Ring-Width Variations of *Bursera*

At Laipuna increment wood cores and discs from *Bursera graveolens* (Burseraceae) were collected. The clear annual growth ring boundaries allowed the measurement of annual increments, and so the first 200-year-long tree-ring chronology for the tropical dry forest was developed (Figure 22 a), which is the longest so far known for this ecosystem. Years with high radial increment are strongly related to years with higher precipitation, coinciding with extreme El Niño events (Figure 22 b). Thus, the El Niño/La Niña-Southern Oscillation (ENSO) phenomenon shows an indirect influence on the growth of the trees.

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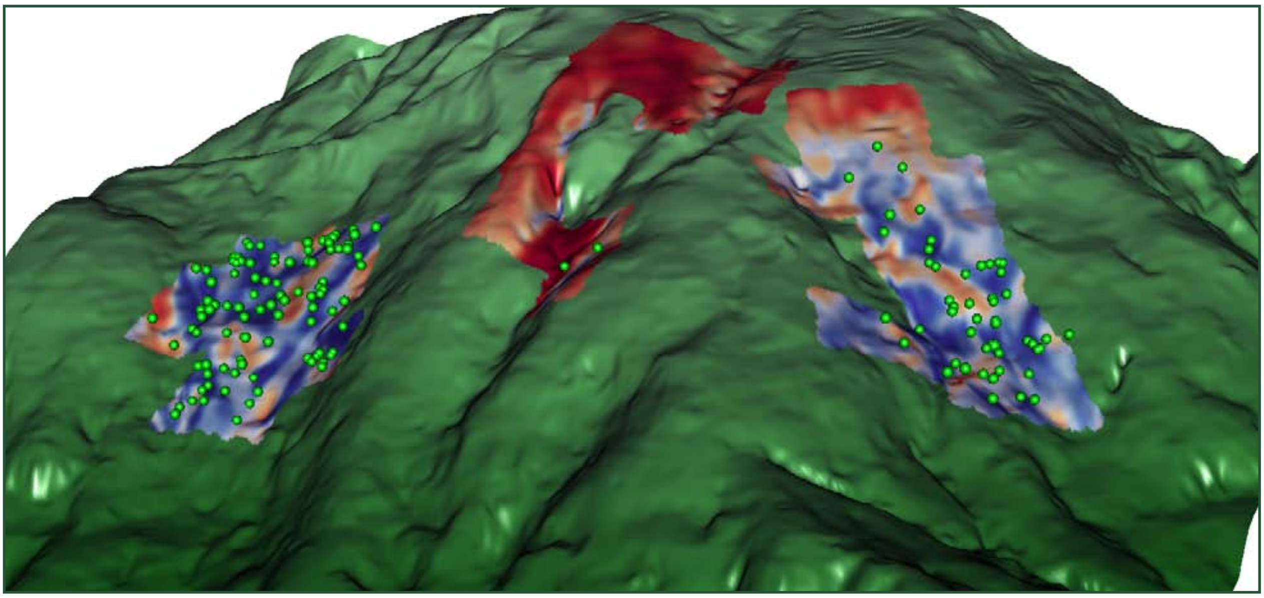

Figure 23: Habitat–suitability map for the tree *Cecropia angustifolia*. Blue colors indicate areas that are suited for this species, whereas red areas are less suited. Green dots represent all trees of *C. angustifolia* in the study area. Graphic: D. Kübler.

Factors Affecting the Spatial Distribution of Tree Species

Homeier et al. [1] identified four different forest types in the Reserva Biológica San Francisco (RBSF), which vary considerably in species composition and structure. Altitudinal and topographic factors play an important role for the occurrence of those forest types [2].

We (subproject C1) quantified the impact of different environmental predictors for the distribution of the most common tree species in our study area, using an Ecological Niche Factor Analysis (ENFA) [4]. It allows determining which environmental predictors are most responsible for the spatial distribution of a species. Tree data from our long term forest inventory plots in Q2, Q3 and Q5 (13 ha) were used in the analysis. From this data, 16 species with the highest importance value index were selected.

We used data derived from a digital elevation model (DEM: elevation, slope, wetness index, topographic position indices with radii of 10 m and 200 m, valley depth) as environmental predictors and soil texture maps (sand, silt and clay percentage) from Ließ et al. [3]. Models were validated using a k-fold cross validation. The values of the Spearman-rank correlation ranged between 0.55 - 0.93 for the different species, indicating a good model performance.

The first factorial axis of the ENFA is the marginality factor. It expresses the habitat preference of a species for an environmental predictor in respect to the study area. Positive coefficients indicate that the species has a preference for higher-than-mean values, while negative coefficients indicate that the species prefers lower-than-mean values. The marginality factor is therefore suited for the estimation of the ecological importance of different environmental predictors for the distribution of different species.

These results were than analyzed with a hierarchical cluster analysis and three different species groups were identified (see Table 1). These groups seem to be ecologically consistent: the 'blue' group are ridge-species and the 'red' group are valley-species. The one tree species in the third group (*Tapirira obtusa*) seems to be an intermediate species that can be classified as neither ridge- nor valley-species. The importance of each factor is described by the absolute value of the marginality factor. The mean of all species was calculated for each environmental predictor (see Table 1).

Additionally, habitat suitability maps were created for each species. However, they are not the principal focus of this study, and therefore only a map for one species (*Cecropia angustifolia*) is shown as an example (Figure 23, previous page).

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Table 1: Marginality Factors for all tree species (columns) and environmental parameters (rows)

Brown and green background colors in the table indicate a negative and positive coefficient for the marginality factors, respectively. The color of the species names corresponds to the three different groups identified by a cluster analysis. The order of the environmental parameters corresponds to the mean marginality factor of each predictor (values in parenthesis), with the topmost predictor being the most important and the lowest being the less important. TPI: topographic position indices. Table: D. Kübler.

	Alchgran	Alzavert	Clusduco	Grafemar	Cecrandi	Cecrangu	Cedrsp	Guarpter	Hyeraspe	Micoquad	Nectline	Nectmemb	Piptdisc	Sapiglan	Tabechry	Tapiobtu
TPI 200 m (0.51)	0.5	0.6	0.5	0.5	-0.5	-0.5	-0.5	-0.7	-0.6	-0.5	-0.7	-0.4	-0.4	-0.5	-0.6	-0.1
Elevation [m] (0.46)	0.5	0.4	0.5	0.5	-0.5	-0.5	-0.5	-0.4	-0.5	-0.4	-0.4	-0.5	-0.5	-0.6	-0.5	-0.2
Valley Depth (0.42)	-0.4	-0.6	-0.5	-0.6	0.5	0.5	0.5	0.5	0.2	0.3	0.3	0.5	0.6	0.5	0.3	0.2
Wetness Index (0.29)	-0.3	-0.4	-0.3	-0.3	0.2	0.2	0.2	0.2	0.0	0.2	0.3	0.3	0.3	0.3	0.1	0.9
Clay [%] (0.25)	-0.2	0.0	-0.1	-0.1	-0.2	0.3	0.4	0.1	0.5	0.5	0.2	0.3	0.3	0.1	0.5	-0.3
Slope (0.16)	-0.3	0.1	-0.3	0.0	0.3	0.2	0.1	0.2	0.1	0.2	0.4	0.1	0.1	0.2	0.1	0.0
Sand [%] (0.14)	0.0	0.0	0.0	0.0	0.3	-0.1	-0.3	0.0	-0.2	-0.4	0.0	-0.2	-0.2	0.1	-0.3	0.1
Silt [%] (0.14)	0.2	0.0	0.2	0.1	-0.3	-0.1	0.0	-0.1	-0.2	0.1	-0.2	-0.1	-0.1	-0.2	0.0	0.2
TPI 10 m (0.09)	0.2	0.0	0.2	0.1	0.0	-0.1	0.0	0.0	0.0	-0.2	0.1	-0.1	0.0	-0.1	0.0	0.2