Patterns of Diversity, Structure and Composition of the Humid Montane Forests of Madidi

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Introduction

Humid montane forests are still not as well known as lowland rainforest. Diversity and composition has only been ascertained in a few places and with little repetition. We will here present our preliminary data and analysis of the montane rain forest in the Madidi Region.

Methods

We established 132 non permanent plots of 0.1 ha (20 × 50 m transect) where all stems with a DBH≥2.5 cm were inventoried. For each individual we recorded: common name, scientific name, family, DBH, total height, and height of the crown. The plots span an elevational gradient of 3220 m (280 to 3500 m), but do not include the dry forest plots.

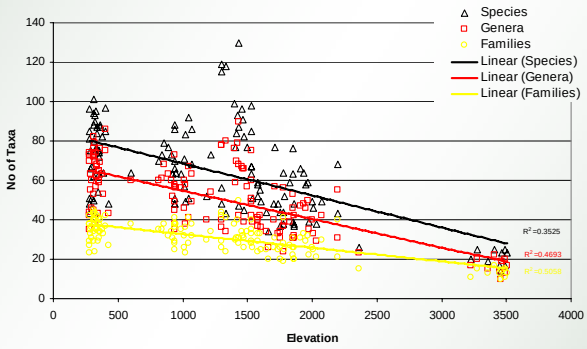
Results

We inventoried 40,553 individuals, corresponding to 1,575 species in 546 genera and 115 families. Most were trees (including palms, tree-ferns, and bambusoid grasses), followed by lianas and hemiepiphytes.

Group	Individual	Species	Genera	Families
Trees	31545	1315	446	105
Lianas	2145	257	123	54
Hemiepiphytes	51	17	11	7
Palms	3770	32	18	1
Tree ferns	1261	17	5	1
Bambusoidea	1781	10	2	1
Total	40553	1575	546	115

The diversity of species, genera, and families all decrease with increasing elevation it is possible that a plateau is found until 1500 m elevation, however most characteristic is the large variation found expressed by the low R^2 values of the fitted curves. The R^2 values decrease with increasing taxonomic hierarchy. From the spread of points it appears that the variance of diversity is much larger around 1500 m than elsewhere, i.e. decreases both upwards and downwards (fig 1). This sets the stage for the potential of an increased beta-diversity particularly at or around 1500 m elevation.

Fig 1



This pattern is repeated if we subdivide the species in trees and lianas, the diversity diminishes with increasing the elevation, and the variance appears to be largest at about 1500 m (fig 2).

The structure of the forest expressed as Basal area, average DBH, and average height (fig 3) all show a negative relationship with elevation, while the density of stem is positively correlated with altitude. It is also here apparent that there is a great deal of variation hidden and not explained by the variables here put forward. The highest levels of variation are again observed at about 1500 m. From our field observations the micro habitats (such as slopes, ridge tope or valley bottom) play an important role in determining both composition and structure.

As diversity and size of the trees diminishes with increasing elevation, the number of individuals increases. However, the number of lianas shows a negative correlation with elevation (fig 4).

Fig 2

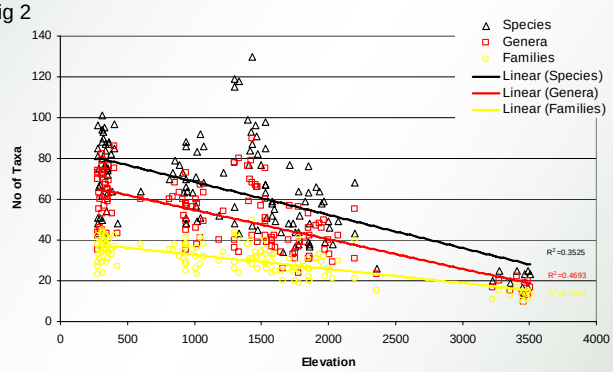


Fig 3

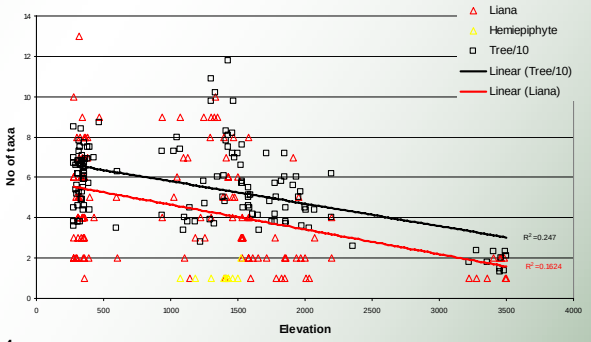
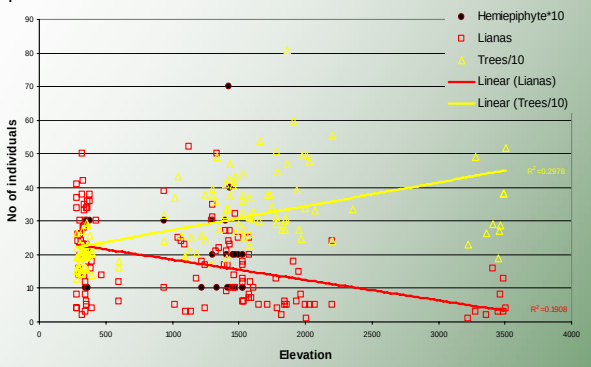


Fig 4



The ten most diverse families in 500 m classes, with the average number of species/0.1 ha

0–500 m n=47		500–1000 m n=4		1000–1500 m n=30		1500–2000 m n=34		3000–3500 m n=6		>3500 m n=10	
Morac.	5.29	Melastom.	4.75	Rubiac.	6.33	Rubiac.	5.21	Melastom.	5.67	Asterac.	3.44
Fabac.	5.08	Morac.	4.25	Laurac.	6.20	Laurac.	5.18	Laurac.	4.50	Melastom.	3.33
Arecac.	4.58	Arecac.	4.00	Melastom.	6.03	Melastom.	5.03	Rubiac.	3.83	Clethrac.	1.56
Rubiac.	3.33	Rubiac.	4.00	Fabac.	4.27	Myrtac.	3.59	Myrtac.	3.00	Araliac.	1.33
Meliac.	2.98	Fabac.	3.75	Myrtac.	3.93	Euphorbiac.	3.03	Euphorbiac.	2.67	Myrsinac.	1.22
Annonac.	2.92	Laurac.	3.75	Morac.	3.47	Fabac.	1.94	Myrsinac.	2.50	Cunoniac.	1.22
Sapotac.	2.60	Myrtac.	3.25	Euphorbiac.	3.47	Morac.	1.88	Clusiac.	2.33	Symplocac.	1.11
Laurac.	2.58	Sapotac.	2.75	Sapotac.	3.37	Araliac.	1.79	Araliac.	1.83	Rosac.	1.11
Bignoniac.	2.27	Elaeocarp.	2.25	Arecac.	2.97	Arecac.	1.71	Aquifoliac.	1.33	Solanac.	1.00
Burserac.	2.13	Burserac.	2.00	Clusiac.	2.00	Myrsinac.	1.44	Podocarp.	1.17	Berberidac.	0.78

A number of families are known to be more diverse in the lowlands (Moraceae, Fabaceae, Arecaceae, Rubiaceae, etc.) while families such as Lauraceae, Melastomataceae, and Myrtaceae area added and becomes increasingly diverse with increasing elevation. At the highest elevation there is an almost complete turnover of families where in addition to Melastomataceae families such as Asteraceae, Clethraceae, and Araliaceae are among the most diverse (see table).