Supplementary material for the manuscript entitled "UAV-Lidar reveals that canopy structure mediates the influence of edge effects on forest diversity, function and microclimate" by Grégoire Blanchard, Nicolas Barbier, Ghislain Vieilledent, Thomas Ibanez, Vanessa Hequet, Stéphane McCoy and Philippe Birnbaum
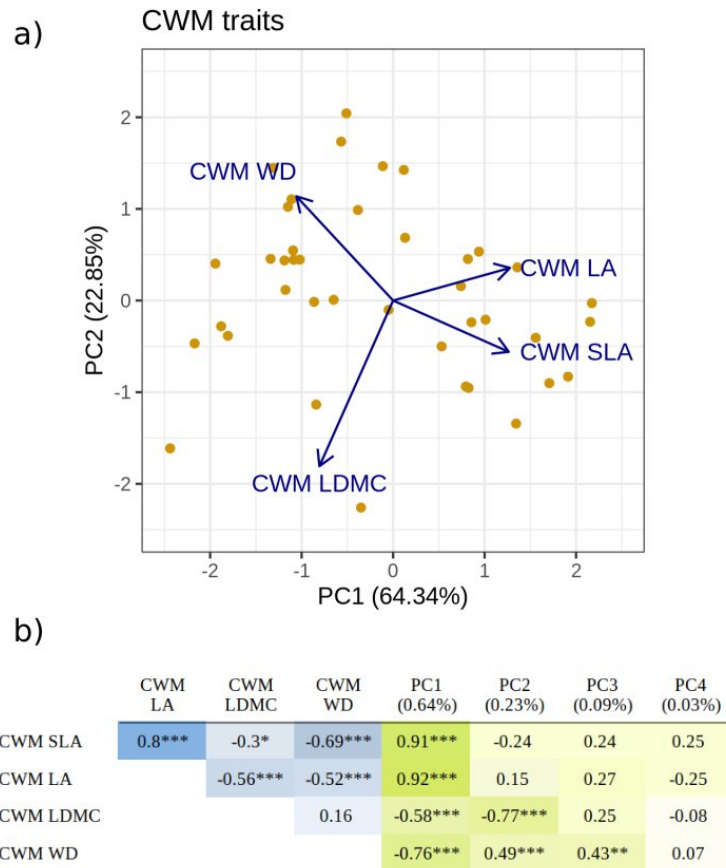
S.M. 1. Schematic representation of the study design. 46 standardized tree inventory plots (400m²) distributed following a spatially random sampling stratified according to the distance to forest edge (10m, 20m, 40m, 100m, 200m, 300m). All trees with a diameter at breast height ('dbh',i.e., 1.30 m) greater than 10 cm were identified to the species level and measured in diameter. Understory microclimate was monitored using 50 data loggers (HOBO Pro-V2 U23, Onset, Cape Cod, MA) installed inside inventory plots. Loggers were positioned at the center of the plots located in the first 100 m from the edge (i.e., in plots located at 10, 20, 40 and 100m from the edge). In the 11 plots whose centers were located at 10 m from the edge, we installed additional loggers right at the edge.
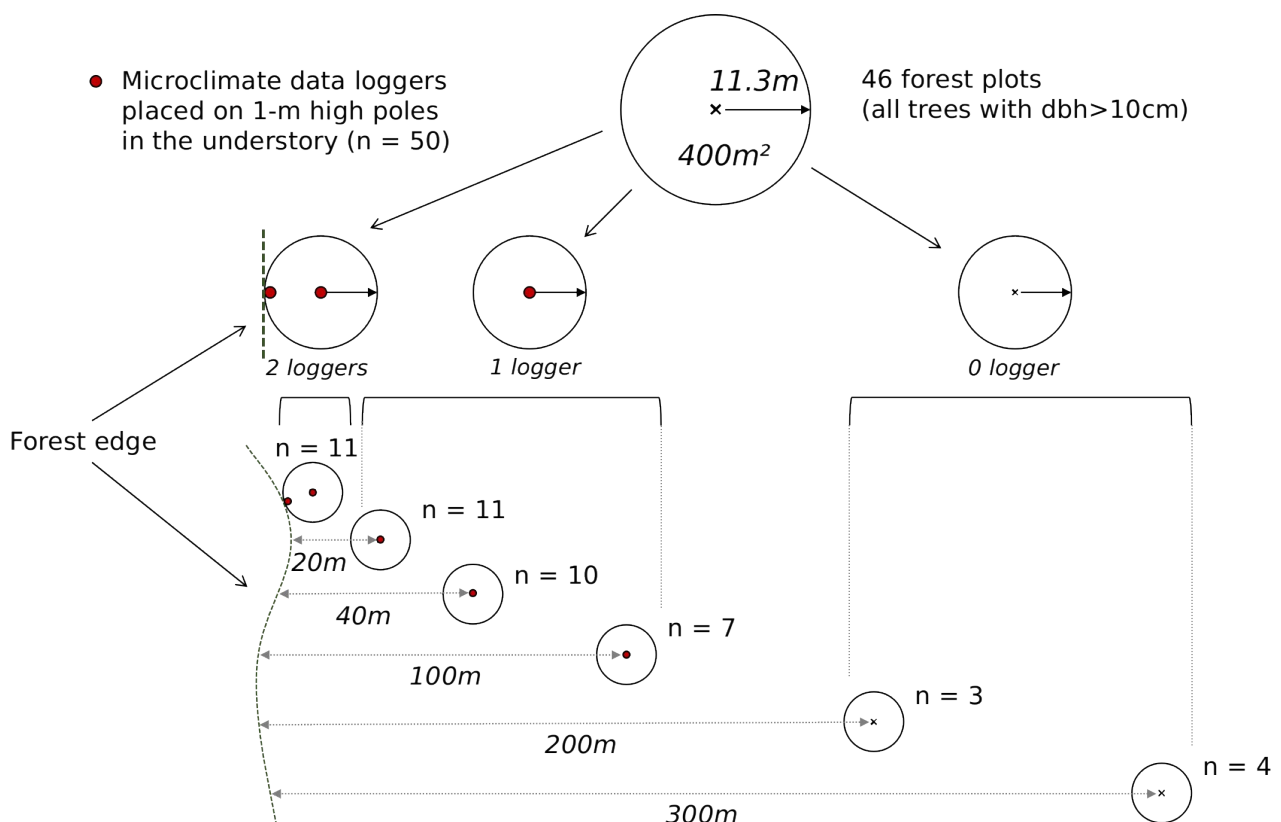
S.M. 2. Annual variation of understory microclimate: mean daily temperature and vapor pressure deficit (VPD) during daytime (8h a.m. to 5h p.m.), as measured by the 50 sensors distributed on forest plots located at different distances from the forest edge. Each point represents a daily mean recorded value from an individual logger. Smoothed curves indicate the variation of mean daily temperature and VPD when considering all loggers located at a given distance from the forest edge edge.
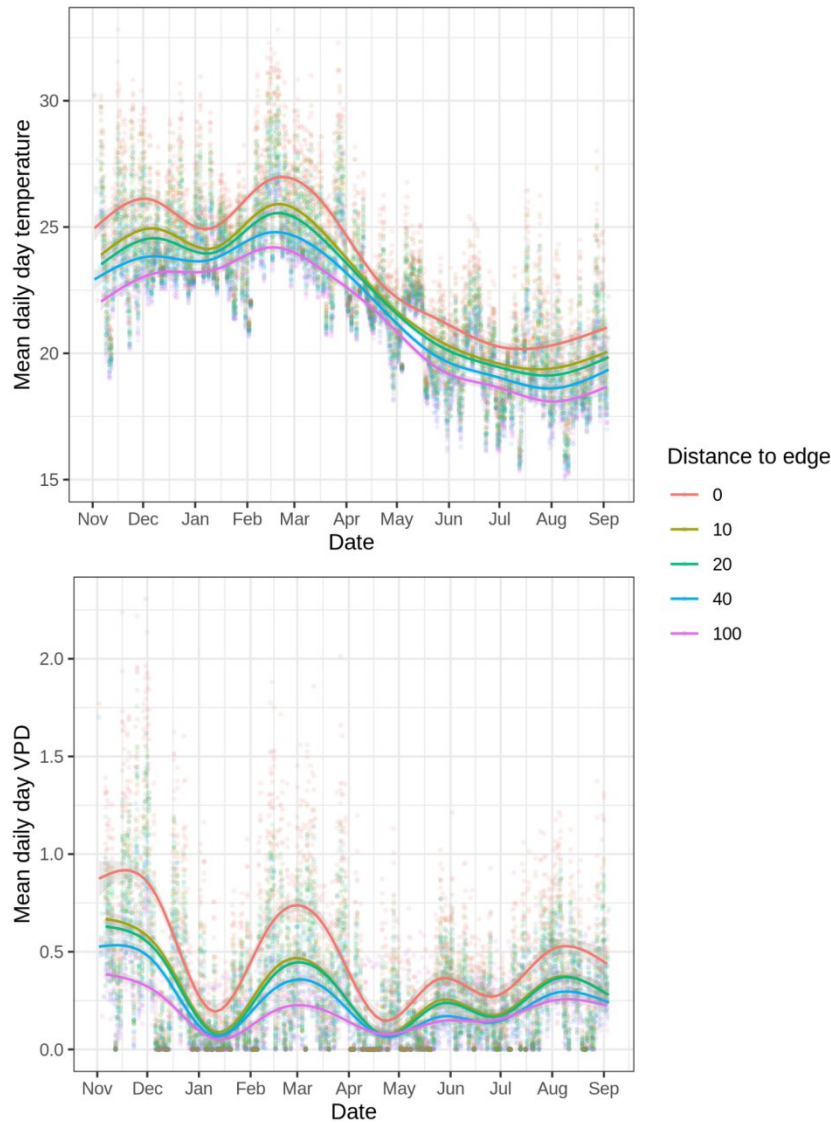
S.M. 3. Covariation in community weighted-mean (CWM) traits. (a) Principal component analysis (PCA) of CWM traits (WD: wood density; SLA: specific leaf area; LA: leaf area; LDMC: leaf dry matter content. The resulting first axis was used as the synthetic variation of CWM traits in further analyses. (b) Matrix of the correlations between CWM traits and axes of the PCA, based on Spearman's rho coefficients (color strength is proportional to the absolute value of the coefficient). Significant correlation are reported (*: p-value < 0.05; **: p-value < 0.01; ***: p-value < 0.001).

	CWM LA	CWM LDMC	CWM WD	PC1 (0.64%)	PC2 (0.23%)	PC3 (0.09%)	PC4 (0.03%)
CWM SLA	0.8***	-0.3*	-0.69***	0.91***	-0.24	0.24	0.25
CWM LA		-0.56***	-0.52***	0.92***	0.15	0.27	-0.25
CWM LDMC			0.16	-0.58***	-0.77***	0.25	-0.08
CWM WD				-0.76***	0.49***	0.43**	0.07

S.M. 4. *Linear regressions showing the influence of distance to forest edge, topography (curvature and slope) and canopy structure (canopy height and gap fraction) on community weighted-mean of each measured trait. Distance to forest edge was log-transformed but predictions are plotted on a regular scale for an easier interpretation, resulting in non-linear relationships. Shaded areas represent 95% confidence intervals of predicted values. Variance explained (R^2) and significance of the models are reported (*: p-value < 0.05; **: p-value < 0.01; ***: p-value < 0.001).*
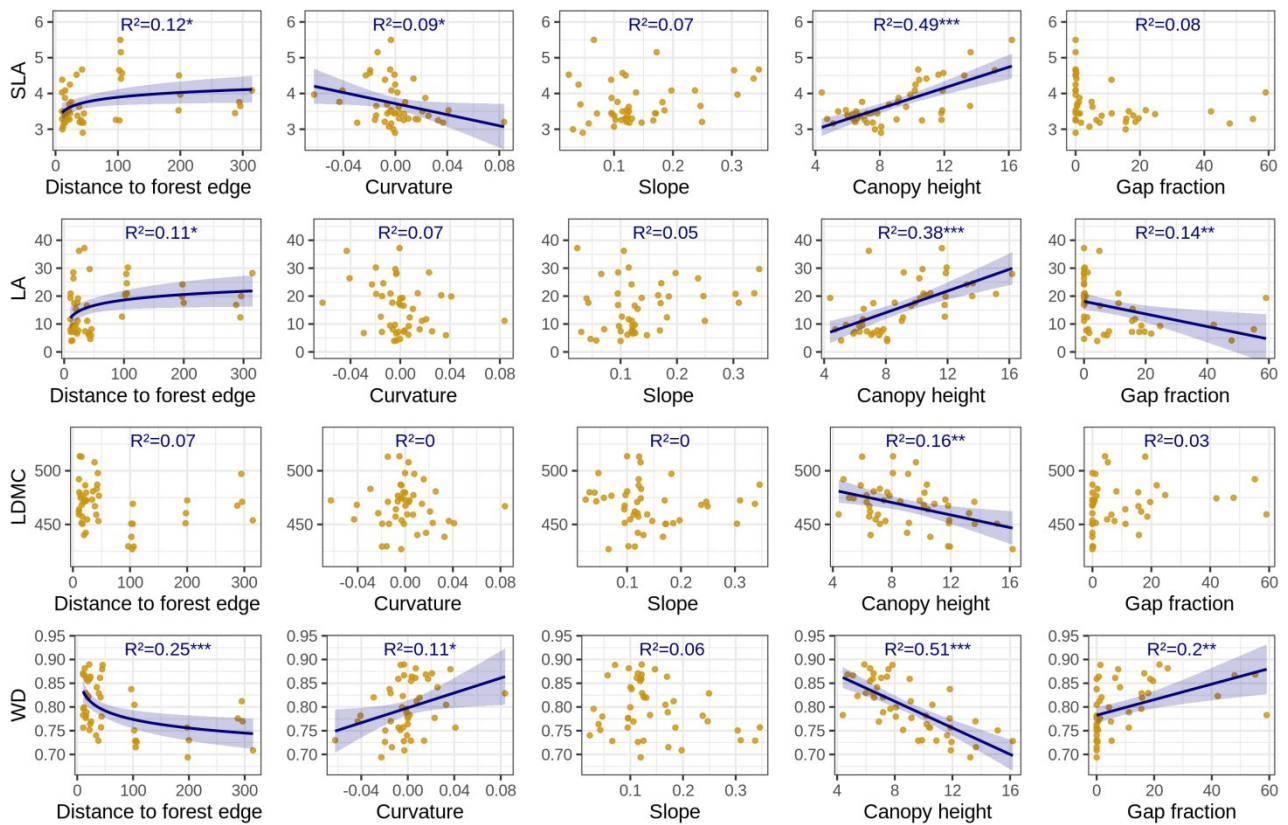
S.M. 5. *Correlation matrix showing the Pearson correlation coefficients between the different predictors of forest attributes (i.e., distance to forest edge, curvature, slope, elevation, canopy height and gap fraction). Elevation was removed from the list of predictors because of both strong collinearity with distance to forest edge (i.e., Pearson correlation coefficient = 0.74) and weak range of variation among the forest plots (i.e., < 80m).*
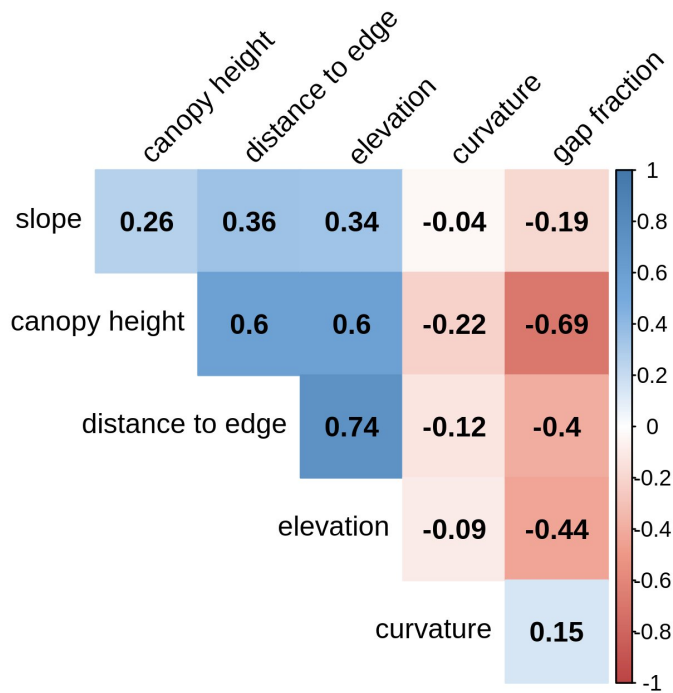
S.M. 6. *Separate structural equation models indicating the direct influence of distance to forest edge and topography on canopy structure, and indirect influence on understory microclimate, aboveground biomass, functional diversity and mean trait values, species richness and β-diversity of tree communities. Significant (p < 0.05) and insignificant pathways and covariances are indicated by solid and dashed arrows, respectively. Standardized parameter estimates are indicated for each path. Global fit statistics of each SEM are indicated on the bottom right of each model: Chi-squared statistic and p-value (p > 0.05 indicates a good fit), Root Mean Square Error of Approximation (RMSEA < 0.08 indicates a good fit), Standardized Root Mean Square Residual (SRMR < .08 indicates a good fit), Comparative Fit Index and Non Normed Fit Index (CFI > 0.9 and NNFI > 0.9 indicate a good fit). Note that model including microclimate was fitted using available data from microclimate logger (i.e., placed on plots located from 10 m to 100 m from the forest edge, including some loggers placed at 0 m from the edge), while other models were fitted using data from plots (i.e., located from 10 m to 300 m from the forest edge), resulting in slightly different relationships between distance to edge, topography and canopy structure.*

Panel 1 (top-left):

Distance to edge → Canopy height: 0.74
Distance to edge → Canopy gap fraction: -0.78
Topography (curvature) → Canopy height: -0.18
Canopy height ↔ Canopy gap fraction: -0.44
Canopy height → Microclimate (max VPD): -0.34
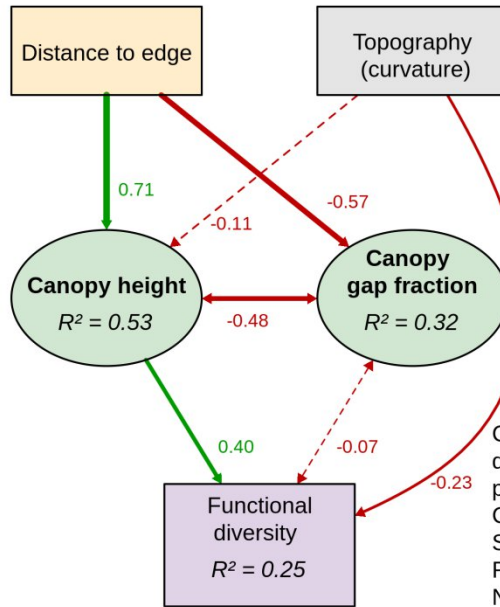Canopy gap fraction → Microclimate (max VPD): 0.34

Canopy height $R^2 = 0.57$
Canopy gap fraction $R^2 = 0.61$
Microclimate (max VPD) $R^2 = 0.77$

Chi2 = 1.11
d.f. = 2
p = 0.57
CFI = 1
SRMR = 0.02
RMSEA = 0
NNFI = 1

Panel 2 (top-right):

Distance to edge → Canopy height: 0.71
Distance to edge → Canopy gap fraction: -0.57
Topography (curvature) → Canopy height: -0.11
Canopy height ↔ Canopy gap fraction: -0.48
Canopy height → Aboveground biomass: 0.92
Canopy gap fraction → Aboveground biomass: 0.06

Canopy height $R^2 = 0.53$
Canopy gap fraction $R^2 = 0.32$
Aboveground biomass $R^2 = 0.84$
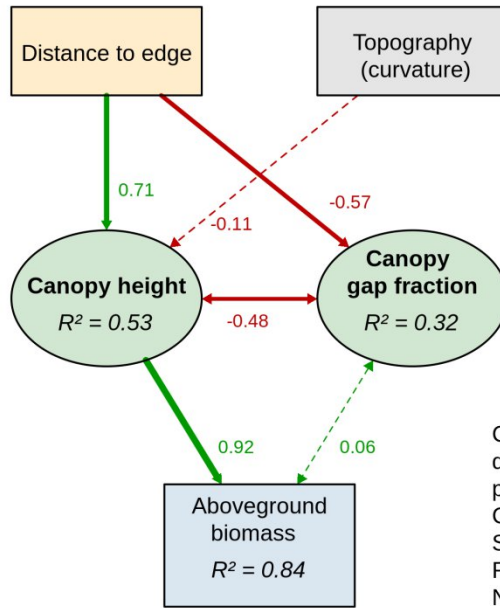
Chi2 = 1.79
d.f. = 3
p = 0.62
CFI = 1
SRMR = 0.02
RMSEA = 0
NNFI = 1.01

Panel 3 (middle-left):

Distance to edge → Canopy height: 0.71
Distance to edge → Canopy gap fraction: -0.55
Topography (curvature) → Canopy height: -0.10
Canopy height ↔ Canopy gap fraction: -0.50
Canopy height → CWM traits: 0.74
Canopy gap fraction → CWM traits: -0.50

Canopy height $R^2 = 0.53$
Canopy gap fraction $R^2 = 0.3$
CWM traits WD <-> SLA $R^2 = 0.55$
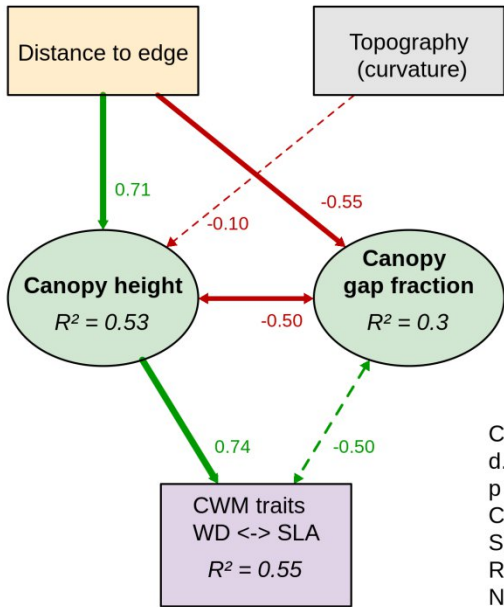
Chi2 = 2.65
d.f. = 3
p = 0.45
CFI = 1
SRMR = 0.04
RMSEA = 0
NNFI = 0.98

Panel 4 (middle-right):

Distance to edge → Canopy height: 0.71
Distance to edge → Canopy gap fraction: -0.57
Topography (curvature) → Canopy height: -0.11
Canopy height ↔ Canopy gap fraction: -0.48
Canopy height → Functional diversity: 0.40
Canopy gap fraction → Functional diversity: -0.07
Topography (curvature) → Functional diversity: -0.23

Canopy height $R^2 = 0.53$
Canopy gap fraction $R^2 = 0.32$
Functional diversity $R^2 = 0.25$

Chi2 = 0.81
d.f. = 2
p = 0.67
CFI = 1
SRMR = 0.03
RMSEA = 0
NNFI = 1.01

Panel 5 (bottom-left):

Distance to edge → Canopy height: 0.71
Distance to edge → Canopy gap fraction: -0.56
Topography (curvature) → Canopy height: -0.10
Canopy height ↔ Canopy gap fraction: -0.49
Canopy height → Rar. species richness: 0.72
Canopy gap fraction → Rar. species richness: -0.49

Canopy height $R^2 = 0.53$
Canopy gap fraction $R^2 = 0.31$
Rar. species richness $R^2 = 0.52$
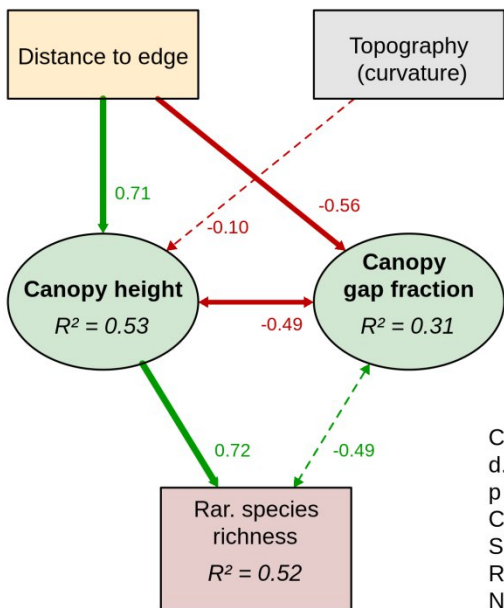
Chi2 = 2.53
d.f. = 3
p = 0.47
CFI = 1
SRMR = 0.04
RMSEA = 0
NNFI = 0.98

Panel 6 (bottom-right):

Distance to edge → Canopy height: 0.71
Distance to edge → Canopy gap fraction: -0.56
Topography (curvature) → Canopy height: -0.11
Canopy height ↔ Canopy gap fraction: -0.49
Canopy height → Rar. β-diversity: 0.73
Canopy gap fraction → Rar. β-diversity: 0.09
Topography (curvature) → Rar. β-diversity: -0.21

Canopy height $R^2 = 0.53$
Canopy gap fraction $R^2 = 0.31$
Rar. β-diversity $R^2 = 0.63$

Chi2 = 1.45
d.f. = 2
p = 0.48
CFI = 1
SRMR = 0.03
RMSEA = 0
NNFI = 0.99

S.M. 7.a. Raw and standardized parameter estimates for SEM including all variables except canopy structure *(*: p-value < 0.05; **: p-value < 0.01; ***: p-value < 0.001).* "~" indicates regression parameters, "~~" indicates residual covariance between or within variables.

Parameter	estimate	standard error	standardized estimate	z
max VPD ~ distance to edge	-0.921	0.122	-0.795	-7.603***
CWM traits ~ distance to edge	0.663	0.188	0.454	3.521***
CWM traits ~ curvature	-0.138	0.061	-0.144	-2.283*
rar sp richness 20 ~ distance to edge	0.674	0.156	0.46	4.332***
rar sp richness 20 ~ curvature	-0.196	0.062	-0.204	-3.151**
Functional diversity ~ distance to edge	0.35	0.19	0.237	1.843
Functional diversity ~ curvature	-0.292	0.113	-0.302	-2.580**
rar beta-diversity ~ distance to edge	0.668	0.159	0.457	4.034***
rar beta-diversity ~ curvature	-0.283	0.071	-0.295	-3.418***
agb plot nc ~ distance to edge	1.021	0.169	0.693	6.047***
max VPD ~~ max VPD	0.223	0.037	0.368	5.991***
CWM traits ~~ CWM traits	0.731	0.117	0.76	6.242***
rar sp richness 20 ~~ rar sp richness 20	0.705	0.108	0.728	6.496***
Functional diversity ~~ Functional diversity	0.821	0.161	0.839	5.106***
rar beta-diversity ~~ rar beta-diversity	0.652	0.084	0.677	7.526***
agb plot nc ~~ agb plot nc	0.508	0.104	0.519	4.871***
max VPD ~~ CWM traits	-0.212	0.061	-0.525	-3.495***
max VPD ~~ rar sp richness 20	-0.262	0.063	-0.66	-4.215***
max VPD ~~ Functional diversity	-0.157	0.076	-0.368	-2.074*
max VPD ~~ rar beta-diversity	-0.249	0.056	-0.653	-4.208***
max VPD ~~ agb plot nc	-0.184	0.055	-0.547	-3.333***
CWM traits ~~ rar sp richness 20	0.574	0.095	0.799	6.068***
CWM traits ~~ Functional diversity	0.294	0.082	0.379	3.565***
CWM traits ~~ rar beta-diversity	0.489	0.082	0.708	5.368***

Parameter	estimate	standard error	standardized estimate	z
CWM traits ~~ agb plot nc	0.4	0.104	0.656	3.843***
rar sp richness 20 ~~ Functional diversity	0.306	0.099	0.403	3.085**
rar sp richness 20 ~~ rar beta-diversity	0.586	0.096	0.864	5.811***
rar sp richness 20 ~~ agb plot nc	0.322	0.101	0.538	3.177**
Functional diversity ~~ rar beta-diversity	0.321	0.106	0.438	3.341***
Functional diversity ~~ agb plot nc	0.12	0.071	0.185	1.689
rar beta-diversity ~~ agb plot nc	0.307	0.09	0.533	3.251**
distance to edge ~~ distance to edge	0.451	0	1	NA
distance to edge ~~ curvature	-0.067	0	-0.098	NA
curvature ~~ curvature	1.046	0	1	NA

S.M. 7.b. Raw and standardized parameter estimates for SEM including all variables with canopy structure *(*: p-value < 0.05; **: p-value < 0.01; ***: p-value < 0.001).* "~" indicates regression parameters, "~~" indicates residual covariance between or within variables.

Parameter	estimate	standard error	standardized estimate	z
canopy height ~ distance to edge	0.875	0.129	0.707	6.800***
canopy height ~ curvature	-0.09	0.071	-0.111	-1.260
gap fraction2 lastools ~ distance to edge	-0.531	0.121	-0.563	-4.383***
max VPD ~ canopy height	-0.345	0.112	-0.363	-3.083**
max VPD ~ gap fraction2 lastools	0.224	0.102	0.18	2.196*
max VPD ~ distance to edge	-0.517	0.155	-0.44	-3.343***
CWM traits ~ canopy height	0.883	0.112	0.744	7.865***
rar sp richness 20 ~ canopy height	0.859	0.103	0.724	8.304***
Functional diversity ~ canopy height	0.533	0.157	0.449	3.402***
beta-diversity ~ canopy height	0.885	0.102	0.756	8.645***
beta-diversity ~ curvature	-0.108	0.051	-0.114	-2.134*
agb plot nc ~ canopy height	1.088	0.076	0.918	14.294***
canopy height ~~ gap fraction2 lastools	-0.145	0.038	-0.484	-3.803***
canopy height ~~ canopy height	0.327	0.068	0.473	4.800***
gap fraction2 lastools ~~ gap fraction2 lastools	0.274	0.085	0.683	3.235**
max VPD ~~ max VPD	0.146	0.031	0.235	4.716***
CWM traits ~~ CWM traits	0.435	0.097	0.446	4.461***

rar sp richness 20 ~~ rar sp richness 20	0.464	0.063	0.476	7.405***
Functional diversity ~~ Functional diversity	0.78	0.158	0.798	4.924***
beta-diversity ~~ beta-diversity	0.365	0.051	0.385	7.120***
agb plot nc ~~ agb plot nc	0.152	0.026	0.157	5.776***
max VPD ~~ CWM traits	-0.07	0.061	-0.277	-1.147
max VPD ~~ rar sp richness 20	-0.13	0.046	-0.498	-2.800**
max VPD ~~ Functional diversity	-0.049	0.058	-0.144	-0.840
max VPD ~~ beta-diversity	-0.103	0.033	-0.446	-3.130**
max VPD ~~ agb plot nc	-0.025	0.024	-0.166	-1.015
CWM traits ~~ rar sp richness 20	0.305	0.067	0.679	4.530***
CWM traits ~~ Functional diversity	0.145	0.074	0.249	1.950
CWM traits ~~ beta-diversity	0.197	0.056	0.496	3.543***
CWM traits ~~ agb plot nc	0.057	0.041	0.223	1.395
rar sp richness 20 ~~ Functional diversity	0.178	0.079	0.297	2.248*
rar sp richness 20 ~~ beta-diversity	0.322	0.054	0.782	5.912***
rar sp richness 20 ~~ agb plot nc	0.012	0.041	0.044	0.283
Functional diversity ~~ beta-diversity	0.175	0.075	0.328	2.325*
Functional diversity ~~ agb plot nc	-0.078	0.043	-0.225	-1.812
beta-diversity ~~ agb plot nc	-0.029	0.036	-0.122	-0.801
distance to edge ~~ distance to edge	0.451	0	1	NA
distance to edge ~~ curvature	-0.067	0	-0.098	NA
curvature ~~ curvature	1.046	0	1	NA