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Structural and physiognomic associations between tropical savanna and forest examined at a pantropical scale.

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Defining relationships between vegetation structural composition and ecosystem functionality provides one means to improve the classification of complex savanna systems and we here present a new analysis to classify savanna and forest vegetation forms and of special relevance the transitional regions. As well as providing a new definition of forest and savanna forms; we also present new data quantifying interactions of the woody and the herbaceous layers, also providing a first analysis of the effects of different soil types and environmental variables on tropical vegetation structural characteristics.

We sampled 64 forest and savannas sites across West Africa, Cameroon, Bolivia, Brazil and Australia used the same field methodology to determine the structural composition of the vegetation for all the sites, almost all of which were 1 ha in area. Woody cover was stratified into 3 layers, stems that have a diameter at beast height (DBH) bigger than 1 dm, stems with DBH between 0.25 and 1 dm and stems with DBH smaller than 0.25 dm. The herbaceous vegetation was defined as being consisting of grasses, herbs, sedges and seedlings with differentiation being made between C_3 and C_4 plants with the woody species and their seedlings categorised as trees or shrubs.

We also calculated crown area index (C) of the woody vegetation per layer and the foliar projective cover of the herbaceous and seedling vegetation. For the clustering analysis we also included the tree height and the 0.95 quartile height of all the trees with a diameter at breast height (H)greater than 1 dm. Our aim was first, to create clusters that define types of structural and physiognomic forms. And second, to determine the relationship of the clusters with the different soil types and environments across the continents.

Our analysis resulted in the definition 12 clusters in total with the main discerning factors being the structural components of tree height and crown area index for the trees with $D>$ 1 dm. Wood canopy crown cover and foliar projective monocotyledon cover were highly correlated across the clusters with the proportion of the herbaceous layer accounted for by C_4 grasses declining with increasing C,even for relatively open savannas.

A first analysis of the floristic variations in transitional zones showed very little overlap between “forest” and “savanna” species for individual plots. Although in both South America and West Africa we did find forest-like formations consisting almost entirely of species usually associated with more open savannas. A mixture of structural and physiognomic information is therefore needed in order to be able to accurately classify these vegetation types.

Keywords: savanna, ^{13}C, clustering, tropical biomes in transition, C_3 and C_4 plants, crown area index, foliar projective cover