

Interactive comment on “Plant functional diversity affects climate–vegetation interaction” by Vivienne P. Groner et al.

Anonymous Referee #1

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The manuscript submitted by Groner et al to “Climate of the Past” discusses the influence of variations in plant functional types on climate at the end of the Holocene. The article is nicely written. However, it is based on assumptions that should be more fully argued or explained.

It has been shown for many years (actually, since the palaeogeographic map drawn up by N. Petit Maire et al., UNESCO-IGCP 252, 1993 and more recently through the reconstructions performed by e.g. Hély and Lézine, 2014) that plant cover in the Sahara during the Holocene was primarily not homogeneous with co-occurrence of plants that are today found in distinct phytogeographical areas. Desert plants are typically found in the Sahara today. These plants co-occurred during the late Holocene with tropical trees probably in restricted areas such as river or lake banks. Actually, pollen data

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show that tropical trees were present but we are unable to infer any evaluation of their coverage in the landscape from pollen data. In other words, palynologists show that the Holocene increased rainfall led to a dramatic increase in biodiversity. There has been no replacement of one biome by another but rather an interpenetration of plants taxa that are found today in distinct biomes. Moreover, the vegetation cover had a mosaic-like character and was certainly discontinuous. An quantified evaluation of the vegetation cover would certainly be possible by applying the algorithms developed by Sugita and colleagues (2007) in West Africa. The importance of the coverage of one biome with respect to another one seems to me an important parameter to take into account, particularly if tropical trees were mostly restricted to the edges of streams and lakes. One of the major characteristics of plant distributions in dry areas is the presence of gallery forests along rivers or open water surfaces.

These gallery forests can host tropical trees far from the climatic zone they originate from. In this case, trees are not in equilibrium with climate and survive under drier conditions only thanks to available ground waters. Actually we do not know since when the water available in the soil is no longer able to compensate for the lack of precipitation.

In this context, could you please precise what are the 21 PFTs used in your study, based on the plant types identified in pollen studies carried out in the Sahara and Sahel and how do you evaluate the coverage and distribution of each of them for the time periods you have selected.

Additional comments:

(1) Temperature of the coldest month: To my knowledge, tropical climates are characterized by relatively constant (hot) temperature throughout the year and a large diurnal amplitude. One of the most important factors for plant distributions is rainfall and the length of the dry season, not temperature (at least in the lowlands). This, of course, in the case of a "climatic" and not an azonal distribution as is the case of forest galleries

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(2) C3/C4 grasses: roughly 30% of the Poaceae growing in the Sahara today are C3, particularly those growing in wet places and in the highlands (Maire & Monod, 1950; Quézel, 1965; Maire, 1952; Quézel & Santa, 1962; Quézel, 1954; Gillet, 1968. ...)

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