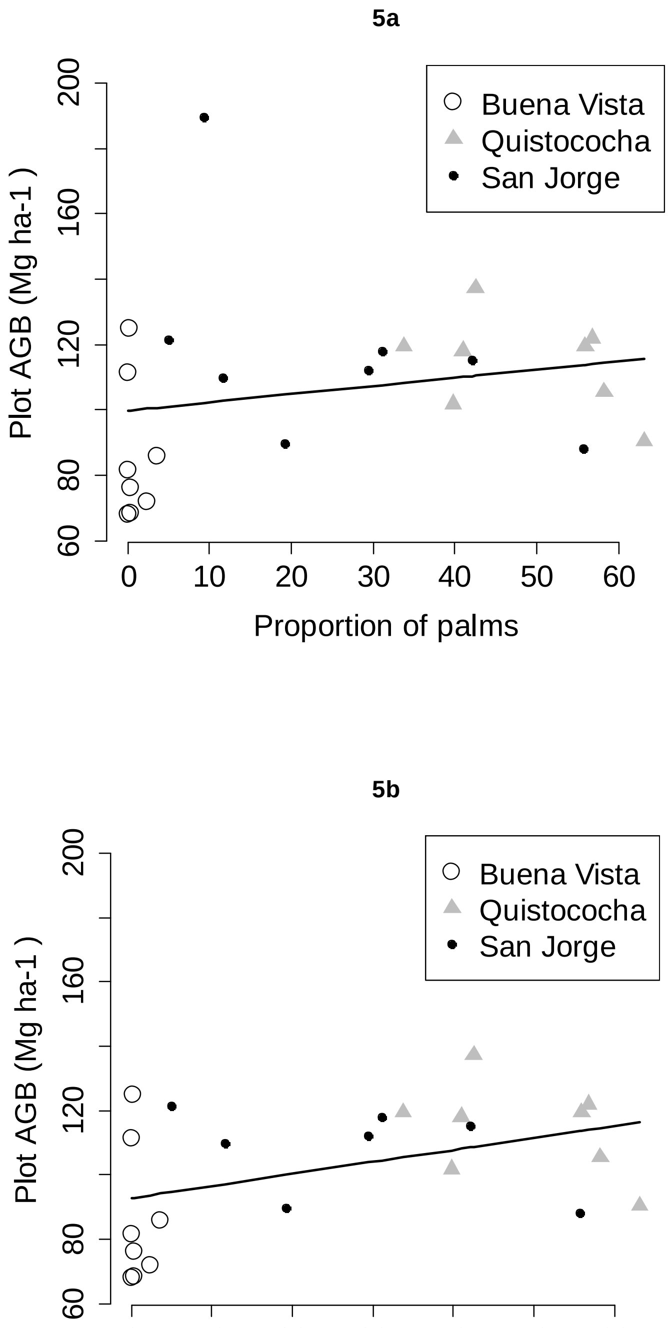

Figure 5: Linear regression between total plot AGB and proportion of palms. ***a*** **-** When the outlier (Plot 6 at SJ) is included, ***b*** - When the outlier is excluded.

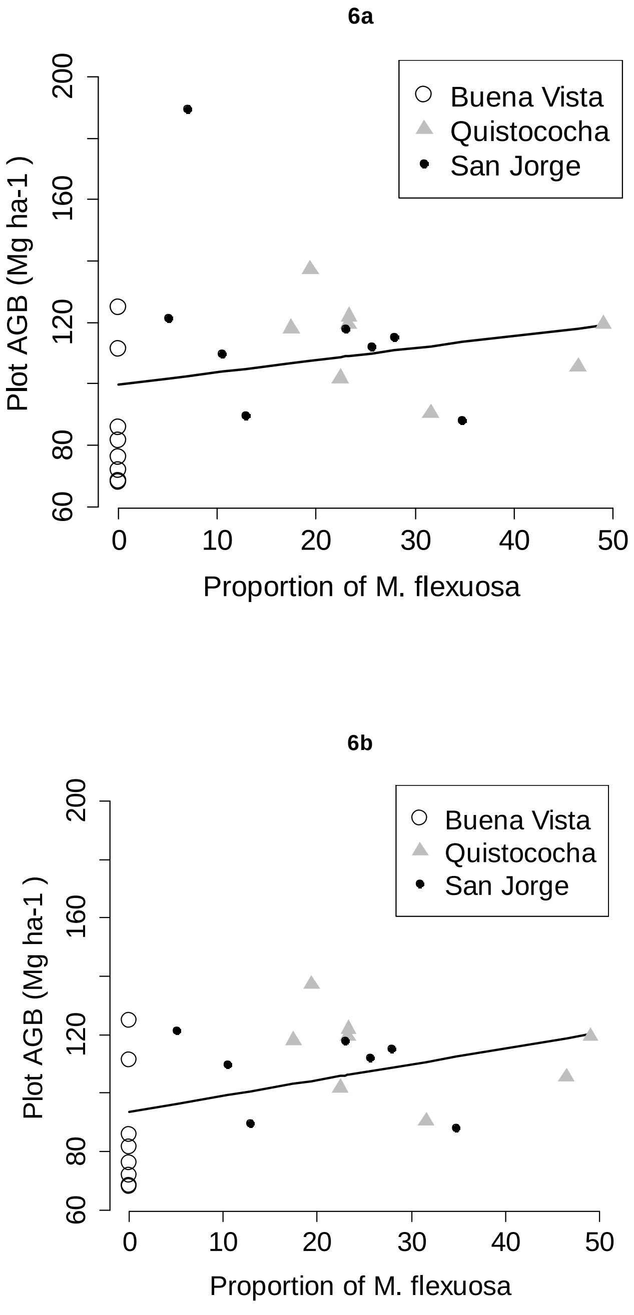

Figure 6: Linear regression between total plot AGB and proportion of *M. flexuosa*. ***a -*** When the outlier (Plot 6 at SJ) is included, ***b*** - When the outlier is excluded.

APENDIX

Figure 01: Map showing the location of study sites in Northern Peruvian Amazonia. Study sites are distributed along the Amazon River. The closest city to these is Iquitos (main city in this part of Amazonia)

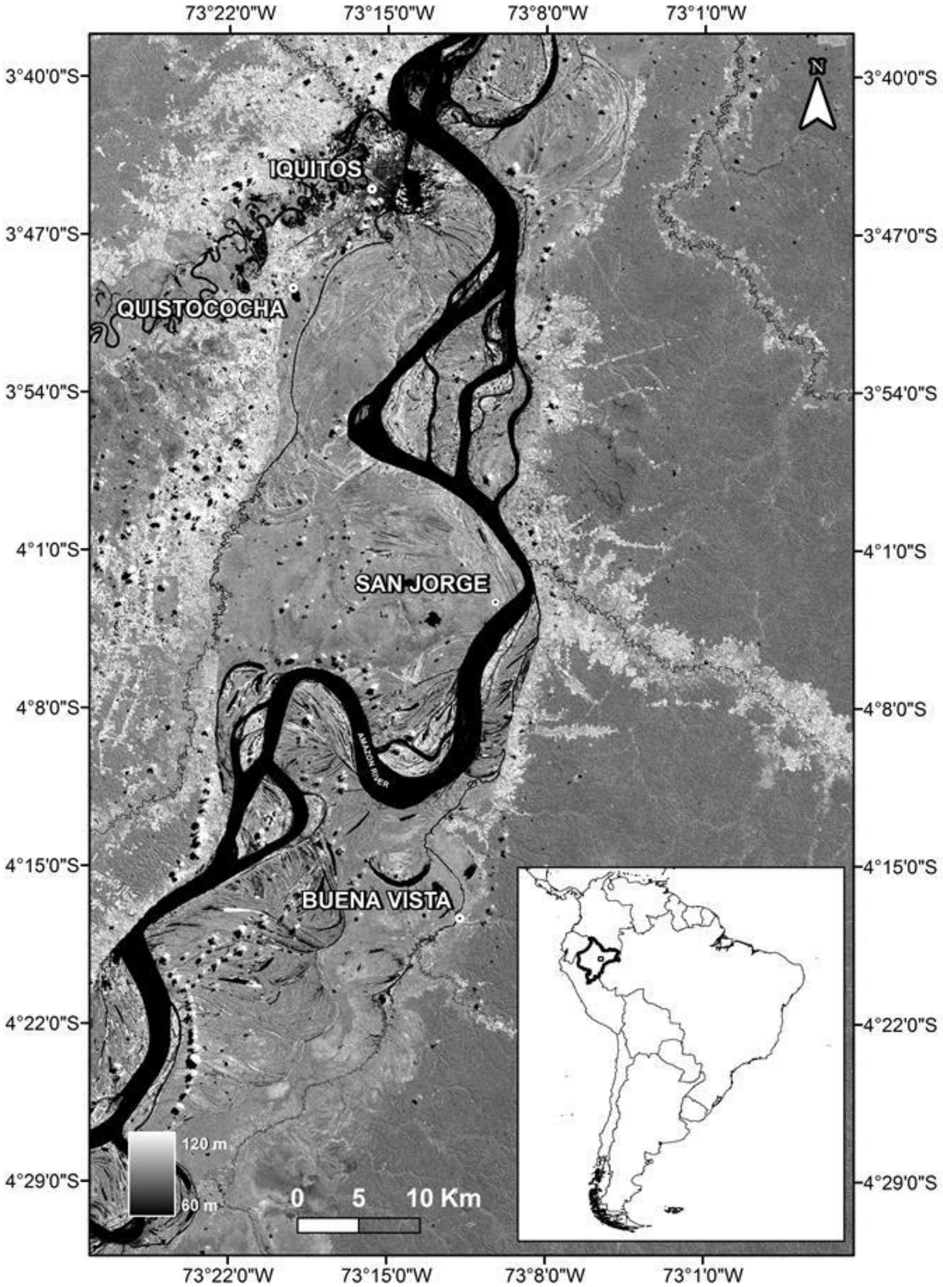

Figure 02: Location of plots in Peru in each peatland of study. (a) Buena Vista, (b) Quistococha, (c) San Jorge.

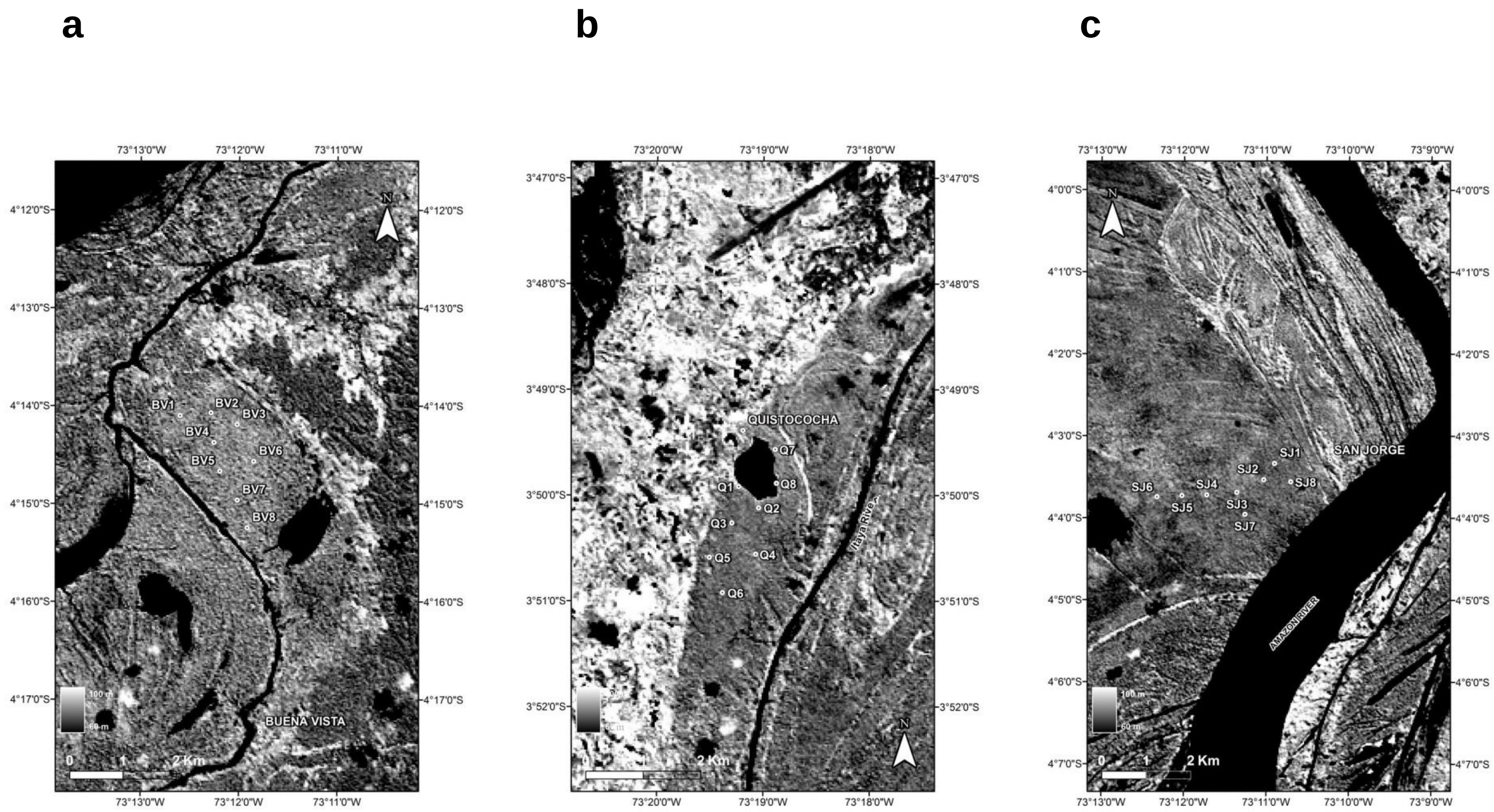

Figure 3: Diagram of the Gentry plot used in this study. The horizontal line was used as a reference to then establish transects (vertical lines) along which the inventory of trees was carried out. The distance between transects was 20m. Each transect was 10 m x and 50 m.

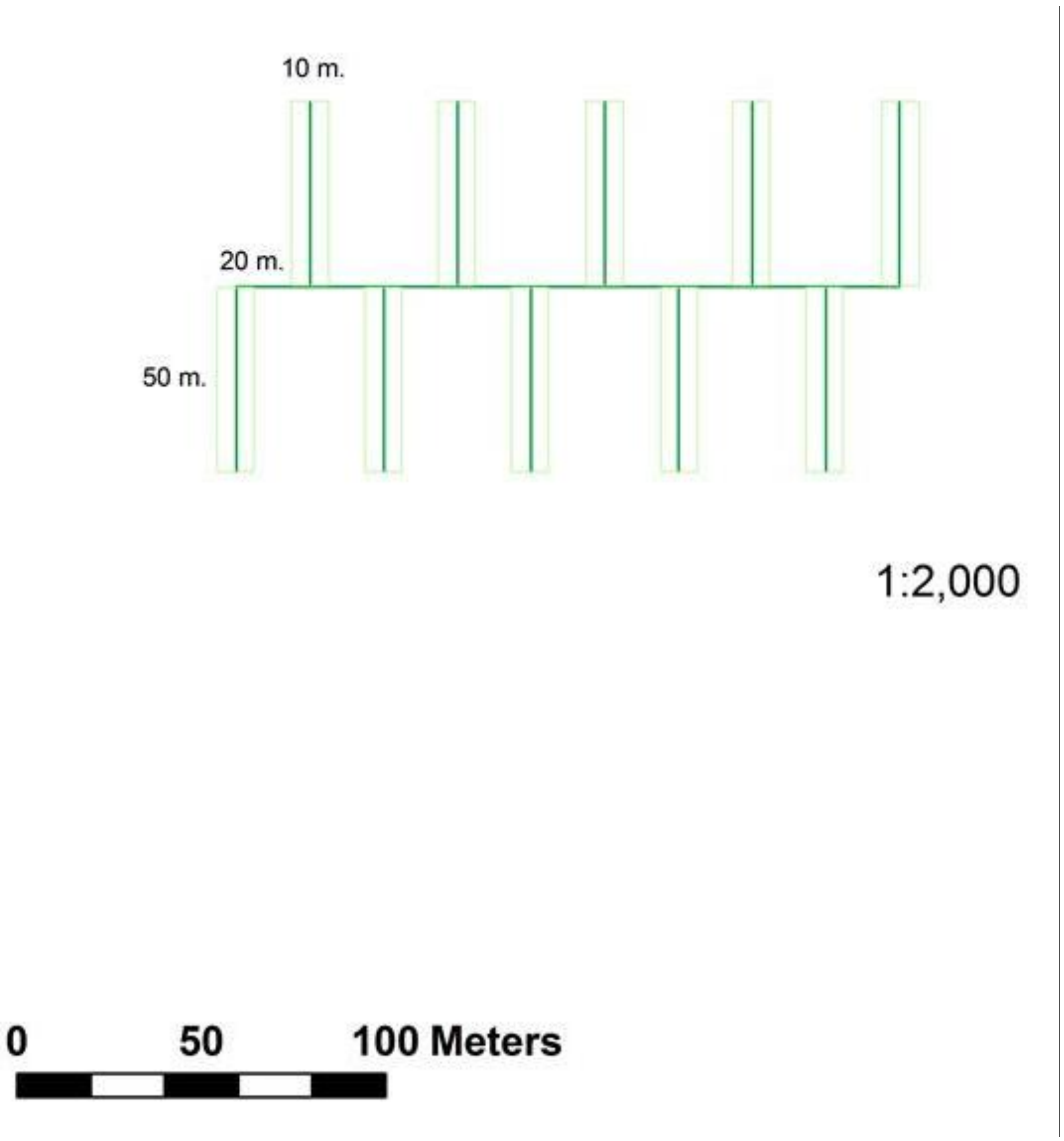

Table 1: Coordinates of plot's location in Peruvian Amazonia. Units are in Universal Transverse Mercator coordinate system (UTM). Altitude of each plot above the sea level is also included. BV = Buena Vista, Q = Quistococha, SJ = San Jorge.

Locality	UTM S	UTM W	Altitude
BV 1	698576	9531660	115
BV 2	699246	9531720	103
BV 3	699739	9531496	111
BV 4	699303	9531160	96
BV 5	699411	9530617	104
BV 6	700051	9530803	102
BV 7	699738	9530073	101
BV 8	699925	9529551	103
Q 1	686475	9576239	109
Q 2	686841	9575885	103
Q 3	686355	9575608	102
Q 4	686766	9575059	111
Q 5	685995	9575029	96
Q 6	686202	9574381	115
Q 7	687128	9576929	100
Q 8	687156	9576313	96
SJ 1	701852	9551501	127
SJ 2	701609	9551134	128
SJ 3	701006	9550852	109
SJ 4	700330	9550793	120
SJ 5	699773	9550779	135
SJ 6	699212	9550755	125
SJ 7	701189	9550357	120
SJ 8	702217	9551087	117

Table 2: Plot scores for NMDS1 and NMDS2 that were extracted from the Non-metric multidimensional scaling ordination analysis (NMDS). BV = Buena Vista, Q = Quistococha, SJ = San Jorge.

Peatland plot	**NMDS1**	**NMDS2**
BV 1	-1.4217657	0.4926497
BV 2	-1.5754015	-0.0879906
BV 3	-1.7854119	-0.0063306
BV 4	-1.6411616	0.0865076
BV 5	-1.680151	0.1317459
BV 6	-1.9102245	0.0366095
BV 7	-1.8607512	0.2003836
BV 8	-1.7277039	0.3973680
Q 1	0.3900896	-0.8627702
Q 2	0.7129447	-0.5445510
Q 3	0.6414613	-0.8828875
Q 4	0.3147775	-0.4743073
Q 5	0.4290851	-0.7188143
Q 6	0.3633698	-0.5985037
Q 7	0.9434084	-0.5251703
Q 8	0.7685269	-0.6308620
SJ 1	0.810162	0.0987543
SJ 2	0.9859096	0.2390745
SJ 3	1.5456412	0.5483222
SJ 4	1.5084658	1.0443818
SJ 5	1.1145668	1.1551009
SJ 6	1.0434625	0.9003685
SJ 7	1.2210763	0.0570483
SJ 8	0.8096237	-0.0561274

Table 3: List of species per family. Number of individuals is shown per plot and study site.

Taxa	Buena Vista								Quistococha								San Jorge								Total
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
Anacardiaceae																									
Tapirira guianensis										2	1							4	2					2	11
Total										2	1							4	2					2	11
Annonaceae																									
Guatteria decurrens												3	3	3			16	5	4	1			4	8	47
Guatteria sp. 1		2	2																						4
Guatteria sp. 2			1	2	1			2																	6
Oxandra riedeliana																		1	18	8	1		7		35
Rollinia cuspidata											1														1
Unonopsis sp. 1									1																1
Total		2	3	2	1			2	1		1	3	3	3			16	6	22	9	1		11	8	94
Apocynaceae																									
Aspidosperma schultesii																							1		1
Couma macrocarpa																							1		1
Himatanthus sucuuba									12		1	8	4		2	1	14	8			1	1	16	9	77
Lacmellea lactescens									1				10												11
Malouetia tamaquarina	9	3		3			1	9	3		7	7	5	9			1							3	60
Parahancornia peruviana									6	5			3	1		10									25
Total	9	3		3			1	9	22	5	8	15	22	10	2	11	15	8			1	1	18	12	175
Aquifoliaceae																									
Ilex aff. *nayana*		1	7	3	1	9	6	3																	30
Ilex andarensis									5	1													2	3	11
Total		1	7	3	1	9	6	3	5	1													2	3	41

Araliaceae																									
Dendropanax cf. *resinosus*																	37	25	25	28	57	34	13	4	223
Total																	37	25	25	28	57	34	13	4	223
Arecaceae																									
Astrocaryum jauari	9			1	1	1		7																	19
Euterpe catinga																	1	3	1			8	6	7	26
Euterpe precatoria										2	12	9	3	4		4	4								38
Mauritia flexuosa									53	95	130	59	60	120	94	79	108	91	48	54	20	25	113	67	1216
Mauritiella armata									57	134	21	70	24	13	94	57	48	10	16	6			50	15	615
Oenocarpus bataua																	2	1	7					2	12
Socratea exorrhiza									6														12		18
Total	9			1	1	1		7	116	231	163	138	87	137	188	140	163	105	72	60	20	33	181	91	1944
Bignoniaceae																									
Tabebuia insignis var. *monophylla*					1				6	109	43	45	14	18	71	99	3		4		1	1	8		423
Total					1				6	109	43	45	14	18	71	99	3		4		1	1	8		423
Burseraceae																									
Protium klugII												2						1					1	2	6
Total												2						1					1	2	6
Calophyllaceae																									
Calophyllum brasiliense																	65	108	118	114	74	87	7	24	597
Calophyllum sp. 1								1																	1
Total								1									65	108	118	114	74	87	7	24	598
Caryocaraceae																									
Caryocar glabrum	8	5		2	5		3																		23
Total	8	5		2	5		3																		23

Chrysobalanaceae																									
Licania heteromorpha	3	10	2	5	3	2	2	1																	28
Licania licaniiflora	1	4	1	1	2		2																		11
Licania octandra								4																	4
Parinari parilis		1		1	2	1	2																		7
Total	4	15	3	7	7	3	6	5																	50
Clusiaceae																									
Garcinia macrophylla	8	10	5	2	4	2	1	4																	36
Symphonia globulifera	1								17	17	14	19	19	11	10	9	7	3					10	7	144
Total	9	10	5	2	4	2	1	4	17	17	14	19	19	11	10	9	7	3					10	7	180
Combretaceae																									
Buchenavia amazonia	8	3	9	3	17	8	4	16																	68
Buchenavia macrophylla														1											1
Terminalia dichotoma	3	2	4	5	5		2	5																	26
Total	11	5	13	8	22	8	6	21						1											95
Ebenaceae																									
Diospyros poeppigiana	5	17	35	33	59	25	14	5																	193
Total	5	17	35	33	59	25	14	5																	193
Elaeocarpaceae																									
Sloanea cf. *guianensis*									4				1												5
Sloanea oppositifolia	11	4	1		1		3	2																	22
Total	11	4	1		1		3	2	4				1												27
Euphorbiaceae																									
Alchornea schomburgkii									3		1	5	1	3	4	2	3	2	3				2	3	32

Alchorneopsis floribunda									1	2			1		1	3	2			1	2	1	2	2	18
Conceveiba martiana																	1	1						6	8
Conceveiba rhytidocarpa								1									3	2					9	22	37
Hevea guianensis									20		7	6	38	5	2	30	5			14		7		2	136
Hura crepitans									1															1	2
Mabea cf. *fistulifera*	1	2	4	3	4	4	1	3																	22
Micrandra sp. 1													18										1		19
Total	1	2	4	3	4	4	1	4	25	2	8	11	58	8	7	35	14	5	3	15	2	8	14	36	274
Fabaceae																									
Campsiandra angustifolia							2	5																	7
Crudia glaberrima									1																1
Cynometra bauhiniifolia								2																1	3
Hydrochorea corymbosa	4	17	8	15	13	18	13	8																	96
Inga cf. *cayennensis*	2											2		1			2	3			4		2	1	17
Inga cf. *psittacorum*		16	16	8	20	16	17	5																	98
Inga sp. 1	1																								1
Inga sp. 2			1	1	3		2																		7
Inga stenoptera	7	15	51	25	36	64	29	35					1									1			264
Machaerium floribundum												2			5		12	14	9				9	12	63
Macrolobium acaciifolium	4	3	6	6	13	5	7	5																	49
Macrolobium cf. *multijugum*					2					4	3	1	1	4	3	1									19
Ormosia coccinea var. *subsimplex*																			3	2	1		7		13
Ormosia macrocalyx		1						2																	3
Parkia multijuga															1										1
Parkia nitida																								1	1
Parkia panurensis													1												1
Pterocarpus amazonum			2	4	6	7	1	4	5			1												1	31
Swartzia schunkei					2	4	1	2																	9
Vatairea guianensis	22	28	21	27	27	14	20	9	13	2	13	39	18	21	3	10	6	4						10	307
Zygia cauliflora		1	1					1				1			1			6							11

Zygia longifolia	1					1																				2
Total	41	81	106	86	122	129	92	78	19	6	16	46	21	26	13	11	20	27	12	2	5	1	18	26		1004
Flacourtiaceae				1																						1
Total				1																						1
Lauraceae																										
Aniba guianensis		1			1	1																				3
Aniba panurensis		1																								1
Nectandra heterotricha	2	4																								6
Nectandra sp. 1					3			1			1															5
Nectandra sp. 2			1																							1
Ocotea aciphylla																		2								2
Ocotea gracilis											2	2				4										8
Ocotea sp. 1																					1					1
Total	2	6	1		4	1		1			3	2				4		2			1					27
Lecythidaceae																										
Eschweilera albiflora	4	18	12	8	24	19	17	13																		115
Eschweilera parviflora	29	25	5	8	6			9																		82
Total	33	43	17	16	30	19	17	22																		197
Lepidobotriaceae																										
Ruptiliocarpon caracolito											1					1	5	8	2				1	10		28
Total											1					1	5	8	2				1	10		28
Malpighiaceae																										
Byrsonima arthropoda	1											1														2
Total	1											1														2

Malvaceae																									
Lueheopsis hoehnei									2	2	10			3		13	8	1							39
Pachira aff. *brevipes*																	18	6	6	135	58	16	23		262
Pachira aquatica									3			4	4	1											12
Pachira insignis																	1	1						4	6
Pseudobombax munguba	1		1			2																			4
Total	1		1			2			5	2	10	4	4	4		13	27	8	6	135	58	16	23	4	323

Meliaceae																									
Trichilia inaequilatera								1																	1
Trichilia pleeana									1																1
Trichilia rubra	3	1	1				1																		6
Trichilia sp. 1														2											2
Total	3	1	1				1	1	1					2											10

Moraceae																									
Batocarpus amazonicus																1							1	5	7
Brosimum utile									8	2		4	5	2	4	2	2	6	1		1	1	9	9	56
Ficus cf. *guianensis*	4	1		2				1	1	1							2	3				1		1	17
Ficus krukovii									3							1									4
Ficus paraensis																			1						1
Ficus trigonata															1										1
Total	4	1		2				1	12	3		4	5	2	5	4	4	9	2		1	2	10	15	86

Myristicaceae																									
Iryanthera paraensis									8																8
Iryanthera tessmannii		1																							1
Virola surinamensis		10	1						13	6	5	11	5	4		2	6	9					7	41	120
Total		11	1						21	6	5	11	5	4		2	6	9					7	41	129

Myrtaceae																									
Calyptranthes macrophylla	12											7	1			7									27
Eugenia sp. 1	6	5	9	12	20	18	22	17				1	3	3	1										117
Myrcia sp. 1	2	12	17	12	16	9	6	6																	80
Myrtaceae sp. 1	3		7	5	9	8	2	15																	49
Total	23	17	33	29	45	35	30	38				8	4	3	1	7									273
Nyctaginaceae																									
Neea cf. *spruceana*	1																								1
Total	1																								1
Ochnaceae																									
Cespedesia spathulata																	2	1	1					2	6
Total																	2	1	1					2	6
Olacaceae																									
Heisteria spruceana								2																	2
Total								2																	2
Phyllanthaceae																									
Amanoa aff. *guianensis*	13	34	11	22	20	11	4	1	5	16	4	18	7	11	1	9								4	191
Didymocistus chrysadenius									1				1												2
Discocarpus brasiliensis		1	3		3	5		1																	13
Total	13	35	14	22	23	16	4	2	6	16	4	18	8	11	1	9								4	206
Polygonaceae																									
Coccoloba sp. 1	3				1			16																	20
Triplaris americana	12	9	19	12	26	11	22	31																	142
Total	15	9	19	12	27	11	22	47																	162

Proteaceae																									
Roupala sp. 1					2	1																			3
Total					2	1																			3
Rubiaceae																									
Platycarpum sp. nov.																		24	102	150	172	172			620
Remijia ulei																		2	2						4
Rubiaceae sp. 1																								1	1
Total																		26	104	150	172	172		1	625
Salicaceae																									
Xylosma cf. *tessmannii*	1						1																		2
Total	1						1																		2
Sapindaceae																									
Talisia sp. 1	2							1																	3
Talisia sp. 2											1	1	2												4
Total	2							1			1	1	2												7
Sapotaceae																									
Chrysophyllum argenteum	3	1		1	1			1																	7
Elaeoluma glabrescens	3	26	18	10	20	23	9	8																	117
Pouteria cuspidata			2						2	3	1	5	2	3											18
Pouteria cuspidata subsp. *robusta*		3		1		2																			6
Pouteria gomphiifolia		14	10	11	14	19		6																	74
Pouteria plicata								1																	1
Total	6	44	30	23	35	44	9	16	2	3	1	5	2	3											223
Simaroubaceae																									
Simaba orinocensis			1	1	2	1	1	1																	7

Total			1	1	2	1	1	1																	7
Stemonuraceae																									
Discophora guianensis																	1								1
Total																	1								1
Styracaceae																									
Styrax guianensis							1																		1
Total							1																		1
Urticaceae																									
Cecropia engleriana									10	4	1	3	3	2		7	1						1		32
Cecropia latiloba	30		4	2	7	1	6	29													1				80
Coussapoa orthoneura												1													1
Coussapoa trinervia		2	7	9	1		8										1								28
Total	30	2	11	11	8	1	14	29	10	4	1	4	3	2		7	2				1		1		141
Violaceae																									
Leonia crassa									1																1
Total									1																1
Indet																									
Indet. sp. 1		1																1							2
Indet. sp. 2		2																							2
Indet. sp. 3		1																							1
Indet. sp. 5	1																								1
Total	1	4																1							6
Grand Total	244	318	306	267	404	312	233	302	273	407	280	337	258	245	298	352	387	356	373	513	394	355	325	292	7831

Table 4 A: Families with the highest number of species across the study plots.

Family	Number of species
Fabaceae	23
Euphorbiaceae	8
Lauraceae	8
Arecaceae	7

Table 4 B: Genera with the highest number of species across the study plots.

Family	Genera	Number of species
Fabaceae	*Inga*	5
Meliaceae	*Trichilia*	4
Moraceae	*Ficus*	4
Sapotaceae	*Pouteria*	4

Table 5 A: Families with the highest number of individuals across the study plots.

Families	Number of individuals
Arecaceae	1944
Fabaceae	1004
Rubiaceae	625
Calophyllaceae	598

Table 5 B: Genera with the highest number of individuals across the study plots.

Family	Genera	Number of individuals
Arecaceae	*Mauritia*	1216
Rubiaceae	*Platycarpum*	620
Arecaceae	*Mauritiella*	615
Calophyllaceae	*Calophyllum*	598

Table 5 C: Species with the highest number of individuals across the study plots.

Family	Species	Number of individuals
Arecaceae	*Mauritia flexuosa*	1216
Rubiaceae	*Platycarpum* sp. nov.	620
Arecaceae	*Mauritiella armata*	615
Calophyllaceae	*Calophyllum brasiliense*	597

Table 6: Total number of stems, species, and above-ground biomass (AGB) values per peatland plots in mega-grams per hectare (Mg ha^{-1}). BV = Buena Vista, Q = Quistococha, SJ = San Jorge.

Peatland	N. of plot	N. of stems	N. of species	AGB (Mg ha^{-1})
BV	1	244	40	85.92
BV	2	318	42	111.27
BV	3	306	37	81.38
BV	4	267	36	68.29
BV	5	404	41	124.80
BV	6	312	31	75.99
BV	7	233	34	68.04
BV	8	302	45	71.90
Q	1	273	32	137.23
Q	2	407	18	121.98
Q	3	280	22	105.48
Q	4	337	29	118.06
Q	5	258	29	119.47
Q	6	245	23	119.50
Q	7	298	17	90.42
Q	8	352	22	101.82
SJ	1	387	31	115.04
SJ	2	356	31	112.03
SJ	3	373	20	89.55
SJ	4	513	11	109.89
SJ	5	394	14	121.33
SJ	6	355	13	189.79
SJ	7	325	28	88.28
SJ	8	292	34	117.82

Table 7: ANOVA table summarizing results of the differences in AGB across species. *df* = Degrees of freedom, MS = Mean squares, SS = Sum of squares.

Source	**SS**	***df***	**MS**	***F***	***P***
Treatment (species)	207.4	97	2.1384	13.27	< 2e-16
Error	337.6	2095	0.1612		
Total corrected	545	2192			

Table 8: Variance and covariance from the equation for estimating AGB. D = diameter, H = height, WD = wood density.

	Variance		**Covariance**	
Variables	**WD**	0.0759	**WD,D**	-0.0228
	D	0.3348	**WD,H**	0.0168
	H	0.0855	**D,H**	0.2376

Table 9: Variance (var) and covariance (cov) from the equation for estimating AGB per species. D = diameter, H = height, WD = wood density.

Species	**Individuals per species**	**var(WD)**	**var(D)**	**var(H)**	**cov (WD,D)**	**cov (WD,H)**	**cov (D,H)**
Aniba guianensis	3	0.0029	0.0012	0.0011	-0.0015	-0.0036	0.0006
Roupala sp. 1	3	0.0051	0.0083	0.0040	-0.0092	0.0046	0.0029
Ormosia macrocalyx	3	0.0002	0.0127	0.0021	0.0028	-0.0010	-0.0094
Cynometra bauhiniifolia	3	0.0001	0.0055	0.0031	-0.0011	0.0002	0.0034
Pseudobombax munguba	4	0.0022	0.0930	0.0057	-0.0079	0.0019	0.0352
Remijia ulei	4	0.0013	0.0043	0.0004	0.0044	0.0005	0.0010
Ficus krukovii	4	0.0030	0.8192	0.0428	-0.0099	0.0024	0.2304
Talisia sp. 2	4	0.0010	0.1429	0.0690	0.0199	0.0054	0.1324
Socratea exorrhiza	4	0.1450	0.0053	0.0039	-0.0429	0.0382	-0.0053
Guatteria sp. 1	4	0.0182	0.1453	0.0029	-0.0312	-0.0093	0.0250
Sloanea cf. *guianensis*	4	0.0026	0.2078	0.0355	-0.0348	-0.0125	0.1642
Licania octandra	4	0.0001	0.1365	0.0228	0.0036	0.0017	0.0987
Micrandra sp. 1	4	0.0415	0.2199	0.0475	-0.1481	-0.0529	0.1980
Nectandra sp. 1	4	0.0050	0.3024	0.0611	0.0348	0.0059	0.2580
Lacmellea lactescens	6	0.0014	0.1734	0.0713	0.0056	0.0020	0.1831
Batocarpus amazonicus	6	0.0003	0.1867	0.0073	0.0029	0.0001	0.0486
Protium klugii	6	0.0020	0.0240	0.0134	0.0010	0.0003	-0.0036
Pachira insignis	6	0.0019	0.1911	0.0111	-0.0064	0.0027	0.0708
Guatteria sp. 2	6	0.0042	0.1357	0.0079	-0.0289	-0.0072	0.0548
Cespedesia spathulata	6	0.0007	0.0364	0.0017	0.0060	0.0000	0.0049
Nectandra heterotricha	6	0.0005	0.1703	0.0082	0.0015	0.0007	0.0574
Chrysophyllum argenteum	6	0.0009	0.0161	0.0200	-0.0038	-0.0012	0.0228
Campsiandra angustifolia	6	0.0006	0.0465	0.0193	0.0089	0.0062	0.0457
Trichilia rubra	6	0.0110	0.0040	0.0054	-0.0018	-0.0036	0.0056
Iryanthera paraensis	6	0.0005	0.0565	0.0172	0.0044	0.0040	0.0522

Pouteria cuspidata subsp. robusta	6	0.0004	0.0550	0.0154	-0.0013	0.0019	0.0350
Parinari parilis	7	0.0020	0.0400	0.0071	0.0084	-0.0023	-0.0017
Inga sp. 2	7	0.0035	0.0243	0.0126	0.0011	0.0062	0.0208
Conceveiba martiana	7	0.0013	0.0671	0.0080	0.0038	0.0024	0.0279
Simaba orinocensis	7	0.0023	0.0252	0.0106	0.0023	0.0005	0.0266
Ocotea gracilis	8	0.0015	0.0373	0.0176	0.0016	0.0067	0.0128
Coccoloba sp. 1	8	0.0130	0.0105	0.0293	0.0080	0.0114	-0.0151
Licania licaniiflora	9	0.0005	0.0839	0.0373	0.0018	0.0018	0.0934
Swartzia schunkei	9	0.0017	0.0472	0.0333	0.0053	-0.0010	0.0300
Tapirira guianensis	9	0.0086	0.1034	0.0128	0.0055	-0.0091	0.0556
Ilex andarensis	10	0.0165	0.0648	0.0148	0.0185	0.0111	0.0443
Ormosia coccinea var. *subsimplex*	11	0.0012	0.2173	0.0050	0.0068	0.0010	0.0510
Oenocarpus bataua	11	0.0407	0.0241	0.0130	0.0284	0.0209	0.0257
Zygia cauliflora	11	0.0014	0.0220	0.0110	0.0008	-0.0002	0.0227
Pachira aquatica	12	0.0032	0.0849	0.0570	0.0133	0.0202	0.0947
Astrocaryum jauari	12	0.0436	0.0294	0.0284	-0.0123	0.0423	0.0128
Discocarpus brasiliensis	13	0.0006	0.0486	0.0125	0.0037	0.0015	0.0405
Ficus cf. *guianensis*	14	0.0047	0.1120	0.0099	0.0000	-0.0051	0.0277
Conceveiba rhytidocarpa	16	0.0025	0.0512	0.0078	-0.0027	-0.0015	0.0107
Coussapoa trinervia	16	0.0014	0.0349	0.0069	-0.0013	-0.0012	0.0186
Calyptranthes macrophylla	17	0.0048	0.0506	0.0124	0.0078	0.0041	0.0240
Sloanea oppositifolia	17	0.0012	0.0646	0.0131	0.0093	0.0028	0.0430
Oxandra riedeliana	17	0.0018	0.0110	0.0095	0.0015	0.0007	0.0077
Inga cf. *cayennensis*	17	0.0018	0.0733	0.0162	-0.0033	-0.0014	0.0517
Pouteria cuspidata	18	0.0006	0.0380	0.0138	-0.0026	-0.0026	0.0299
Alchorneopsis floribunda	18	0.0016	0.0505	0.0156	0.0087	0.0039	0.0241
Euterpe catinga	19	0.0253	0.0296	0.0090	-0.0137	0.0004	0.0075
Parahancornia peruviana	19	0.0015	0.1296	0.0150	0.0051	0.0023	0.0659
Macrolobium cf. *multijugum*	19	0.0019	0.1909	0.0339	0.0207	0.0049	0.1308
Caryocar glabrum	19	0.0020	0.0926	0.0178	0.0066	0.0022	0.0714
Ruptiliocarpon caracolito	20	0.0045	0.0574	0.0117	-0.0077	0.0007	0.0252

Lueheopsis hoehnei	21	0.0042	0.2329	0.0248	0.0168	0.0057	0.1216
Ilex aff. *nayana*	21	0.0078	0.0861	0.0163	0.0097	0.0033	0.0531
Cecropia engleriana	21	0.0129	0.0511	0.0118	0.0078	0.0063	0.0381
Mabea cf. *fistulifera*	22	0.0010	0.0618	0.0208	-0.0001	-0.0012	0.0509
Platycarpum sp. nov.	22	0.0015	0.0759	0.0098	-0.0012	-0.0009	0.0232
Licania heteromorpha	23	0.0029	0.0341	0.0133	0.0016	0.0038	0.0190
Euterpe precatoria	24	0.0516	0.0354	0.0309	0.0233	0.0284	0.0449
Garcinia macrophylla	25	0.0009	0.0923	0.0224	-0.0043	0.0000	0.0660
Cecropia latiloba	26	0.0139	0.0622	0.0129	0.0008	-0.0013	0.0257
Pterocarpus amazonum	26	0.0033	0.0033	0.0178	0.0073	0.0055	0.0194
Terminalia dichotoma	26	0.0027	0.1644	0.0303	0.0213	0.0086	0.1194
Myrtaceae sp. 1	29	0.0016	0.0326	0.0259	0.0011	0.0002	0.0153
Machaerium floribundum	31	0.0028	0.2109	0.0268	-0.0046	0.0009	0.0710
Alchornea schomburgkii	32	0.0029	0.0988	0.0346	-0.0018	0.0040	0.0590
Guatteria decurrens	32	0.0030	0.0928	0.0119	0.0065	0.0026	0.0399
Pouteria gomphiifolia	32	0.0052	0.0665	0.0151	0.0072	0.0032	0.0451
Buchenavia amazonia	33	0.0030	0.0350	0.0234	0.0053	0.0008	0.0215
Eschweilera parviflora	34	0.0034	0.1079	0.0257	0.0061	0.0031	0.0699
Macrolobium acaciifolium	35	0.0028	0.1729	0.0405	0.0121	0.0063	0.1135
Myrcia sp. 1	35	0.0028	0.0607	0.0161	0.0093	0.0053	0.0463
Inga cf. *psittacorum*	35	0.0023	0.0590	0.0082	0.0044	0.0016	0.0231
Dendropanax cf. *resinosus*	37	0.0043	0.0168	0.0098	-0.0066	-0.0043	0.0026
Brosimum utile	38	0.0021	0.1964	0.0337	0.0052	0.0043	0.1127
Elaeoluma glabrescens	39	0.0083	0.0952	0.0261	-0.0114	0.0009	0.0807
Pachira aff. *brevipes*	39	0.0036	0.0831	0.0091	0.0107	0.0040	0.0351
Hydrochorea corymbosa	40	0.0039	0.0917	0.0169	0.0018	0.0031	0.0499
Calophyllum brasiliense	41	0.0036	0.0535	0.0103	0.0051	0.0019	0.0300
Inga stenoptera	41	0.0070	0.0459	0.0117	0.0094	0.0029	0.0161
Triplaris americana	41	0.0023	0.0564	0.0514	-0.0028	0.0005	0.0352
Malouetia tamaquarina	42	0.0156	0.0114	0.0094	-0.0001	0.0037	0.0081
Diospyros poeppigiana	42	0.0037	0.0577	0.0143	0.0013	0.0018	0.0259

Eschweilera albiflora	43	0.0026	0.1271	0.0269	0.0100	0.0051	0.0719
Himatanthus sucuuba	43	0.0028	0.0663	0.0267	-0.0006	0.0026	0.0374
Tabebuia insignis var. *monophylla*	50	0.0033	0.0445	0.0189	0.0020	0.0006	0.0241
Hevea guianensis	52	0.0116	0.0764	0.0266	0.0052	0.0093	0.0583
Symphonia globulifera	57	0.0018	0.1037	0.0220	0.0013	-0.0003	0.0713
Virola surinamensis	60	0.0046	0.1468	0.0334	0.0102	0.0031	0.1096
Mauritiella armata	62	0.1182	0.0089	0.0274	0.0130	0.0191	0.0089
Eugenia sp. 1	65	0.0043	0.0385	0.0243	0.0105	0.0008	0.0213
Amanoa aff. *guianensis*	75	0.0018	0.0646	0.0172	0.0023	0.0007	0.0256
Mauritia flexuosa	90	0.0283	0.0252	0.0188	-0.0010	0.0139	0.0108
Vatairea guianensis	90	0.0044	0.1215	0.0203	0.0022	0.0022	0.0639

Table 10: Spatial autocorrelation test “Moran I test” applied to regression residuals of the regression models in this study. Moran = correlation value.

Hypothesis	**Linear regression model**	**Moran**	***p***
Floristic composition	**1.** $\text{TotalAGB}_{plot} = a + b\ \text{NMDS1}_{plot}$	0.08	0.1
Intra-specific variation	**6.** $\text{TotalAGB}_{plot} = a + b\ \overline{AGBdeviation}_{plot}$	0.2	0.02
Floristic composition and Intra-specific variation	**7**. $\text{TotalAGB}_{plot} = a + b\ \text{NMDS1}_{plot} + \overline{AGBdeviation}_{plot}$	- 0.08	0.1

Table 11: Total AGB per plot (Mg ha^{-1}) in other studies in western Amazonia. Sites: All = Allpahuayo Mishana, Jen = Jenaro Herrera, Suc = Sucusari, Yan = Yanamono. Forest types: FPF = Flooded palm forest, NPF = Non-flooded palm forest, PFPF = Partially-flooded palm forest, SF = Seasonally flooded, TF= Terra firme, TFC = Terra firme on clay soils, TFS = Terra firme on sandy soils.

Author	**Site**	**Area**	**Habitat**	**AGB**
Baker et al., 2004	All 11	0.44	TFC	248.43
Baker et al., 2004	All 12	0.4	TFS	202.4
Baker et al., 2004	All 21	0.48	TFS	232.27
Baker et al., 2004	All 22	0.44	TFC	186.5
Baker et al., 2004	All 30	1	TFS	187.58
Baker et al., 2004	Suc 01	1	TF	215.25
Baker et al., 2004	Suc 02	1	TF	221.66
Baker et al., 2004	Suc 03	1	SF	234.14
Baker et al., 2004	Suc 04	1	TF	241.06
Baker et al., 2004	Suc 05	1	TF	226.83
Baker et al., 2004	Yan 01	1	TF	245.44
Baker et al., 2004	Yan 02	1	TF	243.53
Honorio et al., 2009	13	0.5	NPF	159.1
Honorio et al., 2009	20 de Enero 01	0.5	PFPF	199.6
Honorio et al., 2009	20 de Enero 02	0.5	FPF	72.7
Honorio et al., 2009	Jen 14	0.5	FPF	183.7
Honorio et al., 2009	Jen 15	0.5	NPF	184.4

Table 12: Species scores for NMDS1 that were extracted from the Non-metric multidimensional scaling ordination analysis (NMDS).

Species	**NMDS1**
Alchornea schomburgkii	0.874158839
Alchorneopsis floribunda	1.071249158
Amanoa aff. *guianensis*	-0.365870307
Aniba guianensis	-1.905729673
Aniba panurensis	-1.720081454
Aspidosperma schultesii	1.3375881
Astrocaryum jauari	-1.787442977
Batocarpus amazonicus	0.885796946
Brosimum utile	0.917449573
Buchenavia amazonia	-1.877932496
Buchenavia macrophylla	0.391216166
Byrsonima arthropoda	-0.405081027
Calophyllum brasiliense	1.337274543
Calophyllum sp. 1	-1.885820598
Calyptranthes macrophylla	0.000661979
Campsiandra angustifolia	-1.95802567
Caryocar glabrum	-1.779433074
Cecropia engleriana	0.662112231
Cecropia latiloba	-1.383054441
Cespedesia spathulata	1.164307678
Chrysobalanaceae sp. 1	-1.551134951
Chrysophyllum argenteum	-1.732868481
Coccoloba sp. 1	-1.790632751
Conceveiba martiana	0.930229485
Conceveiba rhytidocarpa	0.887289041
Couma macrocarpa	1.3375881
Coussapoa orthoneura	0.339700897
Coussapoa trinervia	-1.655230433
Crudia glaberrima	0.42337491
Cynometra bauhiniifolia	-0.582678455
Dendropanax cf. *resinosus*	1.303072412
Didymocistus chrysadenius	0.445925303
Diospyros poeppigiana	-1.88933518
Discocarpus brasiliensis	-1.95704535
Discophora guianensis	0.882699688
Elaeoluma glabrescens	-1.894324559
Eschweilera albiflora	-1.897985541
Eschweilera parviflora	-1.754573534
Eugenia sp. 1	-1.283967848

Euterpe catinga	1.17004823
Euterpe precatoria	0.642982781
Ficus cf. *guianensis*	0.126397129
Ficus krukovii	0.5872054
Ficus paraensis	1.693323381
Ficus trigonata	1.026917676
Flacourtiaceae sp. 1	-1.792550922
Garcinia macrophylla	-1.832376831
Guatteria decurrens	1.033353161
Guatteria sp. 1	-1.85007236
Guatteria sp. 2	-1.859750148
Heisteria spruceana	-1.885820598
Hevea guianensis	0.937537509
Himatanthus sucuuba	0.902567977
Hura crepitans	0.645236734
Hydrochorea corymbosa	-1.891200654
Ilex aff. *nayana*	-1.953818904
Ilex andarensis	0.833571519
Indet sp. 1	0.067853523
Indet sp. 2	-1.720081454
Indet sp. 3	-1.720081454
Indet sp. 4	-1.836000777
Indet sp. 5	-1.551134951
Inga cf. *cayennensis*	0.82543981
Inga cf. *psittacorum*	-1.921911796
Inga sp. 1	-1.551134951
Inga sp. 2	-1.914136309
Inga stenoptera	-1.595782125
Iryanthera paraensis	0.42337491
Iryanthera tessmannii	-1.720081454
Lacmellea lactescens	0.456047323
Leonia crassa	0.42337491
Licania heteromorpha	-1.845507808
Licania licaniiflora	-1.833388917
Licania octandra	-1.885820598
Lueheopsis hoehnei	0.723832977
Mabea cf. *fistulifera*	-1.889049785
Machaerium floribundum	1.129717869
Macrolobium acaciifolium	-1.883491172
Macrolobium cf. *multijugum*	0.563636928
Malouetia tamaquarina	-0.152216513
Margaritaria nobilis	-1.720081454
Mauritia flexuosa	0.986169471

Mauritiella armata	0.901428323
Micrandra sp. 1	0.645178886
Myrcia sp. 1	-1.886677404
Myrtaceae sp. 1	-1.899788788
Nectandra heterotricha	-1.648594378
Nectandra sp. 1	-0.635726158
Nectandra sp. 2	-1.951399088
Neea cf. *spruceana*	-1.551134951
Ocotea aciphylla	1.074981875
Ocotea gracilis	0.68201037
Ocotea sp. 1	1.228023428
Oenocarpus bataua	1.339512415
Ormosia coccinea var*. subsimplex*	1.504049249
Ormosia macrocalyx	-1.863851002
Oxandra riedeliana	1.549634113
Pachira aff. *brevipes*	1.402542014
Pachira aquatica	0.404694352
Pachira insignis	0.935160082
Parahancornia peruviana	0.660668168
Parinari parilis	-1.917698355
Parkia multijuga	1.026917676
Parkia nitida	0.878851117
Parkia panurensis	0.464606493
Platycarpum sp. nov.	1.374089968
Pouteria cuspidata	0.208834761
Pouteria cuspidata subsp. *robusta*	-1.091362778
Pouteria gomphiifolia	-1.904415786
Pouteria plicata	-1.885820598
Protium klugii	0.870427905
Pseudobombax munguba	-1.902270638
Pterocarpus amazonum	-1.051192282
Remijia ulei	1.448736806
Rollinia cuspidata	0.695912371
Roupala sp. 1	-1.962457772
Rubiaceae sp. 1	0.878851117
Ruptiliocarpon caracolito	1.061423353
Simaba orinocensis	-1.934935511
Sloanea cf. *guianensis*	0.438893945
Sloanea oppositifolia	-1.794560315
Socratea exorrhiza	0.980282135
Styrax guianensis	-2.037179741
Swartzia schunkei	-1.987498933
Symphonia globulifera	0.710078984

Tabebuia insignis var. *monophylla*	0.807014752
Talisia sp. 1	-1.687795027
Talisia sp. 2	0.523709413
Tapirira guianensis	1.067260682
Terminalia dichotoma	-1.836921821
Trichilia inaequilatera	-1.885820598
Trichilia pleeana	0.42337491
Trichilia rubra	-1.802437751
Trichilia sp. 1	0.391216166
Triplaris americana	-1.884295966
Unonopsis sp. 1	0.42337491
Vatairea guianensis	-0.318776196
Virola surinamensis	0.558266869
Vismia angusta	-1.551134951
Xylosma cf. *tessmannii*	-1.835305955
Zygia cauliflora	0.174551901
Zygia longifolia	-1.858711328
Zygia sp. 1	0.464606493

Table 13: Proportion of *M. flexuosa* in relation to its number of stems and to its total AGB at each plot. BV = Buena Vista, Q = Quistococha, SJ = San Jorge.

Plot	**Total AGB**	**Number of stems**	**Proportion of *M. flexuosa***	**Total AGB of *M. flexuosa***	**Proportion of the AGB of *M. flexuosa***
BV1	85.92	244	0	0	0
BV2	111.27	318	0	0	0
BV3	81.38	306	0	0	0
BV4	68.29	267	0	0	0
BV5	124.8	404	0	0	0
BV6	75.99	312	0	0	0
BV7	68.04	233	0	0	0
BV8	71.9	302	0	0	0
Q1	137.23	273	19.41	56.66	41.29
Q2	121.98	407	23.34	66.23	54.30
Q3	105.48	280	46.43	72.02	68.28
Q4	118.06	337	17.51	56.23	47.63
Q5	119.47	258	23.26	53.92	45.13
Q6	119.5	245	48.98	77.23	64.63
Q7	90.42	298	31.54	62.86	69.52
Q8	101.82	352	22.44	62.20	61.09
SJ1	115.04	387	27.91	66.97	58.22
SJ2	112.03	356	25.56	52.37	46.74
SJ3	89.55	373	12.87	23.12	25.82
SJ4	109.89	513	10.53	24.51	22.31
SJ5	121.33	394	5.08	11.04	9.10
SJ6	189.79	355	7.04	38.98	20.54
SJ7	88.28	325	34.77	56.73	64.26
SJ8	117.82	292	22.95	48.22	40.93