Ecosphere

Predicting aboveground forest biomass with topographic variables in human-impacted tropical dry forest landscapes

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Appendix S1

Table S1. Overview of studies that have analyzed the relationship between tropical forest structure variables and topography. AGB, aboveground biomass, BA= Basal area; DBH, diameter at breath height; SD=stem density; TH, Tree height; cited, literature cited; P, preserved forest, D, disturbed forest.

Cited	Topographic variable related to	Forest structure variable used	Forest type and location	P/D
1	Slope	TH and DBH	Mixed Dipterocarp forest, Borneo	P
2	Relative position on the slope	AGB, BA and SD	Wet tropical forest, Puerto Rico	P
3	Slope	AGB	Terra firme wet forest, Central Amazon, Brazil	D
4	Elevation and slope	AGB	Wet tropical forest, Costa Rica	P
5	Relative position on the slope	AGB	Lowland moist tropical forest, Central Panama	P
6	Relative position on the slope	AGB and TH	Lower montane forest, Borneo	P
7	Elevation and slope	AGB	Terra firme moist tropical forest, Amazon	P
8	Relative position on the slope	AGB and SD	Wet tropical forest, Ecuador	P
9	Elevation	AGB	Tropical forest, Hawaii	P
10	Relative position on the slope	AGB	Lowland tropical forest, French Guiana	P

11	Elevation and Slope	AGB	Tropical moist forest, Atlantic coast, SE Brazil	P
12	Slope	AGB	Lowland moist tropical forest, Central Panama	P
13	Relative position on the slope	AGB, SD and BA	Hill dipterocarp forest, Sumatra	P
14	Elevation and slope	AGC	Tropical montane cloud forest, puna, and transition zone, Peru	D
15	Elevation, slope and aspect	AGC	inhumbane lowland forest, transitional/submontane forest and afromontane forest, Zanzibar -Tanzania	D
16	Elevation, slope, aspect and a terrain ruggedness index	AGC	Multiple types of tropical forest, Colombian Amazon	D
17	Elevation, slope, aspect concavity and convexity	TH	Lowland moist tropical forest, Central Panama	P
18	Elevation	AGB	Mauna Loa, Hawai‘i	P
19	Elevation, aspect and relative position on the slope	AGB	tabonuco forest colorado forest, palm forest and cloud forest, Puerto Rico	P
20	Elevation	AGB	Rain forest, Borneo	P
21	Elevation	AGB	Rain forest, Borneo	P
22	Elevation and aspect	BA	Evergreen broadleaf forest, Vietnam	P
23	Elevation and slope	AGB	Hill dipterocarp forest, Sumatra	P
24	Relative position on the slope	BA and DBH	Tropical rainforests, Costa Rica	P
25	Relative position on the slope	TH and SD	Lowland wet tropical forest, Costa Rica	P
26	Aspect	AGB and SD	Old mixed hardwood forest, USA	P
27	Aspect	AGB and SD	Evergreen sclerophyllous trees and semideciduous shrubs	D

			with herb associations) and dwarf shrublands, Israel	
28	Relative position on the slope	AGB	Mount Zequalla Monastery, Ethiopia	P
29	Relative position on the slope	AGB and BA	Humid tropical montane, Ecuadorian Andes	P
30	Relative position on the slope	AGB	Atlantic Forest, Brazil	P
31	convexity and concavity	AGB	Atlantic rainforest, Brazil	P
32	convexity and concavity	AGB	Montane Ombrophylus Dense Forest, Brazil	P
33	convexity and concavity	AGB	Subtropical mountain moist forest, China	P
34	Elevation	BA and SD	Dry deciduous woodland	D
35	Elevation	BA	Tropical montane forests, Ecuador	P
36	Elevation	BA	Coniferous forest, tropical montane cloud forest and seasonally dry tropical forest, México	P
37	Elevation	TH, DBH and SD	Tropical montane forests, Ecuador	P
38	Elevation	BA	Tropical seasonal dry forest, temperate forest and montane rain forest	D
39	Relative position on the slope	AGB	Tropical seasonal dry forest	P

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Table S2- Variables initially selected to characterize topographic heterogeneity in the study area. m, meters; m a.s.l., meters above sea level; kWh, kilowatts per hour. Letters in parenthesis: a) Wilson and Gallant (2000), b) De Reu et al. (2013), c) Moore et al. (1991), d) Sørensen et al. (2006) and e) Hengl and Reuter (2008).

Variable	Description
Elevation above sea level (m)	Indicator for progressive change in climate. Expressed in meters above sea level (m a.s.l.) (a, e)
Aspect (N,S,E,W)	Compass direction of slope exposure. Indicates topographic shading, due to northern location, highlighted by nearby hills. It has been used to indicate more favorably sheltered areas (c, e).
Profile curvature (Degrees/m)	Determines the downhill or uphill rate of change in slope in the gradient direction. Negative values are upwardly convex and indicate accelerated flow of water over the surface. Positive values are upwardly concave and indicate slowed flow over the surface (a, e).
Planar curvature (Degrees/m)	Also called contour curvature. It measures the rate of change transverse to the direction of maximum slope, in the horizontal plane. It measures converging or diverging flow of water. Negative values indicate divergent water flow over the surface, and positive values indicate convergent flow (a, e).
Tangential curvature	Has the same significance as the planar curvature (controls the acceleration and convergence of surface water flow across land surface), but highlights differences in measurement of flow convergence and divergence in flat areas, to avoid extremely large values when slope is small (a, c, e).
Total insolation (kWh/m^2)	Describes the relationship between the topographic surface and incoming solar radiation. It is the sum of direct, diffuse, and reflected radiation components (a, e).
Diffuse insolation (kWh/m^2)	The scattered radiation that reaches the ground (a, e)
Direct insolation (kWh/m^2)	The radiation that reaches the ground under clear skies (a, e)
Slope (%)	Slope in the steepest downslope direction. Ranging from 0 to 100 (a, c)

Topographic position indices using different scales (number of pixels in the immediately surrounding area included in calculation: 1) 5 pixels 2) 11 pixels 3) 15 pixels 4) 19 pixels 5) 25 pixels 6) 35 pixels 7) 45 pixels 8) 61 pixels	A measure of the micro elevation of the sample point, compared to the immediately surrounding area. It is a measurement, in relative terms, of the position of the pixel along the slope. For each pixel in the raster map TPI compares the pixel elevation to the mean elevation of the surrounding cells. TPI values near-zero or zero indicate flat locations. The more positive the TPI, the higher the topographic exposure of the pixel. The more negative the TPI, the lower the topographic exposure of the pixel. The lower the topographic exposure, the more sheltered the area is from sunlight (a, c).
Topographic wetness index	Used to quantify topographic control on hydrological processes. It is a parameter describing the redistribution of water in the landscape and indicates the tendency of a pixel to accumulate water (a, b, c, d, e).
Distance to road (m)	Measure of human impact, distance from sites to the closest roads was estimated.
Distance to human settlement (m)	See above, distance to human settlements.

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Table S3– Relative importance (%) of each of the topographic variables on aboveground biomass as calculated in the regression tree analysis for the entire dataset (first column) and for groups of communities A (second column) and B (third column). cplan, planar curvature; cprof, profile curvature; ctan, tangential curvature; difinsol, diffuse insolation; dirinsol, direct insolation; elevation, elevation above sea level; slope: slope; tpi19, topographic position index 19 x 19 pixels scale; tpi25, topographic position index 25 x 25 pixels scale; tpi61, topographic position index 61 x 61 pixels scale; TWI, topographic wetness index; NA, not applicable.

Variable	**Overall**	**A**	**B**
community	52	NA	NA
cplan	NA	NA	10
cprof	NA	10	NA
ctan	NA	10	NA
difinsol	10	NA	20
dirinsol	11	NA	5
elevation	8	NA	52
slope	10	10	NA
tpi19	NA	35	NA
tpi25	NA	NA	5
tpi61	9	10	7
TWI	NA	25	NA

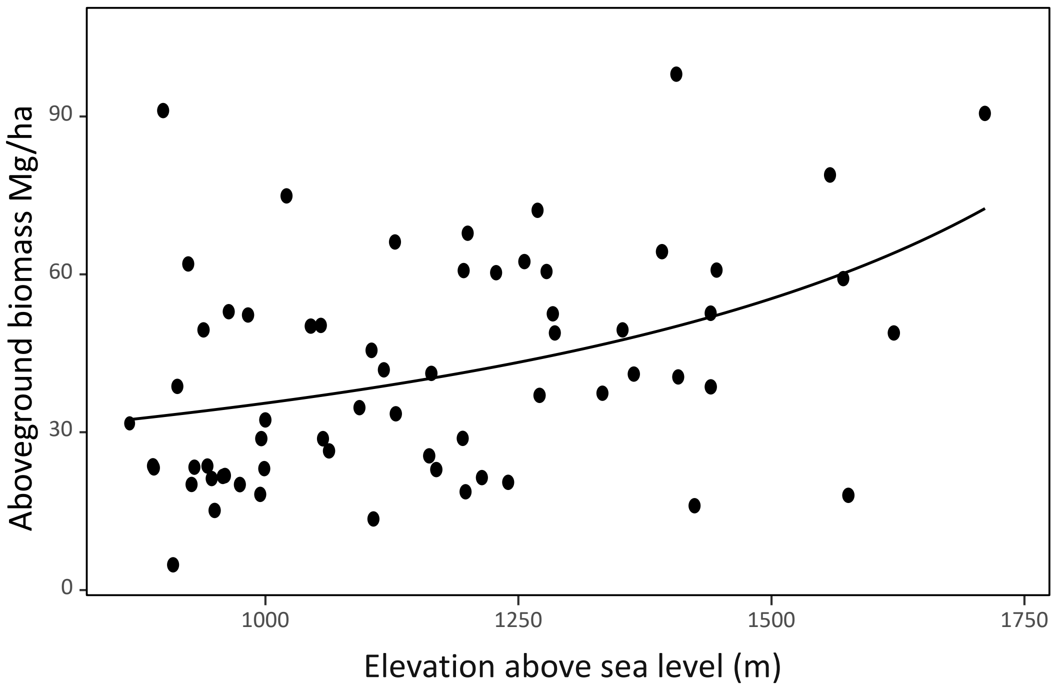

Figure S1– GLM for biomass in Group B as a function of Elevation.