

Ecography

ECOG-02637

Chain-Guadarrama, A., Imbach, P., Vilchez-Mendoza, S., Vierling, L. A. and Finegan, B. 2017. Potential trajectories of old-growth Neotropical forest functional composition under climate change. – *Ecography* doi: 10.1111/ecog.02637

Supplementary material

Appendix 1

Table A1. Pearson correlation coefficients between eight climatic predictors characterizing 127 vegetation plots and first two axes of variation from a kernel principal component analysis summarizing this climatic information. Only significant correlated variables are shown (p value < 0.001).

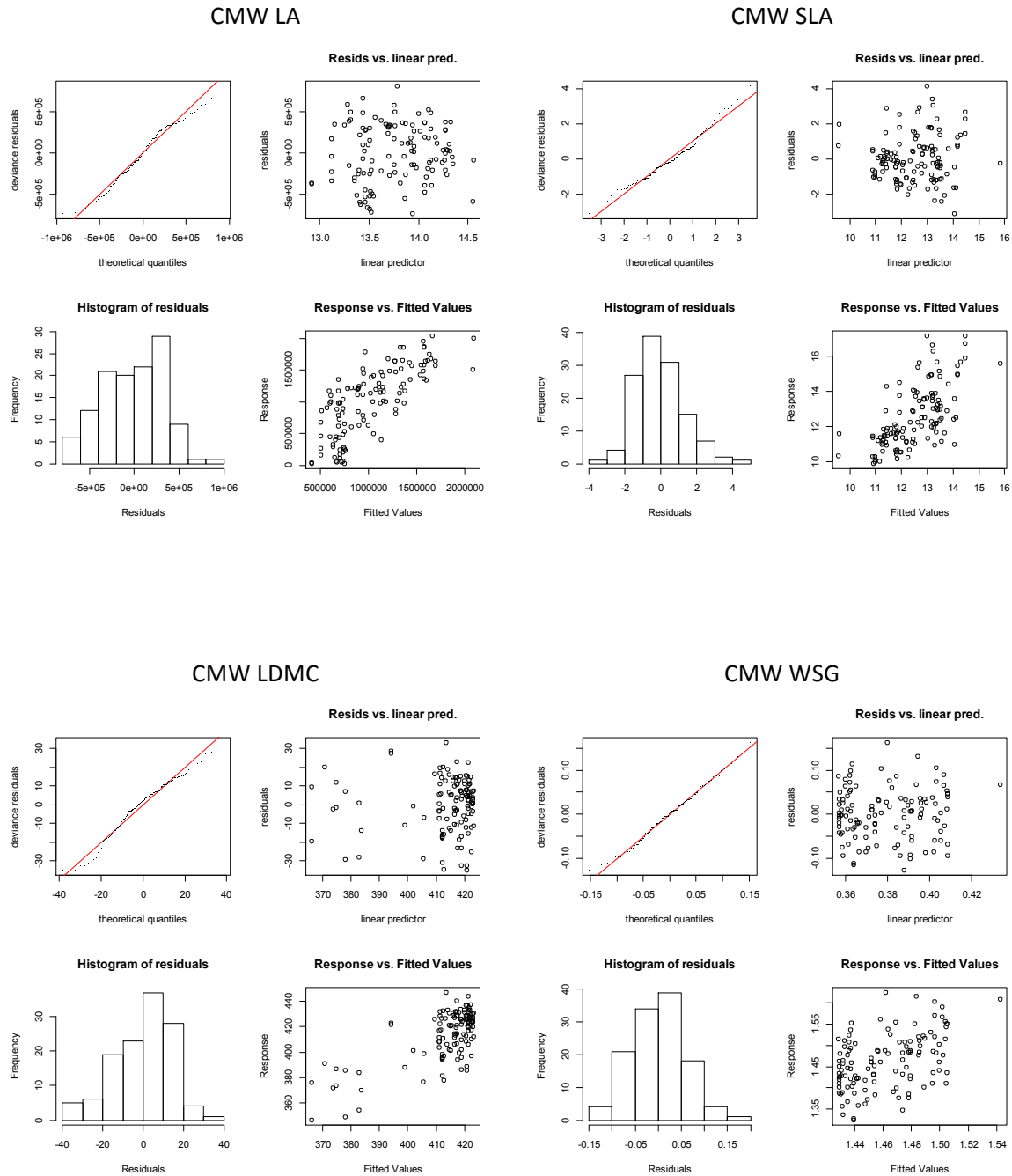
Bioclimatic predictor	PCA Axis 1	PCA Axis 2
AnnTemp		-0.57
TempSD		-0.94
MaxTempWM		-0.64
MinTempCM		-0.59
AnnPrec	-0.97	
PrecWettM	-0.43	0.34
PrecDriesM	-0.83	-0.37
PrecCV	0.66	0.54

AnnTemp: annual mean temperature; MinTempCM: minimum temperature of the coldest month; MaxTempWM: maximum temperature of the warmest month; TempSD: standard deviation of temperature; AnnPrec: mean annual precipitation; PrecDriesM: precipitation of the driest month; PrecWettM: precipitation of the wettest month; PrecCV: coefficient of variation of precipitation.

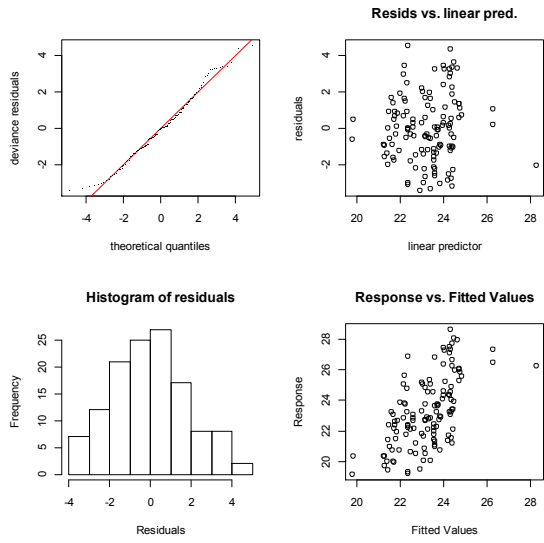
Table A2. Summary of generalized additive mixed models on the relationship between community-weighted mean (CWM) traits and climatic principal component analysis (PCA) axes and UTM coordinates. Degrees of freedom for smoothed terms PCA axis 1, PCA axis 2 and UTM coordinates correspond to the effective degrees of freedom used to fit the curves. Parametric coefficients are presented for UTM coordinates when linear relationship was found between them and response community weighted (CWM) traits.

Trait Factors	Model R^2_{adj}	Degrees of freedom	<i>F</i> -ratio	<i>P</i> -value	Parametric estimate
Leaf Area (LA)	0.544				
Climate PCA 1		4.44	14.41	< 0.0001	
UTM X Coordinates		1.63	19.17	< 0.0001	
Specific Leaf Area (SLA)	0.395				
Climate PCA 1		4.17	11.42	< 0.0001	
UTM X Coordinates		1	25.35	< 0.0001	0.0001009
Leaf Dry Matter Content (LDMC)	0.452				
Climate PCA 2		5.75	17.35	< 0.0001	
Wood Basic Specific Gravity (WSG)	0.182				
Climate PCA 1		3.97	6.75	< 0.0001	
Leaf Nitrogen content (N)	0.322				
Climate PCA 1		4.60	7.36	< 0.0001	
UTM X Coordinates		1	18.70	< 0.0001	0.0001157
Leaf Phosphorous content (P)	0.235				
Climate PCA 1		3.62	7.40	< 0.0001	0.0000044
UTM X Coordinates		1	11.23	< 0.01	

Figure A1. Diagnostic information of fitted GAMMs on six community weighted mean (CWM) functional traits. LA: leaf area, SLA: specific leaf area, LDMC: leaf dry matter content, WSG: wood basic specific gravity, N: leaf nitrogen content, P: leaf phosphorous content.



CMW N



CWM P

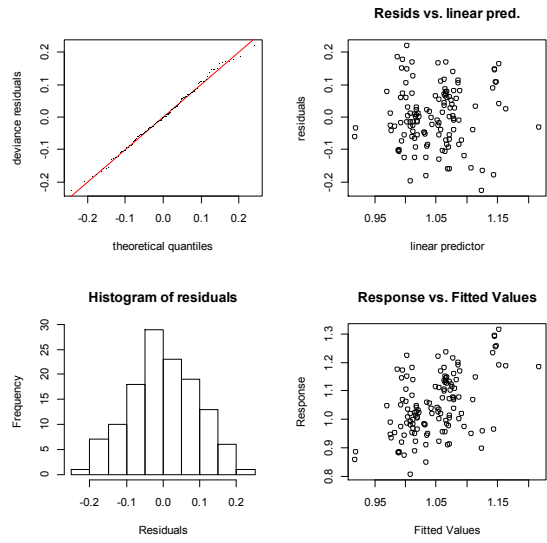


Table A3. Summary statistics of current and future (year 2050) community weighted mean (CWM) trait values in 127 old-growth forest plots in the San Juan La Selva region. Future CWM trait data correspond to plot's average values from 17 general circulation models (GCMs) under a high radiative scenario (RCP 8.5).

Variable (Units)	Current		Future	
	Mean \pm SE	Range	Mean \pm SE	Range
LA (mm ²)	13.8 \pm 0.03	12.2 - 14.6	14.3 \pm 0.08	12.5 - 16.8
SLA (mm ² g ⁻¹)	12.5 \pm 0.10	9.6 - 15.8	14.6 \pm 0.13	11.4 - 16.9
LDMC (mg g ⁻¹)	413.3 \pm 1.17	366.4 - 427.2	411.3 \pm 1.4	379.0 - 505.8
WSG (g cm ⁻³)	0.46 \pm 0.002	0.43 - 0.54	0.45 \pm 0.002	0.38 - 0.53
N (mg g ⁻¹)	23.2 \pm 0.11	19.8 - 28.3	23.9 \pm 0.09	21.8 - 27.4
P (mg g ⁻¹)	1.1 \pm 0.004	0.92 - 1.2	1.2 \pm 0.01	1.0 - 1.6

LA: leaf area, SLA: specific leaf area, LDMC: leaf dry matter content,

WSG: wood basic specific gravity, N: leaf nitrogen content, P: leaf phosphorous content.

Table A4. Pearson correlation coefficients between six community weighted mean (CWM) traits characterizing 127 vegetation plots and first two axes of variation from a principal component analysis summarizing this functional information. Only significant correlated variables are shown (p value < 0.05).

CWM traits	PCA Axis 1	PCA Axis 2
WSG	0.83	
LA	-0.96	-0.20
SLA	0.97	
LDMC	-0.61	0.78
N	0.87	0.34
P	0.95	

LA: leaf area, SLA: specific leaf area, LDMC: leaf dry matter content, WSG: wood basic specific gravity, N: leaf nitrogen content, P: leaf phosphorous content.

Appendix 2. Modeling the response of the tree community without palms.

Figure A1. Generalized additive regression models illustrating the relationship between CWM tree traits and the most significant climate PCA axes of variation. Fitted values are plotted. Dashed lines represent the 95% confidence interval. Explained deviance (R^2_{adj}) represents a significant model ($P < 0.001$). Negative relationships (to the left of the arrow) and positive relationships (to the right of the arrow) between climate variables and PCA Axes 1 and 2 are shown at the bottom. Compare with main text Figure 3.

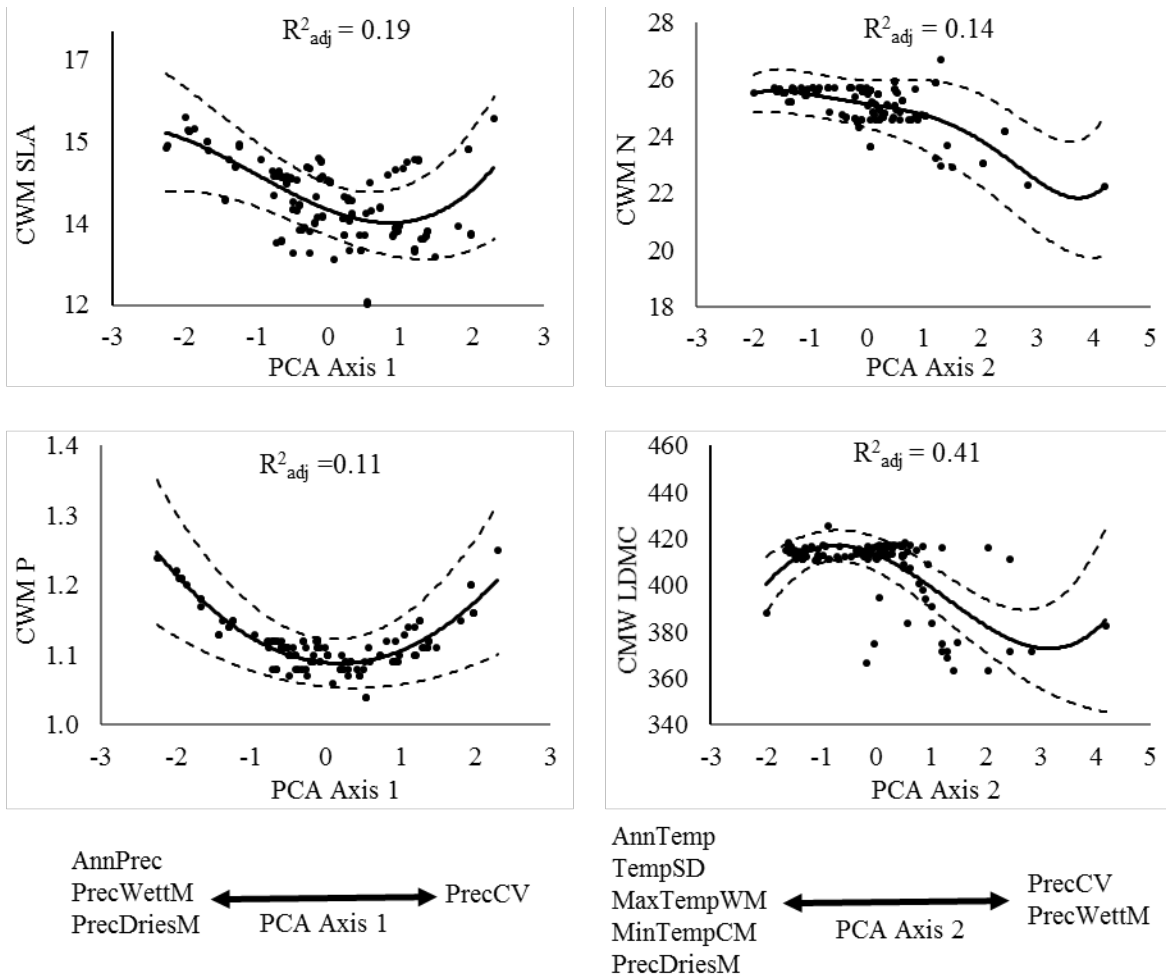


Table A1. Summary of generalized additive mixed models on the relationship between community-weighted mean (CWM) tree traits and climatic principal component analysis (PCA) axes and UTM coordinates. Degrees of freedom for smoothed terms PCA axis 1, PCA axis 2 and UTM coordinates correspond to the effective degrees of freedom used to fit the curves. Parametric coefficients are presented for UTM coordinates when linear relationship was found between them and response community weighted (CWM) tree traits. Results are presented only for those CWM tree traits that showed a significant relationship with climate.

Trait Factors	Model R^2_{adj}	Degrees of freedom	<i>F</i> -ratio	<i>P</i> -value	Parametric estimate
Specific Leaf Area (SLA)	0.19				
Climate PCA 1		2.949	5.097	< 0.01	
UTM X Coordinates		1	13.25	< 0.001	0.00007588
Leaf Dry Matter Content (LDMC)	0.41				
Climate PCA 2		5.376	15.95	< 0.0001	
Leaf Nitrogen content (N)	0.14				
Climate PCA 2		1.694	13.46	< 0.001	
Leaf Phosphorous content (P)	0.21				
Climate PCA 1		2.869	3.936	< 0.01	
UTM X Coordinates		1	7496.1	< 0.0001	0.00000216

Figure A2. Diagnostic information of fitted GAMMs on community weighted mean (CWM) functional tree traits. SLA: specific leaf area, LDMC: leaf dry matter content, N: leaf nitrogen content, P: leaf phosphorous content.

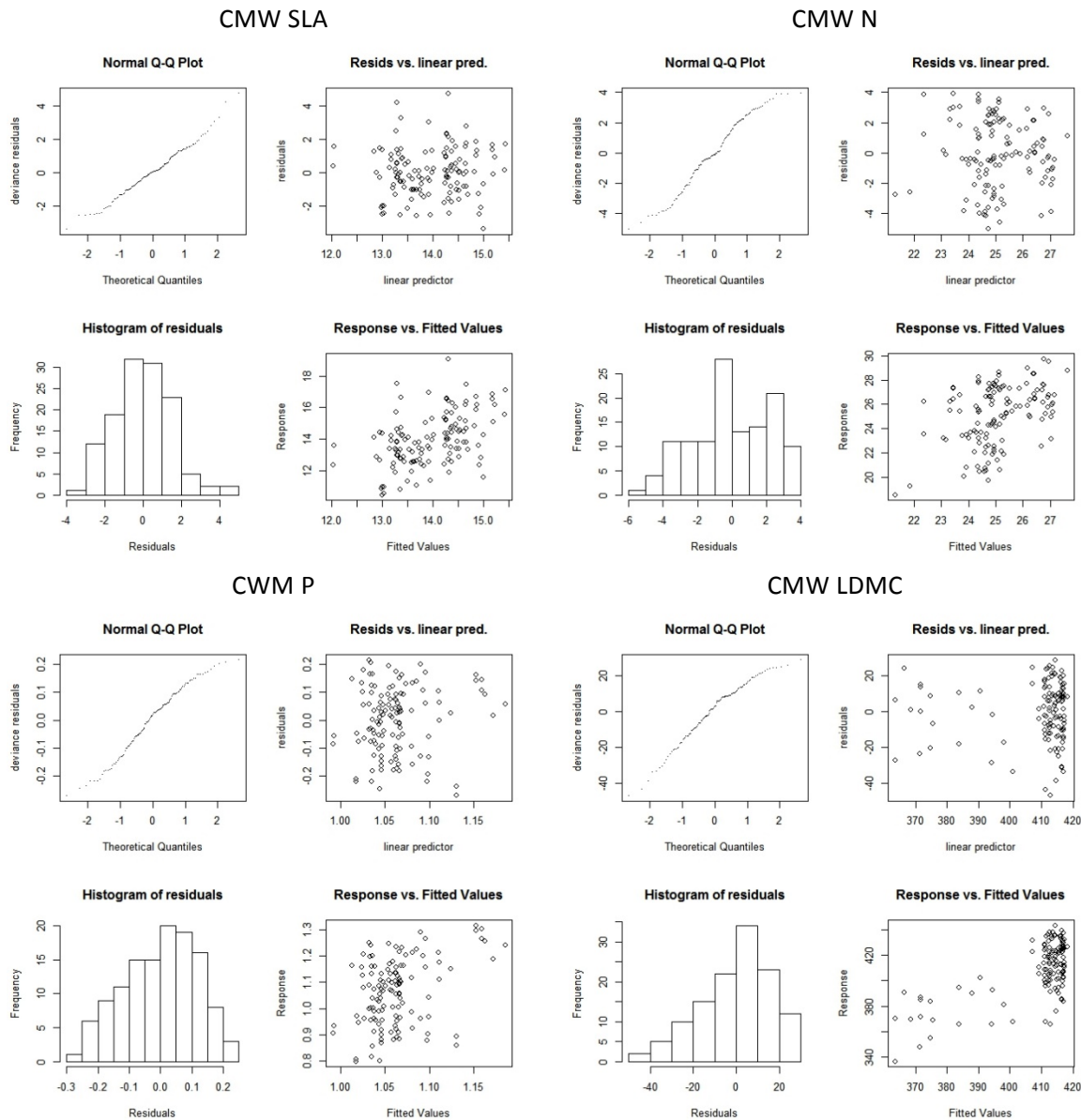


Figure A3. Predicted community weighted mean values of six functional tree traits for 127 forest plots under current and future climate. The area within dashed lines (95% prediction interval) represents the CWM trait values predicted by generalize additive models under current climate. Points indicate the average predicted CWM trait values under future climate (2050, RCP 8.5) and vertical black lines \pm standard error from 17 climate general circulation models. Future average predicted CWM tree trait values lying within current-climate prediction boundaries indicate lack of predictive capacity on trait changes under future climate. Future average predicted CWM trait values above and below current climate prediction boundaries respectively indicate future increase or decrease in plots CWM traits. The proportion of total number of plots showing increase, decrease or no change under future climate is indicated in the lower right corner of each plot. Compare with main text Figure 4.

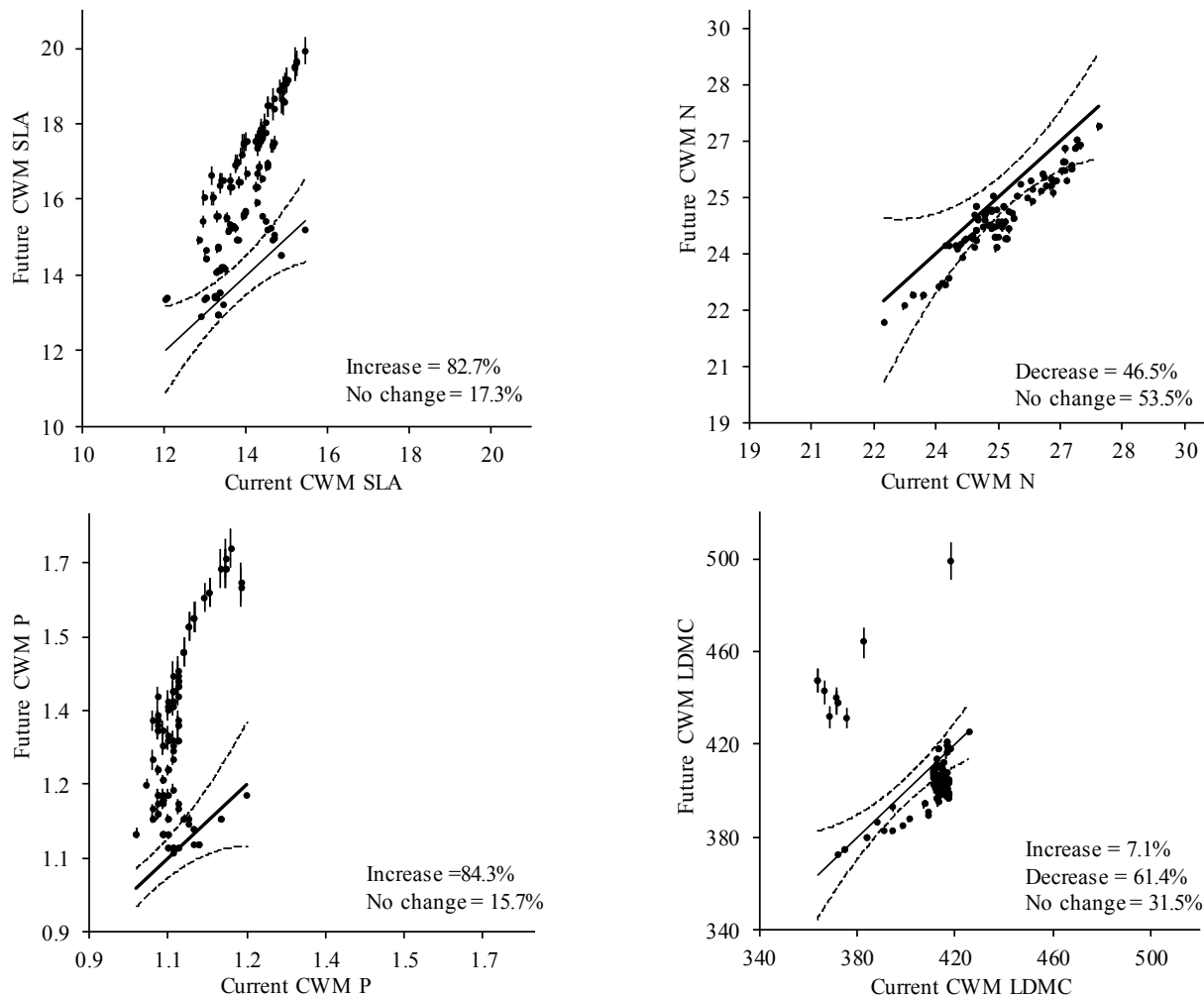


Table A2. Summary statistics of current and future (year 2050) community weighted mean (CWM) tree trait values in 127 old-growth forest plots in the San Juan La Selva region. Future CWM trait data correspond to plot's average values from 17 general circulation models (GCMs) under a high radiative scenario (RCP 8.5).

Variable (Units)	Current		Future	
	Mean \pm SE	Range	Mean \pm SE	Range
SLA	13.95 \pm 0.06	12.02 - 15.43	16.15 \pm 0.16	12.9 - 19.92
LDMC	408.96 \pm 1.22	363.58 - 425.35	405.9 \pm 1.44	372.25 - 498.84
N	25.1 \pm 0.09	22.26 - 27.41	24.5 \pm 0.09	21.66 - 26.87
P	1.07 \pm 0	0.99 - 1.2	1.28 \pm 0.01	1.06 - 1.68

SLA: specific leaf area, LDMC: leaf dry matter content, N: leaf nitrogen content, P: leaf phosphorous content.

Figure A4. Ordination of 127 forest plots within a two-dimensional functional space given their CWM tree traits values under current and future climate. No filled symbols in (a,b,c,d) represent forest plots ordinated in the functional space given their CWM traits predicted under current climate conditions. These different symbols denote three different forest types to which plots belong to. Grey filled triangles in (a,b,c,d) represent forest plots ordinated in the functional space given their six CWM traits values predicted under future climate. In (a,b,c,d) black continuous contours are the probability density function of forest plots in the two dimensional functional space under current climate, and dotted grey contours the probability density function of forest plots in the functional space under future climate. In (b,c,d) arrows indicate the direction and magnitude of climate-induced shift for foothills (b) and lowland (c,d) forest plots. Black arrows in (a) indicate the association of six CWM traits with two PCA axes of variation. Compare with main text Figure 5.

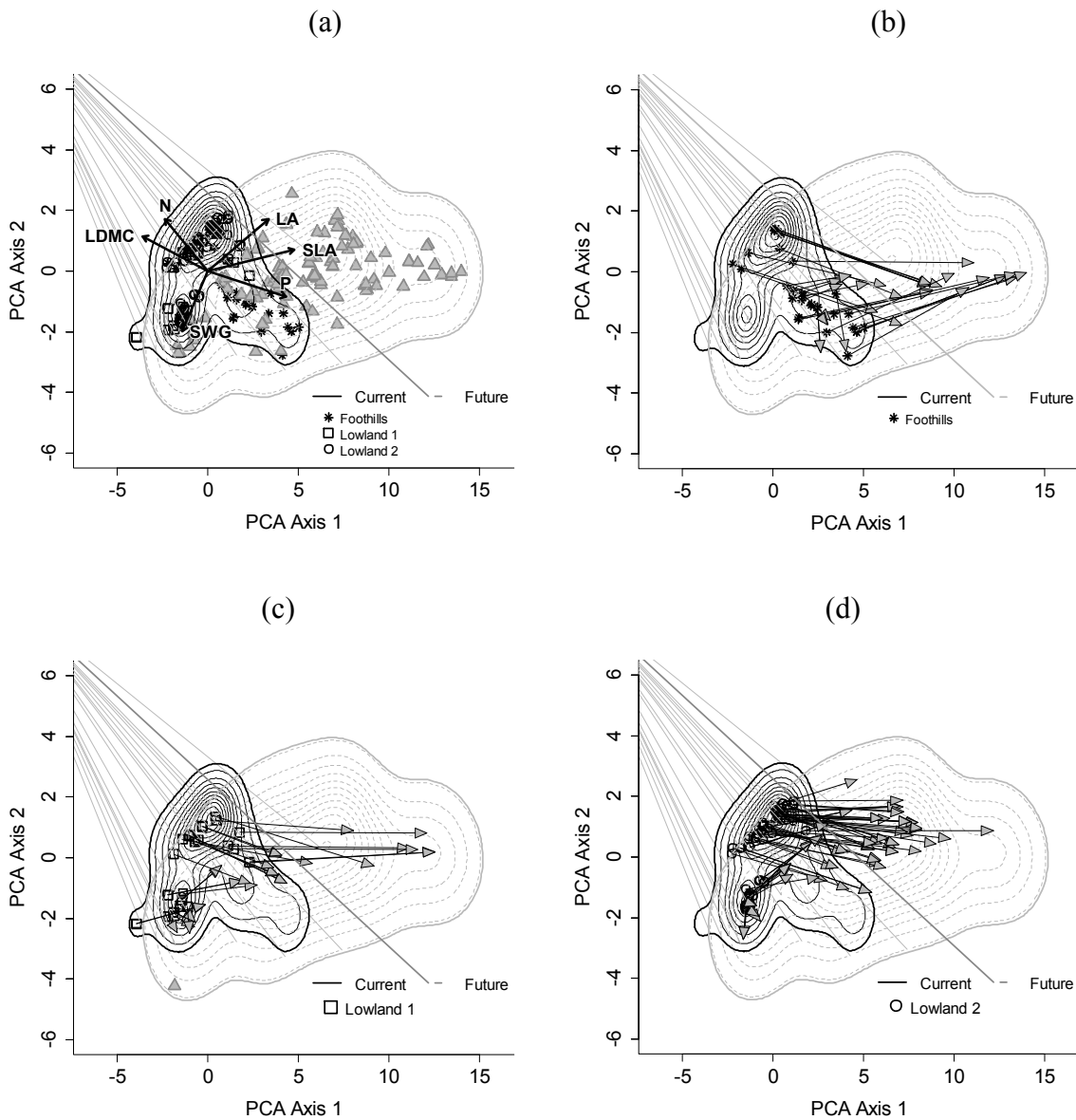


Table A3. Pearson correlation coefficients between six community weighted mean (CWM) tree traits characterizing 127 vegetation plots and first two axes of variation from a principal component analysis summarizing this functional information. Only significant correlated variables are shown (p value < 0.05).

CWM traits	PCA Axis 1	PCA Axis 2
WSG		-0.72
LA	0.66	0.62
SLA	0.95	
LDMC	-0.72	0.42
N	-0.47	0.62
P	0.86	-0.31

LA: leaf area, SLA: specific leaf area, LDMC: leaf dry matter content, WSG: wood basic specific gravity, N: leaf nitrogen content, P: leaf phosphorous content.