Supplementary material S1-S3

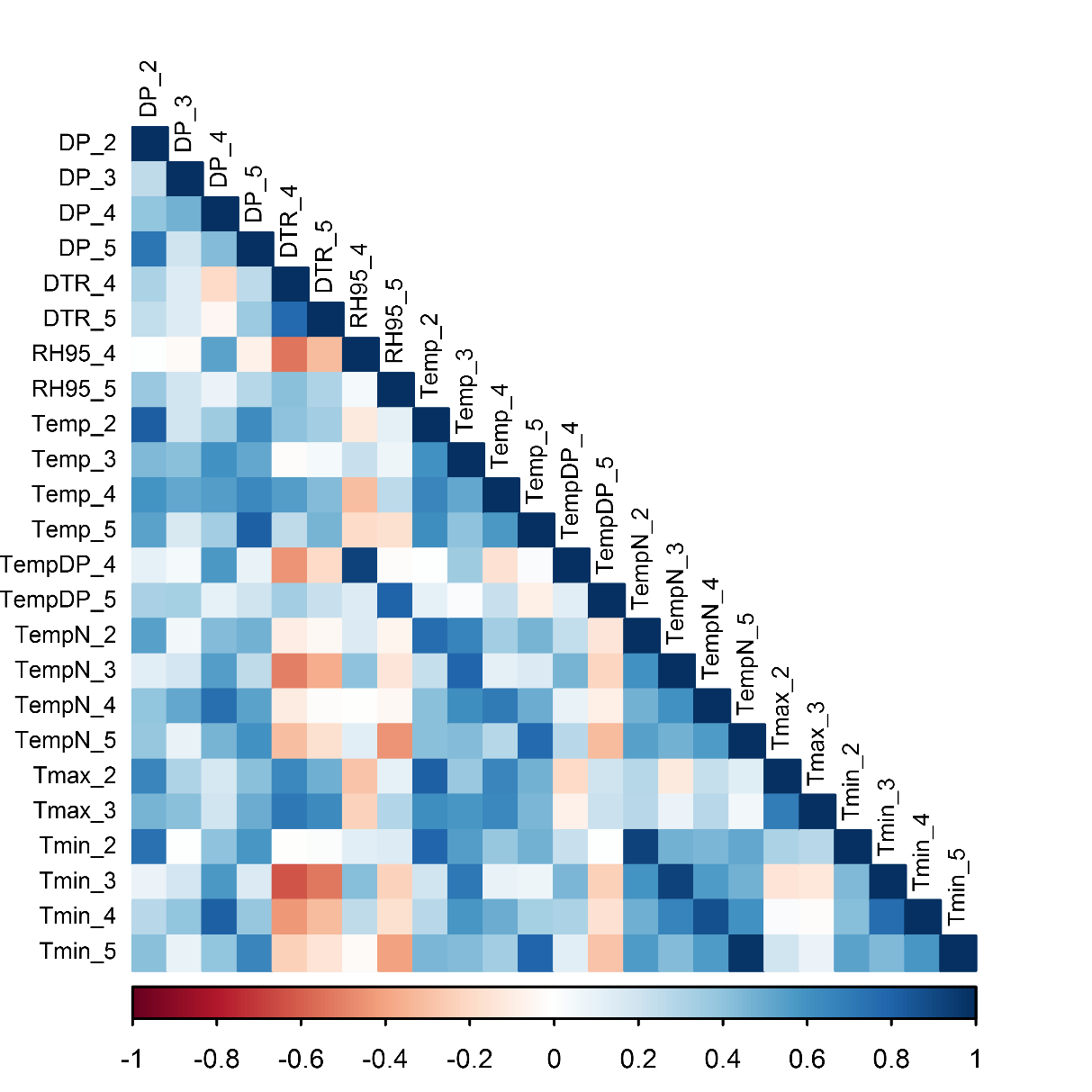
S1 Characterisation of production systems generated by K-means Clustering

Between April and May 2014, the vegetation structure was measured on 144 selected plots (see also Liebig et. al for a detailed description on the selection procedure). A GPS (Garmin eTrex) was used to measure the altitude and plot boundary coordinate. The plot boundary coordinates were used to calculate the plot sizes, which ranged between 0.01–1.55 ha. The number of coffee bushes, banana mats and stems, and shade trees were documented per plot and the number per hectare were calculated. All shade tree species were identified and the number of species per plot calculated. The canopy closure was estimated using a Forestry Suppliers spherical crown densiometer (convex model A) according to Lemmon (1957) at four positions within the plot. The slope as well as slope aspect was measured using a Suunto Tandem Global Compass/Clinometer. Via structured farmer interviews, further data farm and plot level data on coffee production were recorded, including coffee age of the coffee bushes, yield, coffee management, perceived occurrence and impact of coffee pests and diseases, and livelihood characteristics. The typology of coffee production systems was based on variables related to vegetation structure, including shade tree and banana densities per unit area, shade tree species diversity and canopy closure. The variables were standardized and K-means clustering was applied. Using a one-way ANOVA (with Tukey’s post hoc test), the variables were compared between the resulting coffee systems. Data analysis was done using R statistics (R Core Team, 2014).

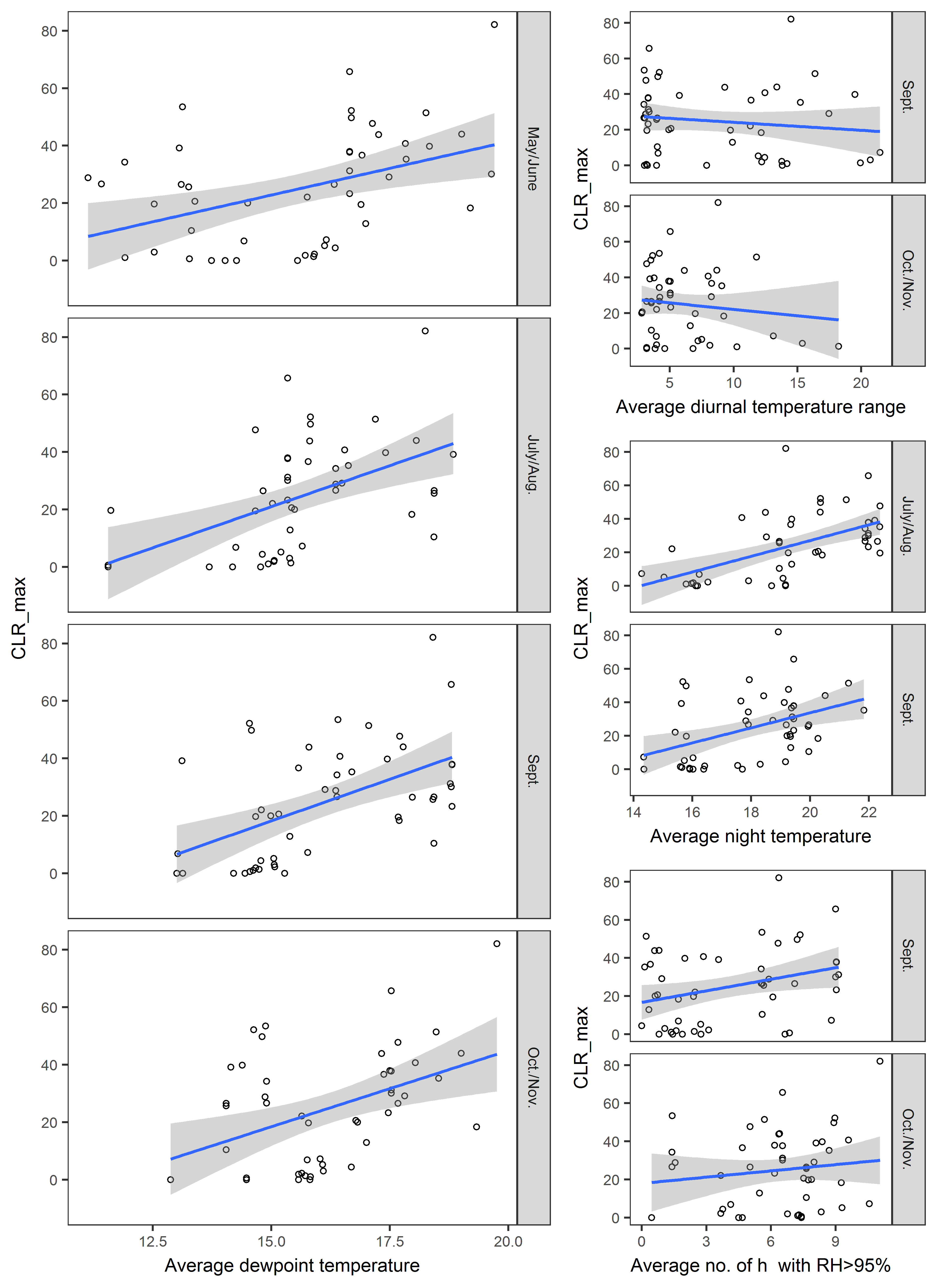
S2 References for conceptual model illustrating potential relationships between components of the environment, coffee production system, microclimatic indicators, coffee productivity and coffee pests and diseases

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S3a-b Selection procedure for micro-climatic variables



S3a Selection procedure for micro-climatic variables and respective time periods to use in piecewise SEM. Visualization of the correlation coefficients matrix between micro-climatic variables and respective periods, related with CLRmax (verified by plotting CLRmax against each potential micro-climatic variable. Out of the initial number of 63 variables, 24 showed a relationship with CLRmax). Numbers refer to monitoring dates: (2) May/June, (3) July/August, (4) September, (5) October / November}



S3b Selection procedure for micro-climatic variables and respective time periods to use in piecewise SEM. Remaining 10 variables after exclusion of highly correlated variables (identified via significant tests of the correlation coefficients) showing its relationship with CLRmax. Since time periods within a variable of micro-climate were autocorrelated among themselves, they were joined to one variable (e.g. dew point temperature of the four time periods were joined to dew point temperature for the period between May- November), resulting in a final number of four micro-climatic variables used in the piecewiseSEM